The state of world fisheries and aquaculture 1998

FOREWORD

The idea of publishing *The State of World Fisheries and Aquaculture* was conceived in 1995 in recognition of the growing demand for reliable information on the subject. Since there was no periodical providing a global and comprehensive view of the sector and covering policy issues, the FAO Fisheries Department decided to publish such a report every two years. *The State of the World Fisheries and Aquaculture 1996* serves as a benchmark document, as it provides an initial overview of world fisheries and aquaculture and places the sector in a longer-term perspective by examining trends from 1950 to the present, while also looking ahead to the year 2010.

While providing a similar overview, this issue of *The State of World Fisheries and Aquaculture* examines developments in the sector from the perspective of sustainability in fisheries and aquaculture. The report aims to shed light on the need for and effects of good governance in fisheries and aquaculture, while also highlighting two closely related issues: the establishment of an enabling environment for aquaculture activity and the integration of fisheries into coastal zone management.

With regard to capture fisheries, matching fishing capacity with available resources and managing by-catch and discards are the main points considered. Several other questions are posed on a more general level. Are fisheries and aquaculture any closer to being sustainably managed as a result of current changes in approach? Do these changes increase the contribution of fisheries and aquaculture to sustainable development? Are international initiatives to support this process helping to head the sector in the right direction?

The need to promote implementation of the Code of Conduct for Responsible Fisheries, especially in relation to the allocation of fishing rights, is made evident throughout *The State of World Fisheries and Aquaculture 1998,* which discusses existing practices in the management of fishing capacity as well as new approaches being adopted by some countries, such as individual transferable quotas (ITQs). A review of patterns in the employment of fishers and an analysis of trends in the world fishing fleet add to the report's value.

Updated information on past and present trends and expected future developments in fisheries resources, production, utilization and trade is complemented by discussions of major issues facing fishers and aquaculturists and a report on the most recent actions taken in the area of fisheries.

The principal purpose of *The State of World Fisheries and Aquaculture* is to inform policy-makers, participants in fisheries and civil society in an accurate and objective manner. Furthermore, by generating awareness of the global interaction inherent to the sector, it seeks to encourage managers and other decision-makers to learn from the experience of others. By doing so, we trust our report will contribute to national, regional and global efforts in ensuring responsible practices and sustainable development in fisheries and aquaculture.

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ACKNOWLEDGEMENTS

The State of World Fisheries and Aquaculture 1998 was prepared by FAO Fisheries Department staff, led by a team comprising U. Wijkström, A. Gumy and R. Grainger. General direction was provided by the department's management staff, including: J. Caddy; I. Feidi; S. Garcia; M. Hayashi; J. Jia; B. Satia; J. Valdemarsen; G. Valdimarsson.

Texts for the first section of Part 1, The state of fishery resources: trends in production, utilization and trade, were provided by J. Csirke (resources), R. Grainger (production, capture fisheries), K. Rana (production, aquaculture) and H. Josupeit (trade).

Contributors to Part 2, Selected issues facing fishers and aquaculturists, included D. Doulman (governance), R. Willmann (integrating fisheries), D. Greboval (fishing capacity), G. Everett (by-catch and discards) and Z. Shehadeh (sustainable aquaculture), whose original texts were coordinated by consultant M. Sanders.

In Part 3, Inland fisheries resources: their status and use was written by J. Kapetsky. Texts for the section Fishers and fishing fleets were contributed by A. Crispoldi, R. Grainger and A. Smith.

Part 4, Outlook: expected trends in supply and demand, was written by U. Wijkström. Part 5, Fishery activities of country groupings, was written by A. Gumy.

Several staff as well as non-FAO authors have contributed texts on specific issues, and they are cited in the relevant boxes throughout the publication. Data for the original version of graphics were provided by S. Montanaro.

Most staff members of the FAO Fisheries Department have contributed in one way or another to this year's report. Many, including staff in FAO Regional and Subregional Offices, provided valuable input in the form of critical text reviews.

The Editorial Group of the FAO Information Division was responsible for the editing, design and desktop publishing of *The State of World Fisheries and Aquaculture 1998*.

GLOSSARY

AFFP
Arab Federation of Fish Producers

AFMA
Australian Fisheries Management Authority

AFTA
ASEAN Free Trade Area

AIS
automatic identification systems

ASEAN
Association of Southeast Asian Nations

CAC
Codex Alimentarius Commission

CAP
Common Agricultural Policy (EC)

CARICOM
Caribbean Community and Common Market

CECAF
Fishery Committee for the Eastern Central Atlantic

CEPT
Common Effective Preferential Tariff (ASEAN)

CET
common external tariff

CFP
Common Fisheries Policy (EC)

CFRAMP
CARICOM Fisheries Resource Assessment and Management Program

CIDA
Canadian International Development Agency

CIDA
Inter-American Committee for Agricultural Development

CITES
Convention on International Trade in Endangered Species of Wild Fauna and Flora

COFI
Committee on Fisheries (FAO)

COMESA
Common Market for Eastern and Southern Africa

CPUE
catch per unit effort

DWFN
Distant-Water Fishing Nations

EC
European Community

EEZ
exclusve economic zone

EIA
environmental impact assessment

EIFAC
European Inland Fisheries

Advisory Committee

EPIRB
emergency position-indicating radio beacon

EU
European Union

FFA
South Pacific Forum Fisheries Agency

FIFG
Financial Instrument for Fisheries Guidance (EC)

FRDC
Fisheries Research and Development Corporation (Australia)

GAA
Global Aquaculture Alliance

GEF
Global Environment Facility

GESAMP
Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (IMO/FAO/UNESCO - IOC/WMO/IAEA/UN/UNEP)

GIS
geographic information system

GMDSS
Global Maritime Distress Safety System

GPS
global positioning system

GRT

gross registered ton

GT
gross tonnage or tonnage (abbrev.)

HACCP
Hazard Analysis and Critical Control Point (system)

HP
horsepower

IAEA
International Atomic Energy Agency

IATTC
Inter-American Tropical Tuna Commission

ICCAT
International Commission for the Conservation of Atlantic Tunas

ICLARM
International Centre for Living Aquatic Resources Management

ICM
integrated coastal management

IMO
International Maritime Organization

INMARSAT
International Maritime Satellite Organization

IOC
Intergovernmental Oceanographic Commission

ITQ
individual transferable quota

IUCN
World Conservation Union

LAES
Latin American Economic System

LIFDC
low-income food-deficit country

MAC
Management Advisory Committee (Australia)

MAGP
Multi-Annual Guidance Programme (EC)

MCS
monitoring, control and surveillance

MLS
minimum landing size

MPN
most probable number

MSY
maximum sustainable yield

MTNs
multilateral trade negotiations

NACA
Network of Aquaculture Centres in Asia-Pacific

NAFTA
North American Free Trade Agreement

NEI
not elsewhere indicated

NGO

non-governmental organization

OIE
International Office of Epizootics

OECD
Organisation for Economic Co-operation and Development

OLDEPESCA
Latin American Organization for Fisheries Development

PRA
participatory rural appraisal

RRA
rapid rural appraisal

SAARC
South Asian Association for Regional Cooperation

SCRS
Standing Committee on Research and Statistics (ICCAT)

SEAFDEC
Southeast Asian Fisheries Development Centre

SPC
Secretariat of the Pacific Community

SPF
South Pacific Forum

SPS Agreement
Agreement on the Application of Sanitary and Phytosanitary Measures

TAC
total allowable catch

TBT
Agreement on Technical Barriers to Trade

TURFS
territorial use rights in fisheries

UNCED
United Nations Conference on Environment and Development

UNCLOS
United Nations Conference on the Law of the Sea

UNESCO
United Nations Educational, Scientific and Cultural Organization

UNEP
United Nations Environment Programme

VMS
vessel monitoring system

WECAFC
Western Central Atlantic Fisheries Commission

WHO
World Health Organization

WMO
World Meteorological Organization

WRI
World Resources Institute

WTO
World Trade Organization

PART 1
World review of fisheries and aquaculture

FISHERIES RESOURCES: TRENDS IN PRODUCTION, UTILIZATION AND TRADE

OVERVIEW

In 1995 and 1996 total world fish production expanded rapidly, reaching 121 million tonnes in the second year. Aquaculture output grew dramatically during the biennium while capture fisheries production registered a slight increase. Supplies for human consumption increased considerably, rising from 14.3 kg per caput (live weight equivalent) in 1994 to 15.7 kg in 1996. However, this increase was almost entirely due to raised production reported for mainland China.[1] Excluding mainland China, at 13.3 kg, the average food fish supply for the world in 1996 remained close to the level recorded during the first half of the 1990s but was somewhat lower than that of the 1980s. Catches destined for the production of fishmeal and fish oil (reduction) contracted somewhat. (These trends in production and utilization are shown in Figures 1 and 2 and Table 1.)

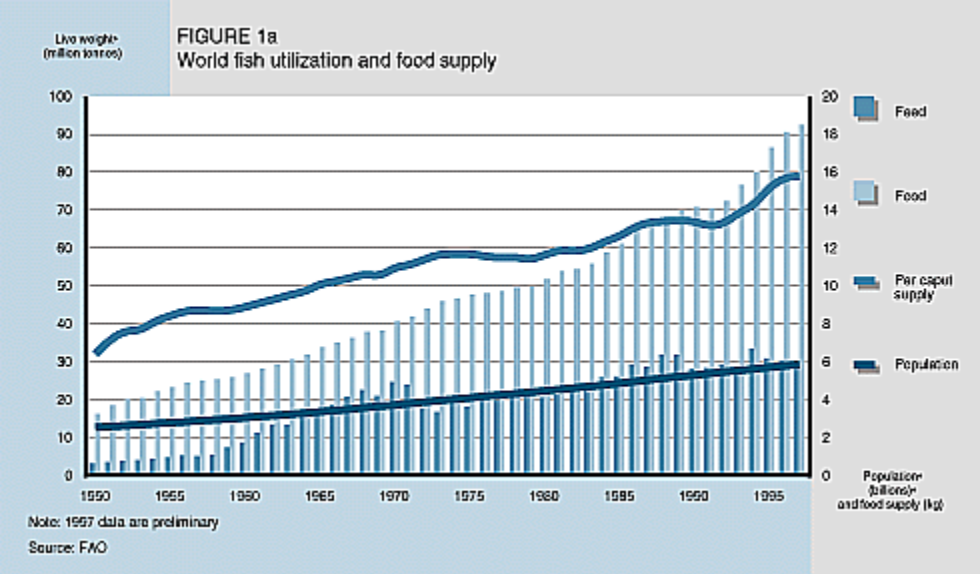


FIGURE 1a
World fish utilization and food supply

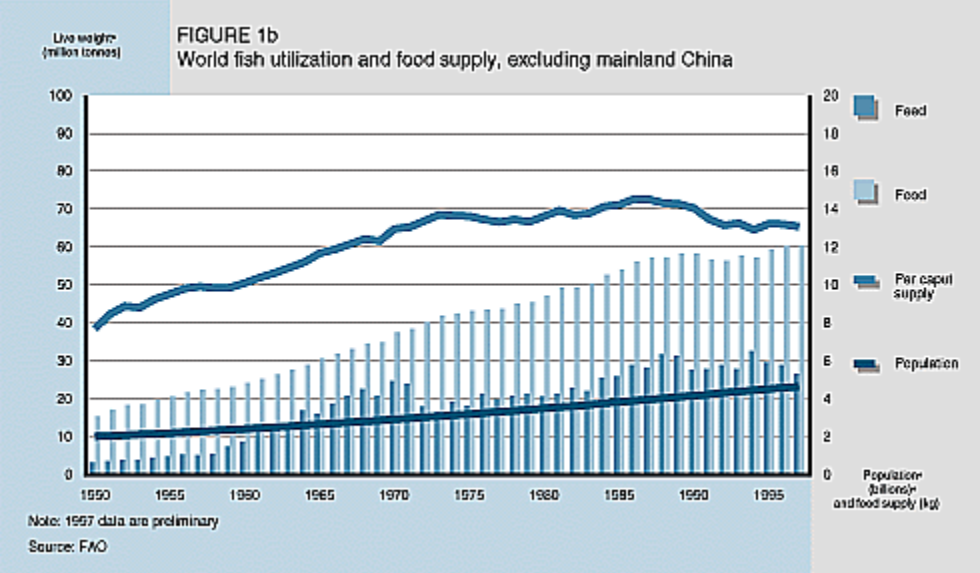


FIGURE 1b
World fish utilization and food supply, excluding mainland China

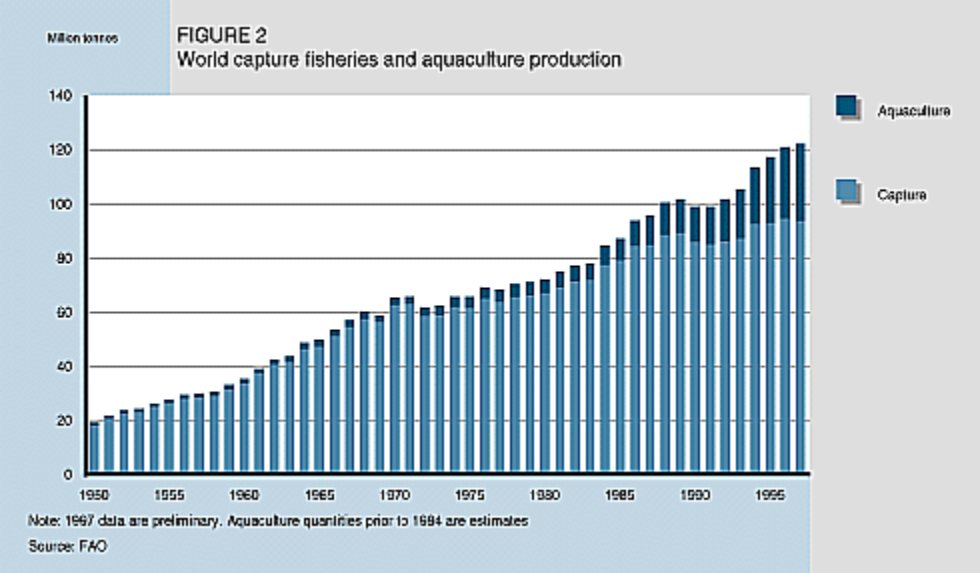


FIGURE 2
World capture fisheries and aquaculture production

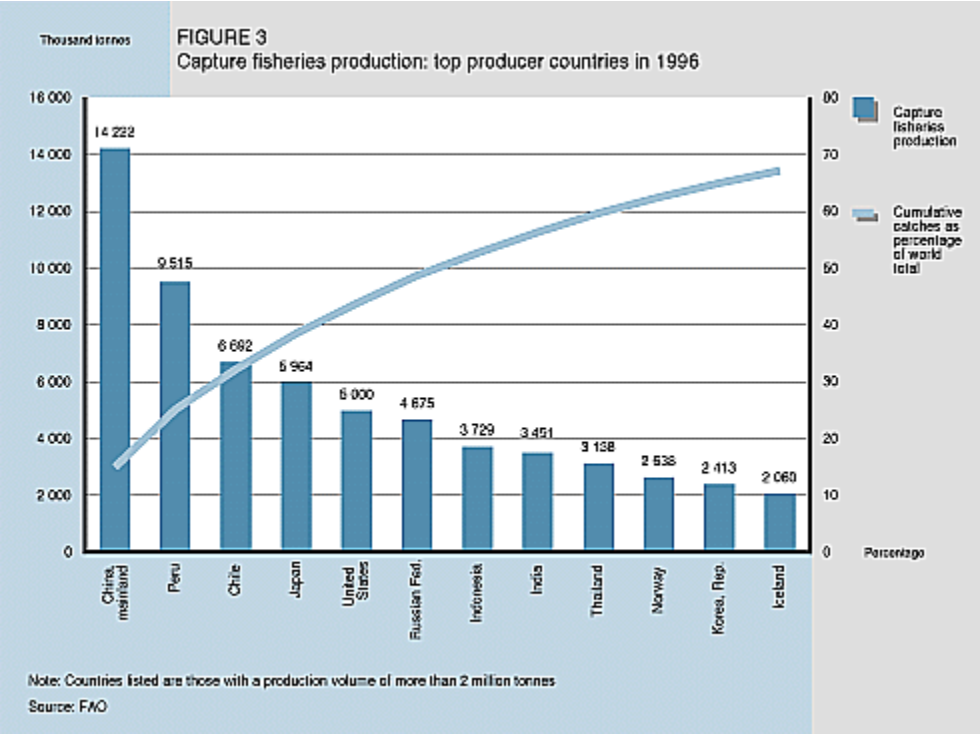
Trade increased during the 1996-1997 biennium, although at a slower pace than in the previous two years, and the value of world exports of fish and fishery products reached US$52.5 billion in 1996, with developing countries achieving a net trade surplus of US$16.6 billion.

PRODUCTION AND THE STATE OF FISHERIES RESOURCES

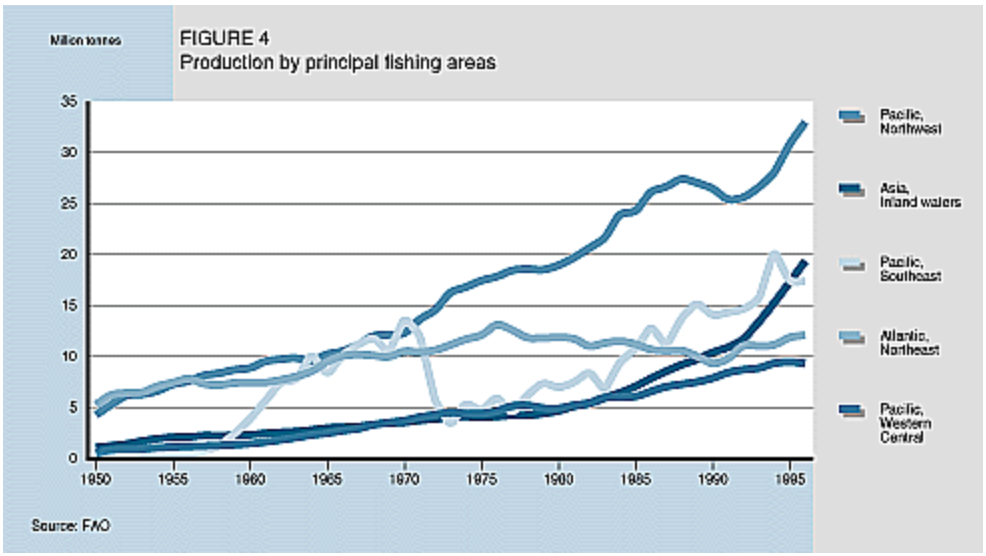
Capture fisheries

Total capture fisheries production in 1996 amounted to 94.6 million tonnes. China, Peru, Chile, Japan, the United States, the Russian Federation and Indonesia (in that order) were

the top producer countries in 1996, together accounting for more than half of world capture fisheries production in terms of tonnage (Figure 3). Marine capture fisheries continued to account for more than 90 percent of world capture fisheries production, with the remainder coming from inland waters.



World marine capture fisheries production reached a new record of 87.1 million tonnes in 1996 (Table 1). However, as in previous years, the rate of increase continued to slow during the biennium. In the 1950s and 1960s, total world marine fisheries production increased on average by as much as 6 percent per year, doubling from 17 million tonnes in 1950 to 34.9 million tonnes in 1961, and doubling again in the following two decades to reach 68.3 million tonnes by 1983. In the following decade, the average annual rate of increase dropped to 1.5 percent and to a mere 0.6 percent during the 1995/96 biennium. The Northwest Pacific remains by far the most important fishing area in terms of both volume and value of landings (Figures 4 and 5).



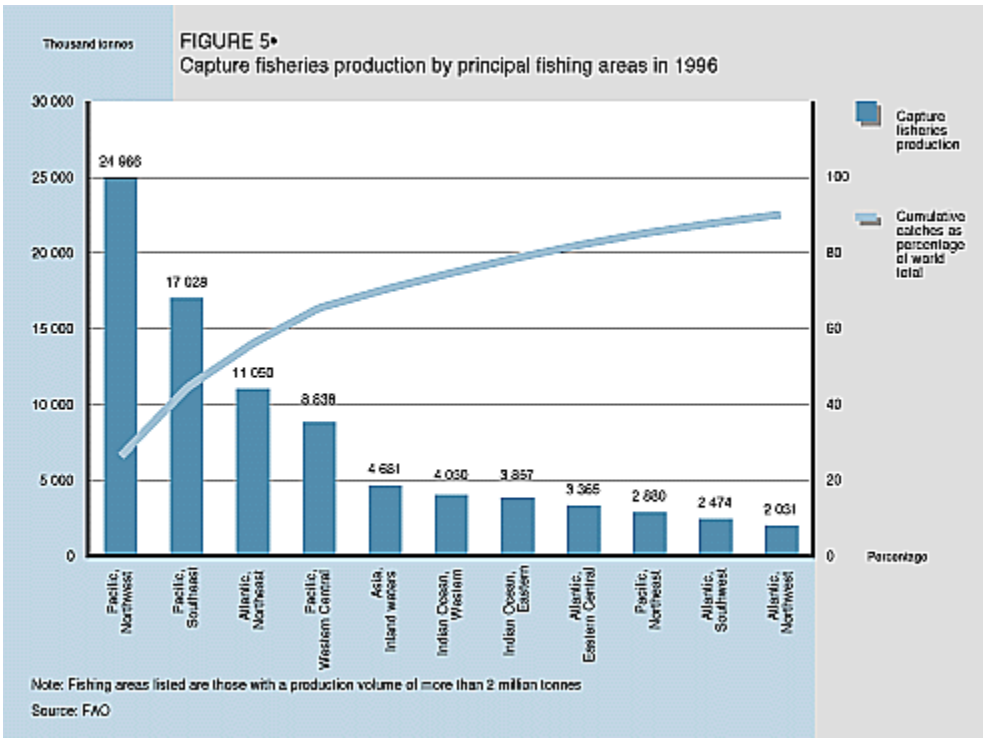


TABLE 1
World fisheries production and utilization

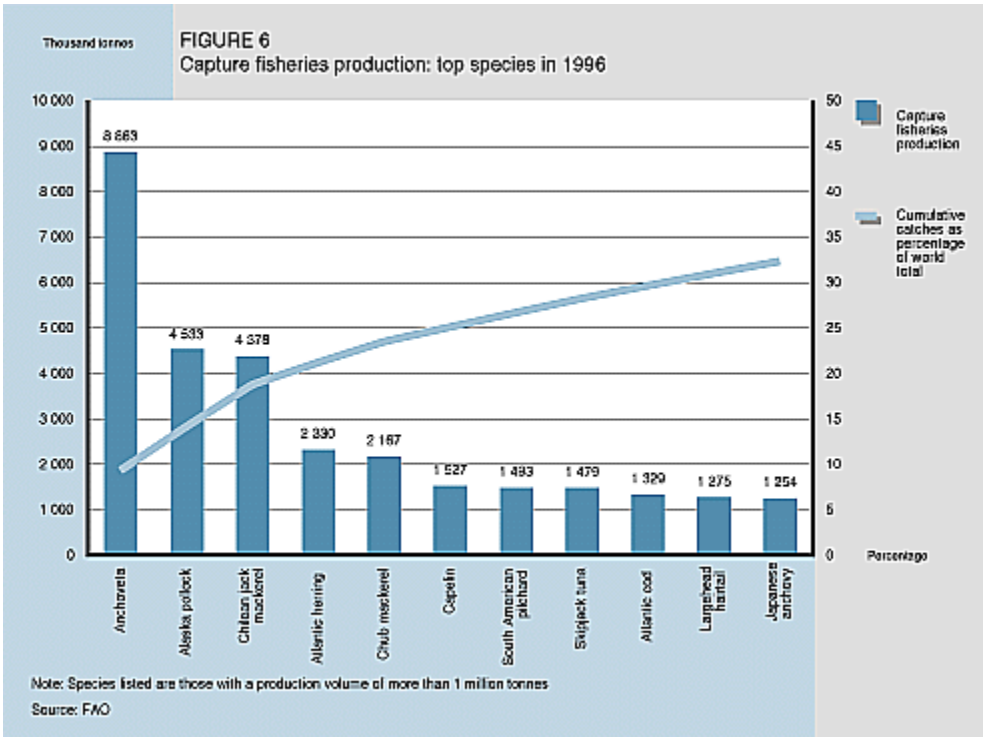
	1990	1992	1994	1995	1996	1997[1]
	(million tonnes)					
PRODUCTION						
INLAND						

Aquaculture	8.17	9.39	12.11	13.86	15.61	17.13
Capture	6.59	6.25	6.91	7.38	7.55	7.70
Total inland	**14.76**	**15.64**	**19.02**	**21.24**	**23.16**	**24.83**
MARINE						
Aquaculture	4.96	6.13	8.67	10.42	10.78	11.14
Capture	79.29	79.95	85.77	85.62	87.07	86.03
Total marine	**84.25**	**86.08**	**94.44**	**96.04**	**97.85**	**97.17**
Total aquaculture	13.13	15.52	20.77	24.28	26.38	28.27
Total capture	85.88	86.21	92.68	93.00	94.63	93.73
Total world fisheries	**99.01**	**101.73**	**113.46**	**117.28**	**121.01**	**122.00**
UTILIZATION						
Human consumption	70.82	72.43	79.99	86.49	90.62	92.50
Reduction	28.19	29.29	33.47	30.78	30.39	29.50

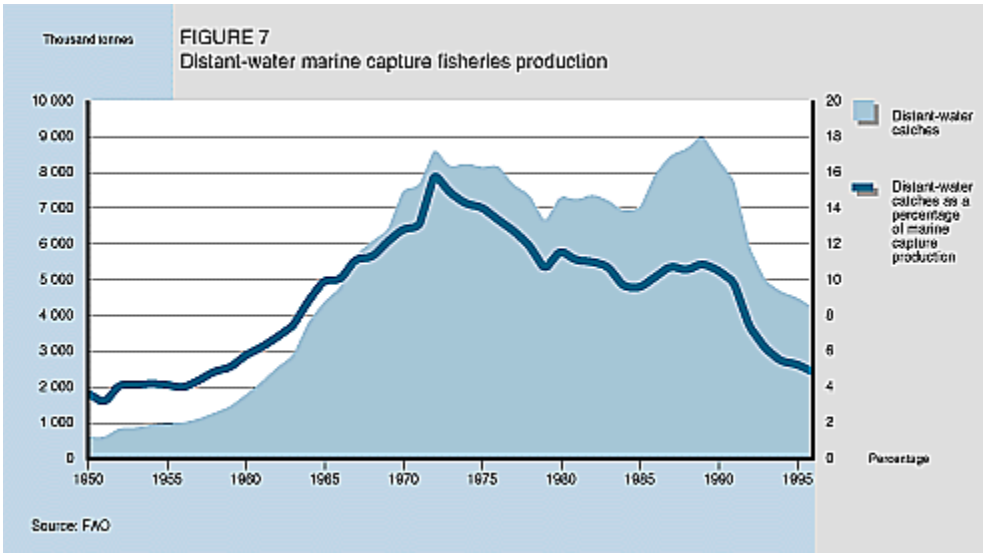
[1] Preliminary estimate.

For the world as a whole, therefore, landings of marine fish are continuing to level off. This is also the general trend for most major fishing areas of the world, where fisheries have evolved from a phase of increasing fishing effort and production to one in which production has stagnated and in some cases declined (i.e. a senescent phase). Judging from known fish stocks and resources of traditional fisheries, the total marine catches from most of the main fishing areas in the Atlantic Ocean and some in the Pacific Ocean would appear to have reached their maximum potential some years ago, and substantial total catch increases from these areas are therefore unlikely.

The relatively stable marine capture fisheries production total for the last three years masks some major fluctuations for individual species. Major increases in landings between 1995 and 1996 were recorded for capelin, chub mackerel and Japanese anchovy, whereas major decreases between 1994 and 1995 were observed for South American pilchard and anchoveta as well as Japanese pilchard. In 1995, six species - anchoveta, Alaska pollock, Chilean jack mackerel, Atlantic herring, chub mackerel and capelin - accounted for 25 percent of total capture fisheries production (Figure 6).



Distant-water fisheries production[2] has declined sharply since 1990 (Figure 7), mainly owing to the demise of the state-sponsored fleets of the former USSR. Japan had the largest distant-water fisheries production in 1996, with total catches of 668 000 tonnes. This is Japan's lowest figure since 1963, as the country's distant-water production has declined steadily since the early 1970s when it amounted to about 2 million tonnes.



State of marine fish resources. Overall, the state of exploitation of the main fish stocks (in fisheries for which assessment information is available) has remained more or less unchanged since the early 1990s. Recent reviews tend to confirm that, among the major fish stocks for which information is available, an estimated 44 percent are fully exploited and are therefore producing catches that have reached or are very close to their maximum limit, with no room expected for further expansion. About 16 percent are overfished and likewise leave no room for expansion; moreover, there is an increasing likelihood that catches might decrease if remedial action is not undertaken to reduce or suppress overfishing. Another 6 percent appear to be depleted, with a resulting loss in total production, not to mention the social and economic losses derived from the uncontrolled and excessive fishing pressure, and 3 percent seem to be recovering slowly.

Fisheries in the Northwest Atlantic, the Southeast Atlantic and the Eastern Central Atlantic reached their maximum production levels one or two decades ago and are now showing a declining trend in total catches. In the Northeast Atlantic, the Southwest Atlantic, the Western Central Atlantic, the Eastern Central Pacific, the Northeast Pacific and the Mediterranean and Black Seas, annual catches seem to have stabilized, or are declining slightly, after having reached a maximum potential a few years ago. The declining and flattening catch trends in these areas are consistent with the observation that these areas have the highest incidence of fully exploited fish stocks and of stocks that are either overexploited, depleted or recovering after having been depleted.

The main areas where total catches still follow an increasing trend and where, in principle, some potential for increase still exists are the Eastern and Western Indian Ocean, the Western Central Pacific and the Northwest Pacific. These areas tend to have a lower incidence of fully exploited, overexploited, depleted or recovering fish stocks, with relatively more underexploited or moderately exploited stocks. However, these areas are also the ones with the largest incidence of stocks whose state of exploitation is unknown or uncertain, and for which production estimates and stock assessments are consequently less reliable.

BOX 1
Quotas for cod stocks: an update

The quotas for Atlantic cod in the Barents Sea were reduced by about 195 000 tonnes or approximately 22 percent from 1997 to 1998. However, about 13 000 tonnes of the Norwegian 1997 quota was not caught and the share of the Russian quota not caught is expected to be even higher - approximately 40 000 tonnes. Consequently, the decrease in catch from 1997 to 1998 might not be as large as the quota indicates. According to Norwegian experts, the reduction is not expected to be of the same scale in the near future.

Iceland has also increased its cod quota, raising it by 32 000 tonnes to 218 000 tonnes for the period from 1 September 1997 to 31 August 1998. By 1 January 1998, 144 000 tonnes of the Icelandic quota had not been taken, which is about 30 000 tonnes more than the previous year. The outlook for future output from Icelandic waters is also good, although very weak results in the Barents Sea loophole[1] in 1997 indicate a pause in the Icelandic cod fishery in this area. In the Pacific, the major cod-catching country is the United States, and it is reducing its quotas from 270 000 tonnes in 1997 to 210 000 tonnes in 1998.

[1] An international fishing area surrounded by national EEZs.
Source: H. Josupeit. FAO Fisheries Department.

Inland capture fisheries production. Nominally, exploitation of inland fisheries resources amounts to 7.6 million tonnes, equal to 8 percent of total capture in 1996. Exploitation is mainly of finfish, although molluscs (7 percent) and crustaceans (6 percent) may be locally important. The production of reptiles, including crocodiles, alligators and caimans, is recorded by number and reached slightly more than 1 million in 1996 (including cultured production).

Six of the ten top producers for inland capture fisheries are in Asia: China, with a production of nearly 1.8 million tonnes, produces 23 percent of the world total and nearly three times as much as the second largest producer, India. Altogether, the top ten producer countries account for about 62 percent of world landings from inland capture fisheries.

In Africa, the majority of freshwater fish landings consist of Nile perch, followed by Nile tilapia, other tilapias, dagaas and silver cyprinid. These reflect both the importance of large lake fisheries (Lake Victoria, at its peak, accounted for about one-fourth of all of the inland catch from Africa) and the fact that more complete catch data are available for these fisheries than for smaller water bodies.

Inland catches mainly consist of: cyprinids as a group, snakeheads and shads in Asia; European perch, common carp, northern pike and roaches in Europe; of Azov Sea sprat, freshwater bream, roaches and pike perch in the CIS and the Baltic states; of characinids and freshwater siluroids in Latin America; and of lake whitefish, yellow perch, crayfish and catfish in North America.

***State of inland fish resources*.** Based on total inland capture for the period 1984-1996, it is clear that increasing use is being made of inland fisheries resources. The average annual increase is about 130 000 tonnes (about 2 percent per annum), and exploitation is most intensive in Asia and Africa (Figure 8).[3]

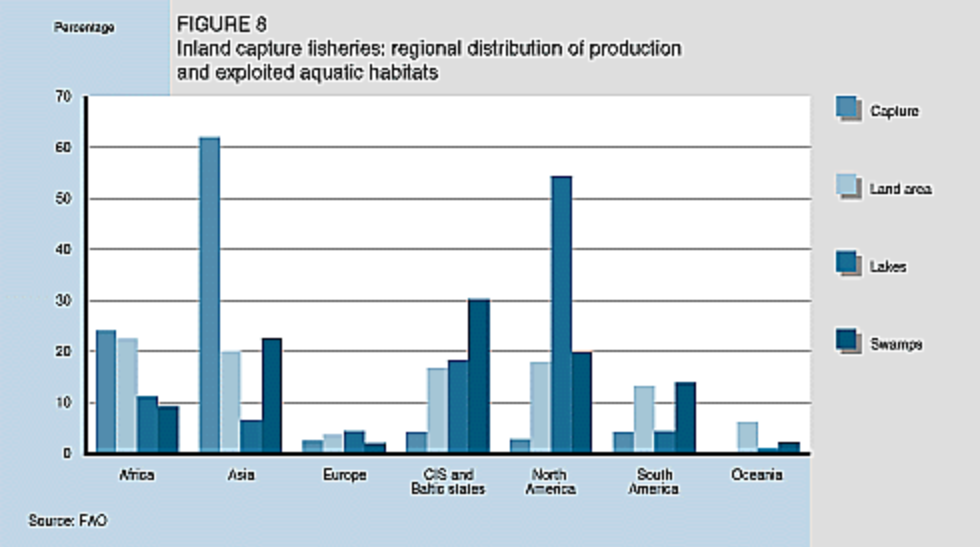
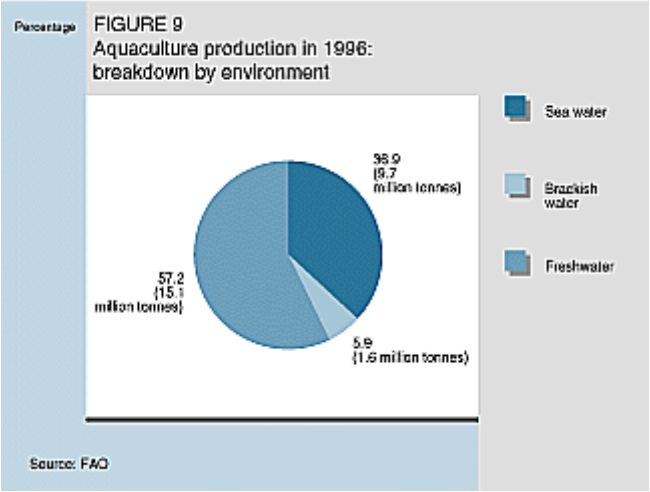


FIGURE 8
Inland capture fisheries: regional distribution of production and exploited aquatic habitats

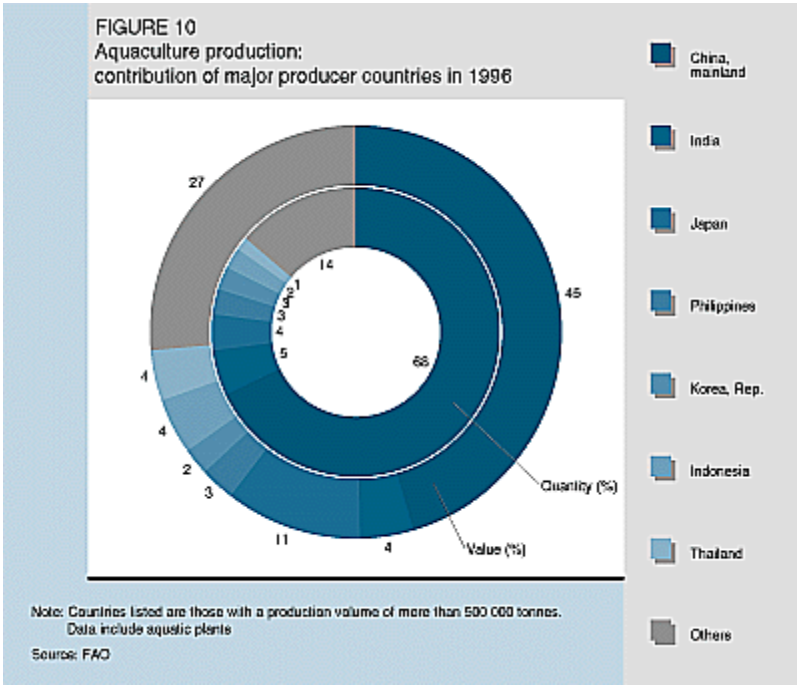
Looking broadly at continental areas, neither the present state of nor the short-term outlook for inland aquatic resources is encouraging. An increase in the loss and degradation of land and forest resources and of biodiversity and habitat as well as the growing scarcity and pollution of freshwater can be observed in Africa, Asia and the Pacific, Latin America and the Caribbean and West Asia.[4] Europe and the CIS and the Baltic states are also experiencing increasing biodiversity loss and habitat degradation. On the other hand, in North America, land degradation is decreasing.

Aquaculture

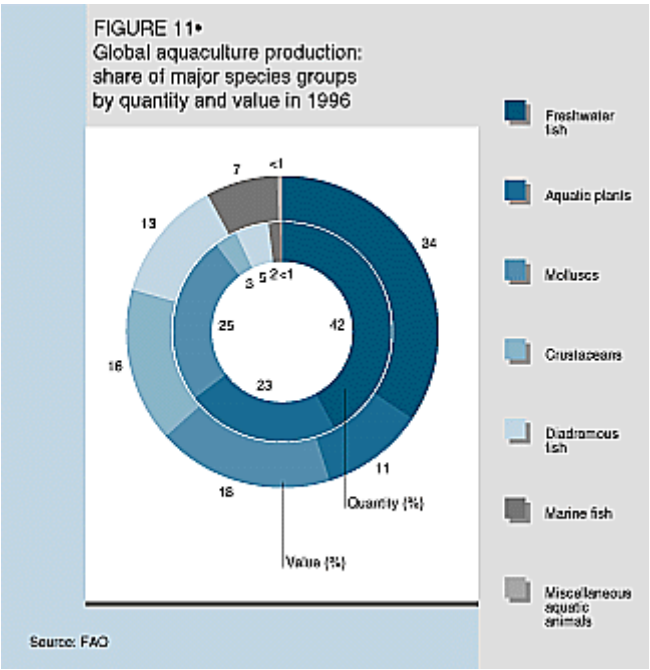
Aquaculture provided 20 percent of global fisheries production (and 29 percent of food fish) in 1996. Most aquaculture production (15.1 million tonnes) originated in freshwater. Of the remainder, 9.7 million tonnes were produced in marine environments and about 1.6 million tonnes in brackish water environments (Figure 9). These figures are excluding the production of aquatic plants, which amounted to 7.7 million tonnes in 1996.



Global production of aquaculture continues to be dominated by China, which in 1996 accounted for more than 67.8 percent of world output (Figure 10). However, given the relatively low value of carp and seaweeds, which dominate Chinese culture, its contribution to the world value of aquaculture production was just 45.4 percent. Japan, on the other hand, accounted for 4 percent of total world aquaculture production by weight but for more than twice that share by value because of the high-value species cultured (e.g. amberjack, scallops and oysters).

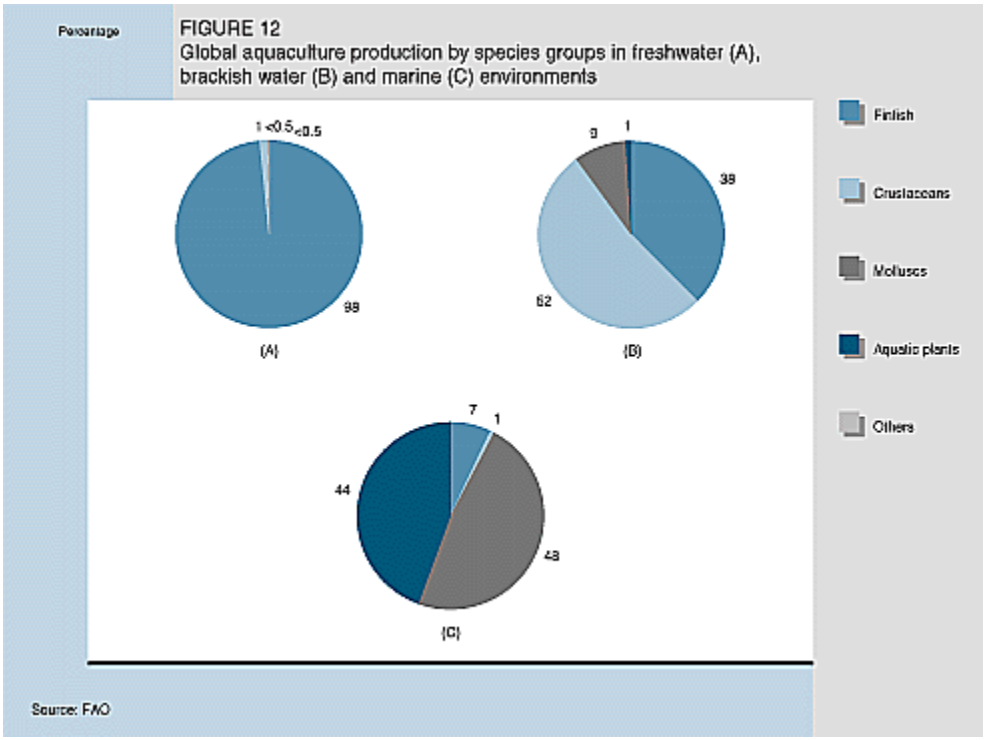


The dominant global aquaculture activity in 1996 continued to be finfish production, accounting for about 49 percent of total aquaculture production by weight and 55 percent by value (Figure 11).



As in previous years, freshwater finfish, in particular Chinese and Indian carp, accounted for the greatest share (42 percent) of total aquaculture production. Aquatic plants, 70 percent of which come from China, were valued at nearly US$5 billion and represented almost one-quarter of total production in 1996. A key factor in the rapid production growth of some species of finfish and crustaceans is the increasing availability of hatchery-produced seed, in turn a reflection of a wider diffusion of the expertise needed for successful hatchery operations.

While finfish account for almost 99 percent of freshwater aquaculture production, they account for less than 10 percent of culture in the marine environment (Figure 12).



In 1996 the production of kelp, *Laminaria japonica*, totalled just more than 4 million tonnes (Table 2). In terms of volume, this production figure made it the most important species in aquaculture for that year. In fact, two of the top ten aquatic species produced through culture were plants. It is worth noting that all these top species are low in the food chain, i.e. they are either primary producers, filter feeders or finfish that, in their adult stage, are herbivores or omnivores.

TABLE 2
World cultured aquatic production: top ten species in 1996, ranked by volume

Common name	Latin name	Production
		(million tonnes)
Kelp	*Laminaria japonica*	4.17
Pacific cupped oyster	*Crassostrea gigas*	2.92
Silver carp	*Hypophthalmichthys molitrix*	2.88
Grass carp	*Ctenopharyngodon idellus*	2.44
Common carp	*Cyprinus carpio*	1.99
Bighead carp	*Aristichthys nobilis*	1.41
Yesso scallop	*Pecten yessoensis*	1.27

Japanese carpet shell	*Ruditapes philippinarum*	1.12
Crucian carp	*Carassius carassius*	0.69
Nile tilapia	*Oreochromis niloticus*	0.60

Because of its high unit value, the giant tiger prawn tops the list of species ranked according to the total value (ex farmgate) of production (Table 3). Nearly all giant tiger prawn production is carried out in a tropical environment and the product exported to developed economies. This particular activity therefore provides a significant contribution to some Asian and Latin American economies.

TABLE 3
World cultured aquatic production: top ten species in 1996, ranked by value

Common name	Latin name	Value
		(billion US$)
Giant tiger prawn	*Penaeus monodon*	3.93
Pacific cupped oyster	*Crassostrea gigas*	3.23
Silver carp	*Hypophthalmichthys molitrix*	2.79
Kelp	*Laminaria japonica*	2.70
Common carp	*Cyprinus carpio*	2.42
Grass carp	*Ctenopharyngodon idellus*	2.23
Atlantic salmon	*Salmo salar*	1.87
Yesso scallop	*Pecten yessoensis*	1.62
Japanese carpet shell	*Ruditapes philippinarum*	1.52
Bighead carp	*Aristichthys nobilis*	1.31

The other high-value species that is not among the ten with the highest production figures is Atlantic salmon, which is grown in cold climates where a large share of it is also consumed.

Although a few advanced economies such as Japan, Norway and the United States feature among the top producers (Figure 10), aquaculture production is carried out predominantly in low-income food-deficit countries (LIFDCs) .

By 1996, 27.9 million tonnes, or around 82 percent of world total finfish, shellfish and aquatic plant production originated in LIFDCs. The contribution of this group of countries to world production has increased sharply since 1990 (Figure 13). At 16.7 percent, between 1990 and 1996 the average expansion rate of the aquaculture sector

within LIFDCs was nearly six times that in non-LIFDCs, which recorded 2.9 percent overall. Most of the production comes from six countries, with China accounting for about 83 percent (Figure 14).

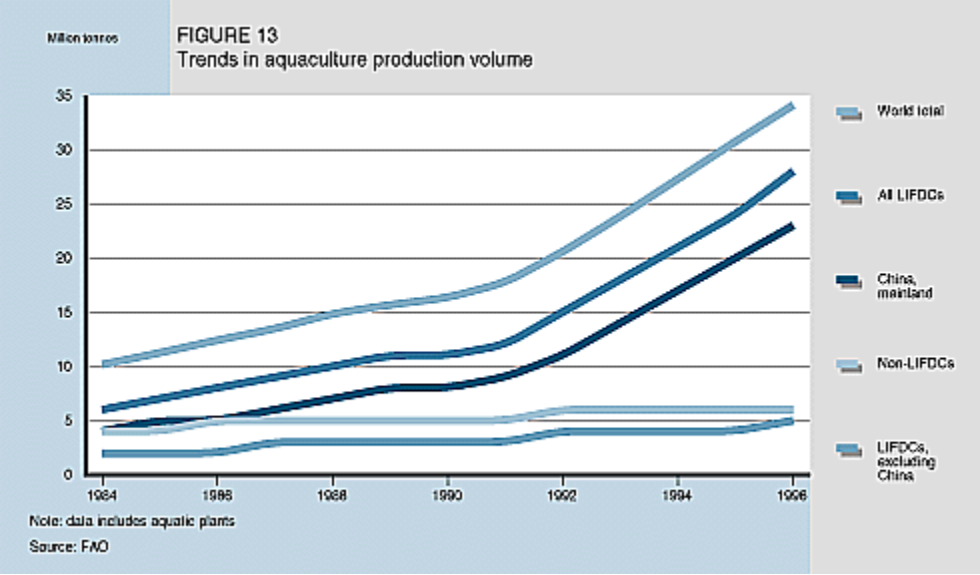


FIGURE 13
Trends in aquaculture production volume

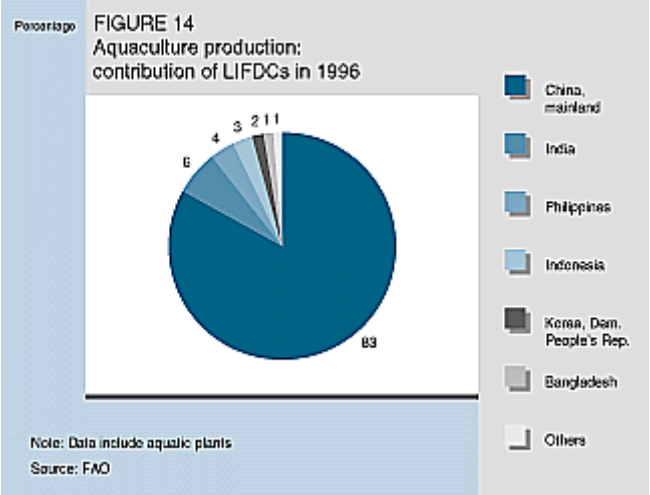


FIGURE 14
Aquaculture production:
contribution of LIFDCs in 1996

BOX 2
Monitoring hatchery production: at least 160 million fry a day!

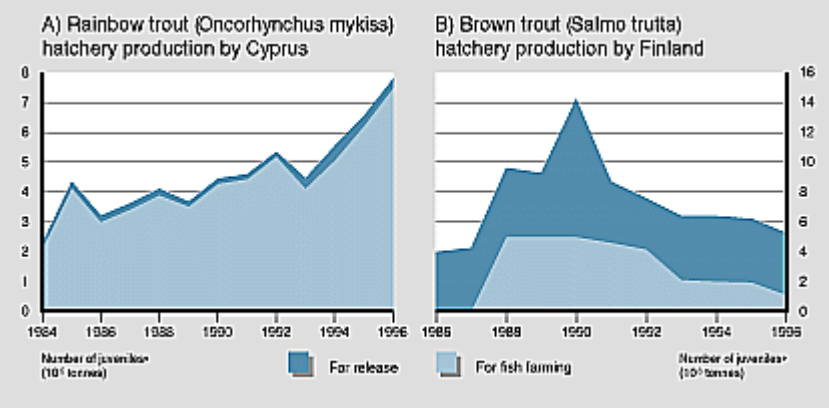
To improve the utilization of aquatic biodiversity, governments need information on hatchery output. However, the collection of

information on this subject is not always systematic, since a central mechanism for collating related data is often lacking.

At the request of FAO, therefore, member countries have recently submitted hatchery production statistics, and these have been analysed, revealing a total reported production for 1996 of 58 000 million fry and/or fingerlings, i.e. almost 180 million juveniles per day! Of these, 99 percent were finfish. The majority of this reported hatchery production was intended for "release to the wild".

The data supplied are most complete for those countries where inland waters have traditionally been stocked for recreational fishing. The most consistent data have been obtained from Australia, Belgium, Croatia (since 1992), Cuba, Cyprus, Finland, France, Latvia, Malaysia, Morocco, Panama, the Republic of Korea, South Africa (since 1993), Switzerland and the United States.

Figures A and B show hatchery production of rainbow trout (for Cyprus) and brown trout (for Finland) as examples of similar species used for different purposes.



Source: A.J. Immink. Visiting scientist (aquaculture), FAO Fisheries Department.

Numbers of fishers and fishing vessels

Information provided recently by FAO member countries on numbers of fishers[5] and fishing vessels[6] indicates that, while the expansion of fishing fleets seems to be slowing down, the number of fishers appears to be rising relatively fast. However, as the number of fishers includes individuals engaged in aquaculture - and not separately identified in

most cases - the increase in the number of participants in capture fisheries is in fact slower than the overall figures suggest.

***Fishers*.** Recent information on the number of fishers[7] is scarce, as few countries collect and publish annual estimates. Among those that do are China, Iceland, India, Japan and Norway, data for which are presented in Table 4. As can be expected, the figures show that, while the numbers of fishers are shrinking in capital-intensive economies, they are expanding in economies that are still predominantly labour-intensive.

TABLE 4
Number of fishers (including fish farmers) in selected countries[1]

Country		1970	1980	1990	1994	1995	1996
China	(number)	2 300 000	2 950 344	3 460 345	4 740 483	5 071 940	5 396 370
	(index)	*66*	*85*	*100*	*137*	*147*	*156*
Japan[2]	(number)	549 357	457 380	242 990	202 000	193 000	...
	(index)	*243*	*188*	*100*	*83*	*79*	
Iceland	(number)	4 895	5 946	6 951	6278	5 661	5 635
	(index)	*70*	*86*	*100*	*90*	*81*	*81*
India	(number)	104 000	2 008 913	1 741 265	2 045 701	2 394 174[3]	...
	(index)	*60*	*115*	*100*	*118*	*138*	
Norway	(number)	21 000	19 425	20 475	16 442	17 160	17 087
	(index)	*102*	*95*	*100*	*80*	*84*	*83*

[1] The data for Japan and Iceland include part-time fishers.
[2] Japan's data for 1994 and 1995 do not include women engaged in fisheries and aquaculture. These figures have been reported separately and are, respectively, 55 460 and 54 230.
[3] Estimate (1995 data unavailable).
Note: ... = data unavailable.

Non-decked vessels. The numbers of non-decked fishing vessels, more than 90 percent of which are found in Africa and Asia, have expanded only marginally since 1985.

Decked fishing vessels. Information provided by countries indicates that that the number of decked fishing vessels - like marine fish landings - is increasing but at a declining rate (Figure 15). This contrasts with a more rapid expansion witnessed during the period 1970-1989. The aggregate of the fleet tonnage (GT) has displayed a similar development.

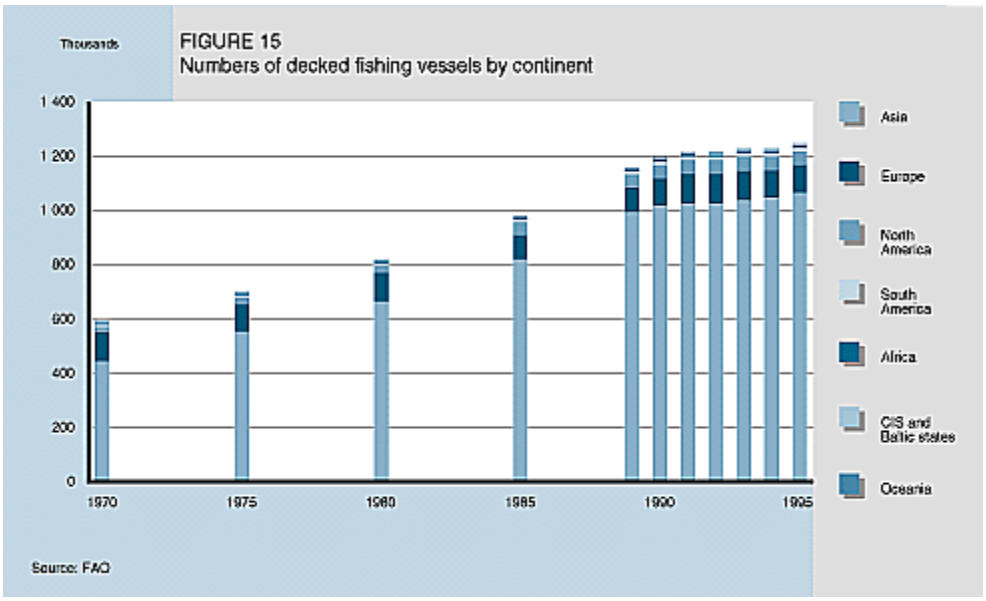


FIGURE 15
Numbers of decked fishing vessels by continent

Between 1980 and 1997, China's fleet of decked fishing vessels increased from about 60 000 to 460 000 vessels (Figure 16). Without this increase, the number of decked fishing vessels in the world would have remained stable during the period.

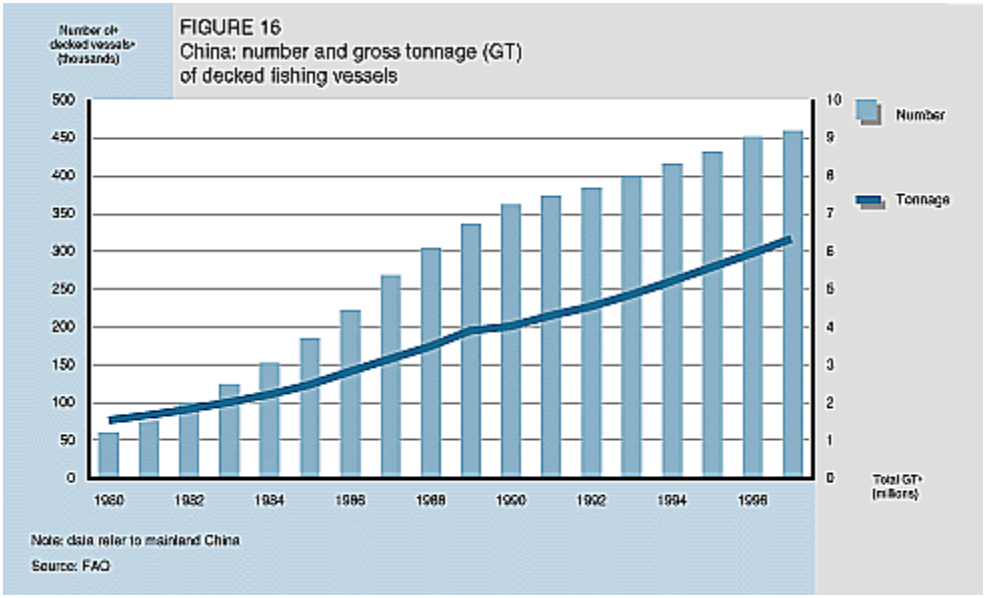


FIGURE 16
China: number and gross tonnage (GT)
of decked fishing vessels

A study of Lloyd's Register of Shipping[8] reveals that *fishing vessels above 100 GT* have decreased in number over the last seven years, as the decommissioning of vessels has outpaced new constructions. In 1991, there were slightly fewer than 26 000 fishing vessels of this class in Lloyd's Register; in 1997, the number was about 22 700, which is

below the number of vessels recorded for the year 1985. Of the vessels currently in the register, more than 10 000 are 20 years old or more and are likely to be decommissioned or scrapped over the next decade. However, given that Lloyd's Register has incomplete statistics for Chinese fishing vessels, the known increase in the size of the world fishing fleet (of vessels above 100 GT) is not evident in its records.

The register shows that there has been a long-term reduction in the building rate for vessels of more than 100 GT, with construction at its lowest in 1997. According to a provisional estimate, only 155 vessels were built in that year.

BOX 3
Tonnage measurement and fishing capacity

For a given type of fishing gear, a vessel's capacity to catch fish is determined by a combination of several of its physical characteristics as well as many intangibles such as the skill of the captain and crew. While it may be theoretically possible to determine the fishing capacity of one design relative to another, it may not be practical to do so in consideration of the elaborate formula that would be required to give proper weight to every characteristic or variable related to capacity.

Any survey aimed at determining the capacity of a fishing vessel or of a fishing fleet would need to cover information on a number of vessel characteristics, of which gross tonnage (GT), length and engine power would be among the most important. Of these, GT is probably the most significant single variable influencing fishing capacity and, in many respects, it is a good compromise between having a perfect measure or none at all.

Tonnage is often confused with the measure of displacement, or weight, of a vessel. In fact it refers to the size of the vessel, and not to its weight. Its origin dates back to the fifteenth century when a standard-sized barrel, called a tun, was decreed in England for the purpose of measuring ship capacity, eventually referred to as *tunnage*, or tonnage. However, the method of tonnage measurement has since evolved and differs considerably from country to country.

Unification of this unit of measure for large ships on international voyages was a slow process. A number of international meetings held since the 1930s concluded with the 1969 International Convention on Tonnage Measurement of Ships (referred to as the London Convention), which entered into force in July 1982. It applies to ships undertaking international voyages, although ships of less than 24 m

(and warships) are exempt. Furthermore, GT as defined by this convention only became obligatory for all vessels (more than 24 m long and engaged in international voyages) after 18 July 1994. Until then, the system of tonnage defined by the 1947 Convention for a Uniform System of Tonnage Measurement of Ships (the Oslo Convention) continued to be valid. This system applied the gross registered ton (GRT) as the unit of measure.

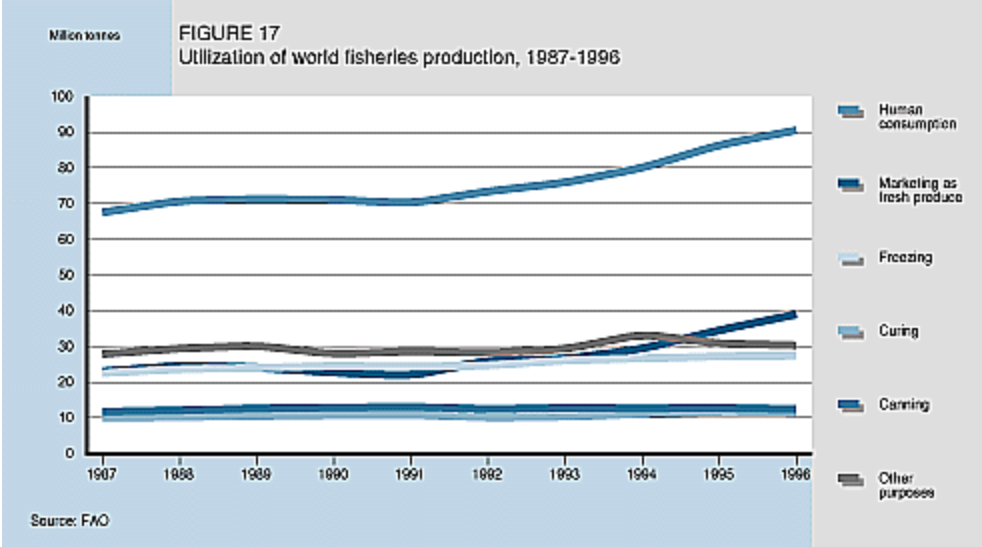
An important point to note is that the GT of a given vessel can be significantly greater than its GRT because, under the London Convention, certain parts of the vessel (e.g. enclosed spaces above the upper deck) are included in GT whereas they were previously excluded from GRT. This means that many vessels that were below 100 GRT prior to 1994 are now being classified above 100 GT. Therefore, as the existing fleet is being reclassified, the size of the world fishing fleet consisting of vessels "above 100 tons" will be increasing. Much care must be taken not to confuse this increase in the number of vessels with an increase in fishing capacity, as in reality the capacity has not changed, only the measurement used.

Source: J. Turner. FAO Fisheries Department.

FISH UTILIZATION

Fish for food

In recent years, the volume of fishery products marketed in their fresh state has increased not only in absolute terms but also as a percentage of all uses of fish. In 1996, about 33 percent of all fish was marketed fresh compared with 20 percent in 1986 (Figure 17).



The supply of frozen fish is growing in both developed and developing countries. The production of frozen fish fillets, shrimps and prawns has increased in volume, as has the supply of fish in the form of ready-to-eat meals and other convenience food products.

Fish for feed

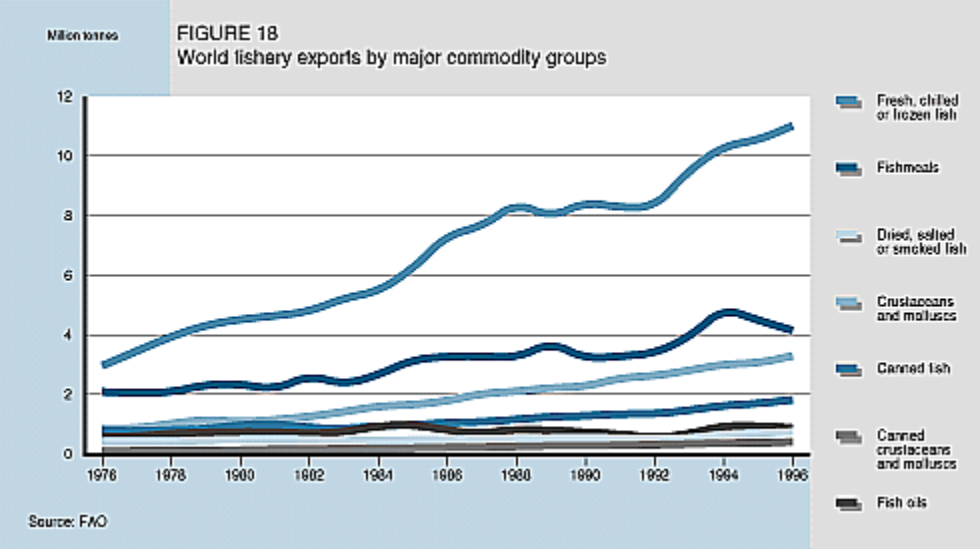
After 1994, when nearly 32 million tonnes of fish (representing nearly 30 percent of the total world fisheries production) were used for feed, there was a decrease in this usage in 1995. As a consequence of the El Niño phenomenon, the stocks of small pelagics in the Eastern Pacific are expected to shrink and the volumes landed in the course of 1998 may consequently be several million tonnes below those recorded in 1996.

TRADE IN FISH AND FISHERY PRODUCTS

Fish, shellfish and fishery products are widely traded, with no less than 195 countries having exported part of their production and some 180 countries having reported fishery imports of varying amounts in 1996. In parallel with the increase in production, international trade has continued to grow, and at an accelerating rate in recent years. The largest part of this growth is real in that it is linked to the expansion of the world's economies and also reflects the increased availability - owing mainly to aquaculture production - of species in high demand as well as the sustained demand for fishmeal. Another part of the increase is fictitious, or nominal, as it is due to trade among countries that were formerly part of one political entity.

Export volumes reached 22 million tonnes in 1996 (Figure 18), which is nearly three times the volume traded in 1976 and, when reconverted into the estimated live weight equivalent, represents 40 percent of overall fisheries production. This level has been

reached after a period of relative stability, with foreign trade accounting for around 30 percent of production.

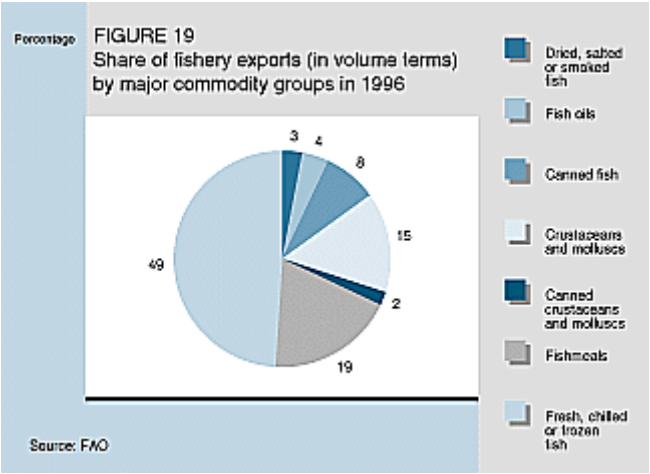


In 1996, the export sector earned US$52.5 billion, representing 11 percent of the value of agricultural exports and about 1 percent of total merchandise trade. The share of trade in fish and fishery products in all agricultural trade has increased somewhat over the last decade.

Although fishery trade is not prominent at the global level, in some countries its contribution to foreign currency earnings is vital to the national economy; for example, fish and fishery products represent more than 75 percent of total merchandise exports for Iceland, the Faeroe Islands, Greenland, Maldives and Seychelles. In a further 20 countries, including Chile, Ecuador, Kiribati, Madagascar, Mauritania, Morocco, Mozambique, Namibia, Peru and Senegal, fisheries exports account for between 75 and 10 percent of total merchandise exports. Despite the importance of fisheries to their economies, none of the above countries accounts for a significant share of the world market and, even taken together, their exports account for only 15 percent of the total. In a further 38 countries, fishery exports in 1996 contributed between 9 and 2 percent of trade receipts. Among these countries were Thailand, with net earnings of US$3.2 billion, and Indonesia, with net earnings of US$1.6 billion.

In terms of value, fishery exports are almost entirely (95 percent) composed of food products, although, in terms of volume, fishmeal and fish oil account for a much greater share (Figure 19). In value terms, more than half of the fishery export trade originates in developing economies and consists largely of imports into developed economies. While Thailand was the leading world exporter of fish products between 1993 and 1996, at a value of US$3.4 billion, Norway's fishery exports were the highest in 1997. Japan, with US$15.5 billion worth of imports in 1997, is the leading importer while the United States

absorbs about 10 percent of world fish imports. These two countries and the European Community (including the value of the intra-EC trade) import 75 percent (in value terms) of internationally traded fishery products.



Shrimp

The shortage of shrimp on the world market continued in 1997. With an output of some 175 000 tonnes, Thailand continues to be the world's main supplier of cultured shrimp, although this figure represents a substantial drop from two years earlier. Other Asian suppliers also reported a lower output in 1997. By contrast, Ecuador's shrimp output is growing and broke a new record during that year, as its production was helped by larger amounts of larvae collected from the wild, a situation that was favoured by El Niño.

The United States shrimp market was very strong, owing to the country's expanding economy and to the high value of the US dollar. A strong domestic demand, combined with limited supplies on the world market, led to record prices. In only one year, prices grew by 20 percent, with even higher increases experienced for large-sized shrimp. United States imports expanded by 10 percent in 1997, allowing it to overtake Japan for the first time as the world's major shrimp market. Asia as a whole maintained its share of the United States market, as smaller exporting countries in the region, such as Indonesia (12 800 tonnes, +29 percent) and China (12 900 tonnes, +68 percent), showed very good performances in 1997.

Japanese imports of shrimp fell by 7 percent in 1997 to only 267 200 tonnes, the lowest figure in nine years. A downward trend was apparent throughout the whole of 1997, not only in the closing months when the economic crisis hit the country. Short supplies of tropical shrimp, high prices and a weaker yen contributed to the decline in shrimp consumption on the Japanese market.

In 1997, after 13 years, India again became the major supplier of shrimp to the Japanese market. Indian shrimp exports to Japan increased by 6.6 percent to a record 59 100 tonnes. Some of this shrimp was redirected to Japan as a result of an EC ban on Indian seafood, which started in August 1997. Indonesia lost its top position because of disease in its shrimp farms, and its exports to Japan fell by 11 percent. Thailand experienced similar problems in its farms, and its shrimp exports to Japan declined by 30 percent.

Tuna

In general, tuna catches continued to be low in 1997. In the Eastern and Western Pacific, the El Niño phenomenon led to lower catches in the opening months of the year while, in the Atlantic, catches were also low. The tuna fleets in the Indian Ocean were successful in targeting skipjack.

Domestic landings of tuna in the 42 major harbours of Japan increased to 385 000 tonnes in 1997, up from 340 000 tonnes in 1996 but still about 17 000 tonnes short of the 1995 result. This figure, however, only gives a partial indication of the overall performance of the Japanese fleet, as another 300 000 tonnes of the catch are landed in other ports of Japan or outside the country and sent directly to canneries in the United States and Thailand. Apart from bluefin, higher landings were reported for all tuna species in 1997, with strong increases for fresh skipjack and frozen albacore.

Japan is the world's major market for tuna products, of which its apparent consumption exceeds 1 million tonnes or nearly 30 percent of world tuna catches. About 70 percent of this consumption is accounted for by domestic production while the remainder comes from imports.

In 1997, Japanese imports of tuna amounted to 311 000 tonnes, a 5 percent decline from the 326 000 tonnes imported in 1996. Imports of yellowfin tuna dropped by 22 percent in 1997 and bigeye imports were also reduced. Taiwan Province of China continues to be the main exporter of tuna to Japan, despite a 20 percent decrease to about 76 800 tonnes in 1997. This is 47 percent below the maximum volume of Taiwanese tuna exports to Japan, which was recorded in 1993.

The Republic of Korea is the second major exporter of tuna to the Japanese market. Shipments expanded in 1997, almost regaining the levels recorded in the early 1990s.

Groundfish

The world market for highly priced, whitefish fillets is starting to accept cheaper substitutes. There is already a growing acceptance of fillets of hoki from New Zealand both in Europe and the United States. Since 1995, New Zealand hoki exports have benefited from reduced EC tariffs, resulting in an increasing proportion being directed to the European market. In the United States market, farmed whitefish, mainly catfish but also tilapia, is increasingly replacing wild capture groundfish. However, in Europe, hoki,

catfish and tilapia are not fully accepted substitutes, and this is leading to higher prices in the region, as has already been seen in the case of cod.

The composition of United States imports of frozen whitefish changed during 1997. While the total volume of blocks and slabs was practically the same as in 1996, imports of minced whitefish decreased by 17 percent in volume. Pollack remained the predominant species, accounting for about 57 percent of total imports of frozen whitefish blocks. However, imports of pollack block dropped by approximately 7 percent in 1997, with most of this decrease accounted for by lower volumes from the Russian Federation. Imports of cod blocks show the opposite tendency, having increased by about 40 percent. Imports of flatfish blocks also increased, doubling in volume between 1996 and 1997.

A shift was evident in the United States market for frozen fillets and steaks in 1997. Cod imports increased by about 9 500 tonnes, while Alaska pollock imports decreased by approximately 6 000 tonnes. In general, imports of species and products from the North Atlantic increased, while products derived from Alaska pollock decreased.

The market for traditional whitefish fillets and blocks is influenced by the market situation for surimi and roe and also by the market for salted and dried whitefish. This is because the raw material is the same and flexible production units can to some extent change the production mix according to the current market situation. While Alaska pollock traditionally has been the species utilized for surimi, most salted and dried products are derived from cod. As a result of the financial crisis in Asia, the situation in the surimi and roe market is somewhat turbulent but, nevertheless, the demand for salted and dried groundfish is expected to be relatively stable or even to increase slightly.

Between 1996 and 1997, imports of Alaska pollock surimi into Japan decreased slightly to 125 000 tonnes. However, imports of hake or cod surimi increased by about 53 percent to more than 26 000 tonnes, with the United States supplying almost 95 percent of this volume. Itoyori surimi imports increased by more than 30 percent to 37 000 tonnes, two-thirds of which were supplied by Thailand. Imports of Patagonian toothfish (*Dissostichus eleginoides*) fillets increased from 11 141 to 13 767 tonnes, with Chile as the main supplier.

Fishmeal

Peruvian fishmeal production dropped to 1.66 million tonnes in 1997, about 0.3 million tonnes less than in 1996, and Chile's production dropped by 0.2 million tonnes to 1.2 million tonnes. During the same period, fishmeal production in Europe increased; production in Norway, Denmark and Iceland was 0.1 million tonnes greater than in 1996.

Despite lower production, however, Peruvian fishmeal exports increased in 1997, with 1.96 million tonnes exported - about 0.3 million tonnes more than in 1996. This record export left the country with no fishmeal in stock at the end of 1997. Peruvian consumption of fishmeal was halved during the year. In 1997, Chilean fishmeal exports were 0.1 million tonnes below the volume reached in 1996. High fishmeal prices resulted

in increased export earnings for South American countries overall, despite lower production. Prices touched a peak of US$721 per tonne in December 1997, when Peru's fishmeal exports were valued at US$990 million.

Fish oil

Fish oil production in Peru declined sharply from 415 000 tonnes in 1996 to 280 000 tonnes in 1997. Nevertheless, exports of fish oil were higher in 1997 than in 1996, expanding in value terms to reach US$95 million.

[1] Chinese production statistics held by FAO for several species of molluscs have undergone a major revision since the last issue of *The State of World Fisheries and Aquaculture*, which was based on information available up to mid-1996. While the numerical production data received from China had been understood to be in live weight units (i.e. including shell weight), the data for some species of molluscs in fact reflected meat weight. As FAO statistics on mollusc production are recorded on a live weight basis, an upward revision has been made for all years. The revision mainly affects aquaculture production statistics.
[2] Distant-water fisheries production is defined here as catches taken in FAO fishing areas that are non-adjacent to the flag state of the fishing vessel used.
[3] The intensity of exploitation in this case is calculated in terms of capture in tonnes of landed weight, contrasted with surface areas (km^2) of the continents and their lakes and swamps.
[4] UNEP. 1998. *Global State of the Environment Report 1997*. Nairobi.
[5] For details see FAO. 1997. *Numbers of fishers.* FAO Fisheries Circular No. 929. Rome.
[6] For details see FAO. 1998. *Bulletin of Fishery Statistics,* No. 35. Rome.
[7] For a review of trends in numbers of fishers over the period 1970-1990, see the section Fishers and fishing fleets.
[8] Information drawn from Lloyd's Register of Shipping is provided under exclusive licence by Lloyd's Maritime Information Services (LMIS).

PART 2
Selected issues facing fishers and aquaculturists

INTRODUCTION

Capture fishers and aquaculturists often come up against operational difficulties and controversial issues which must be overcome if capture fisheries are to remain a stable source of food and income and if aquaculturists are to meet the consumer demand for an ever-increasing stream of aquatic products.

Access to and the use of natural resources are the main subject of controversy, in which there are two basic points at issue:

- The first concerns which natural resources humans may use (and, in doing so, alter). Many civil society groups argue that there should be more "undisturbed" natural resources reserved for "non-consumptive" uses, i.e. as an amenity. On the other hand, the growing world population, in addition to its increasing mobility, is progressively diminishing the earth's "wild" natural resources. In time, a greater degree of non-consumptive use will leave even fewer resources available for consumptive purposes.
- The second point concerns the sustainability of consumptive uses of renewable natural resources. In this case, civil society (and some participants in the fisheries sector) maintains that certain fishery and aquaculture practices modify the ecosystem to such an extent that it is no longer able to support the regeneration of its natural resources. The production technologies adopted for such practices are therefore deemed unsustainable. This argument is reflected, for example, in the popular protest against overfishing, which is believed to lead to the permanent destruction of marine aquatic life.

This review starts with the general and moves on to more specific aspects of the issues discussed. The first topic to be considered is that of governance of the fisheries sector. Here, governance is understood to be the legal and institutional framework designed to guarantee that the role played by capture fisheries and aquaculture is considered appropriate by society as a whole. Governance should also set rules to ensure that, within the sector, competition is constructive and access to resources equitable.

The questions addressed under governance are discussed in more detail as part of the next two issues which deal with the creation of an enabling environment for aquaculture, and the integration of fisheries into coastal zone management. The final two issues - how to match fishing capacity with available resources, and how to manage by-catch and discarding - need to be resolved by the capture fisheries sector, although they have attracted considerable attention outside the fisheries sector.

NATIONAL FISHERIES GOVERNANCE

THE ISSUE

Ninety percent of the global fish catch is taken within zones of national jurisdiction, owing primarily to the higher productivity and proximity of the coastal and shelf areas. It follows, therefore, that these are the areas where the bulk of fisheries management problems occur.

Such problems are not a new development: for 50 years at least, recognition has been given to the need for governments to be aware of the state of their fisheries, to implement effective policies aimed at preventing resource depletion and the wastage of fisheries inputs and, increasingly, to facilitate stock rehabilitation.

With about 60 percent of the main monitored commercial stocks considered to require improved or new management, the current state of world fisheries indicates a need for better governance. The challenge for governments is to manage fisheries in such a way that ensures the optimum and sustainable use of resources as well as economic efficiency and widespread social benefits. Furthermore, it is increasingly recognized that the responsibility for management should not rest with governments alone but rather be a shared responsibility, involving those operating in the fisheries sector as well as others who consider they have a right to participate in decisions concerning humanity's natural heritage.

In the 1980s, it was widely anticipated that fisheries governance would improve substantially in parallel with the establishment of extended national jurisdiction under the United Nations Conference on the Law of the Sea (UNCLOS). This was the case for countries that were able and had the will to strengthen their governance. Very often they were already engaged in exclusive economic zone (EEZ) fisheries or had readily available capacity (e.g. trained fishers, investment capital and infrastructure) within the sector to do so. Subsequent experience has shown that, even under the most favourable circumstances, achieving good governance is a protracted process. Those governments that now have soundly managed fisheries generally owe this achievement to 20 to 40 years of continuous effort and adjustment (see Box 4, The evolution of fisheries management in New Zealand).

BOX 4
The evolution of fisheries management in New Zealand

Capacity problems in New Zealand's inshore fisheries began to manifest themselves in the 1960s. The appearance of foreign fishing vessels off the New Zealand coast had created the perception that commercial opportunities for domestic fishers were being foregone. Consequently, in 1963 the government removed the restrictions on fishing effort applied to local fishers and, in 1965, provided guarantees on loans for fishing vessel purchases. The country had accordingly re-established open access as well as government encouragement of increased fishing capacity.

While the intention was to base fisheries development on the offshore resources, the fishing effort in the prime inshore fisheries also expanded rapidly. In fact, by the early 1980s, overfishing of species in these zones and overcapitalization within the inshore fleets had become a problem. Measures aimed at restoring control in these fisheries were introduced at this time. They included:

· a declaration designating these zones as controlled fisheries, a new

licensing regime that limited vessel numbers and a blanket moratorium on new entrants to the inshore fisheries;
· the removal of "part-time" fishers from the inshore fisheries;
· enhanced powers, under the Fisheries Act 1983, in the regulation of fisheries using management plans that would be formulated after extensive public consultation and would identify the resources to be managed and the regulatory controls (on fisheries inputs) to be applied.

The cumbersome nature of the consultation and planning process was such that, while it was still under way, the inshore fisheries advanced further into an overfished and overcapitalized state. In 1984, the inshore harvesting sector was overcapitalized by an estimated $NZ 28 million (present value) and, where inshore fisheries were most concentrated, overcapitalization was estimated to represent about 44 percent of the existing fishing capacity.

After an intense period of policy development, the government and industry agreed to the introduction of total allowable catches (TACs) to ensure stock conservation, and individual transferable quotas (ITQs) to facilitate industry restructuring. This approach to controlling capacity through controls on the outputs of fisheries was seen as the most likely to succeed in meeting these two objectives. Furthermore, it was accepted that the initial TACs and ITQs would be set so as to effect a reduction in fishing activity. The main elements of the scheme were:

· the allocation of a case history to each fisher, on a national basis (with case history defined as the fisher's catch in two of the three years of 1981, 1982 or 1983); and
· the buy-back of case histories to a level that is equivalent to the TAC for each fishery.

The government ultimately spent $NZ 45 million (present value) to buy out 15 800 tonnes of fishers' case histories. The important outcome was that a viable and more sustainable future was secured for the affected fisheries and the industry in general. The additional advantages perceived by the fishers included the "right" to buy, sell or lease their entitlements to engage in the fisheries without undue government restrictions or the requirement of consent, and the ability to shift their vessels throughout the year between different fisheries for which they had quotas. The government benefited by being able to purchase case histories at prices that did not reflect their full value, owing to the absence of an established ITQ market at the time.

The introduction of ITQs followed extensive consultations with the

fishing industry to ensure their commitment. In this respect, the involvement of industry representatives in the planning, development and implementation of the quota management system was seen as an important element in the successful introduction of ITQs.

By this process, ITQ management was established for 29 species, including 21 inshore and eight deep-water species. Other species have been included since 1986, and there are now 33 species managed under ITQs. These represent about 80 percent of the total commercial catch from New Zealand's EEZ. The Fisheries Act provides for additional commercial species to be managed using ITQs.

There are approximately 117 species currently outside the quota management system, and they are being managed by a system of permits and regulations. For reasons of fisheries management, the government's intention is to bring additional species into the quota system as soon as possible. At present, a moratorium has been placed on the issuing of new permits for non-ITQ species as a means of controlling the fishing effort prior to these species' inclusion in the quota management system.

The introduction of ITQs, together with the financial assistance to restructuring, was designed to reduce fishing capacity. The initial adjustment retired 15 800 tonnes of catch from New Zealand fisheries. The reduction in the size of the fleets, whether it was due to this assistance scheme or to the subsequent introduction of ITQs, was dramatic. The number of vessels dropped by 22 percent between 1983/84 and 1986/87 and there was a further 53 percent reduction resulting from the use of ITQs between 1986/87 and 1994/95. As this rationalization primarily occurred in the country's inshore fisheries, one of its effects was to redirect investment into deep-water fisheries.

Source: W. Emerson, Ministry of Fisheries, Wellington, New Zealand.

In many countries, governance has continued to languish for a variety of reasons, including a scarcity of the human, institutional and financial resources required to devise and implement management programmes; a lack of understanding, by both governments and fisheries participants, of the potential benefits that good management can generate; and the reluctance of governments to make unpopular decisions. Through aid and financial assistance projects, the international community continues to direct substantial efforts towards improving the capabilities of the fisheries institutions in such countries. The countries with the poorest governance are those whose populations face more

pressing, fundamental problems such as war, civil disturbances, natural disasters and weak government.

POSSIBLE SOLUTIONS

The prerequisites for good governance in the fisheries sector are generally well recognized: the need for a strategy explicitly aimed at ecological, economic and social sustainability; effective fisheries agencies and research institutions (producing, *inter alia*, reliable and up-to-date information on the sector); a cooperative, organized and informed fisheries sector; adequate laws and legal institutions, including deterrent monitoring, control and surveillance (MCS); and linkages with the appropriate regional and international bodies. Since the early 1980s, attention has been paid to giving the fisheries sector joint responsibility with government in the management of fisheries. In many instances, this has been recognized by law, as in the creation of statutory committees (e.g. on management formulation, licensing and appeals) whose members include representatives from the fisheries sector. In some countries, this has been extended to the creation of semi-autonomous fisheries management authorities acting under joint industry and government boards of control (see Box 5, Industry participation in management in Australia).

BOX 5
Industry participation in fisheries management in Australia

Responsibility for the management of fisheries in Australia is shared among the commonwealth, states and territories. The Constitution provides that the commonwealth is responsible for the management of fisheries outside the three-nautical mile territorial sea, with states and internal territories being responsible for fisheries in all other waters adjacent to that state.

The administration of commonwealth fisheries in Australia involves three bodies. The Australian Fisheries Management Authority (AFMA) is responsible for managing commonwealth fisheries; the Commonwealth Department of Primary Industries and Energy is responsible for formulating policy (e.g. concerning foreign fishing access rights, taxation rulings applicable to fisheries and the environment); and the Fisheries Research and Development Corporation (FRDC) is responsible for funding research and development in the country's fisheries (both state and commonwealth).

The AFMA's responsibilities, objectives and functions in managing commonwealth fisheries are defined under the 1991 Fisheries

Administration Act. The AFMA may determine a management plan for a fishery after it has given public notice of its intention and both invited and considered representations. Such a plan must set out its objectives and the proposed methods for achieving its goals. It may also include the amount of fish that can be taken, fishing concessions, procedures for selecting persons to whom concessions may be granted and the kind and quantity of equipment that may be used.

While the responsibility for determining management arrangements lies directly with the AFMA, the 1991 Fisheries Administration Act allows the establishment of management advisory committees (MACs) to it "... in the performance of its functions and the exercise of its powers in relation to a fishery". The AFMA can delegate functions to the MACs, in which case the committees can hold the same level of power as the AFMA. In these circumstances, the MACs must act in accordance with policies determined by the AFMA and must comply with its directions. Within the MACs, issues relating to a fishery are discussed, problems identified, possible solutions developed and recommendations made to the AFMA. MACs provide a forum for the AFMA to consult with industry on its management arrangements, for the industry to make its views known and for consultation between researchers and industry.

The MACs consist of: an independent chairperson, the AFMA officer responsible for the management of the fishery in question and up to seven members determined by the AFMA after consultation with states, industry, interest groups and researchers. In practice, in the last category, the MACs have a number of industry representatives, usually at least one member representing state fisheries organizations and one from the fisheries research community. There is also an increasing trend towards representation of conservation and recreational fishing interests.

Despite the increased role of industry in management, many operators feel that the AFMA does not consult sufficiently with the MACs, that the MACs are not sufficiently representative and that consultation is often superficial, with little real notice being taken of the views of the industry. There have also been questions raised regarding the appropriateness of the AFMA's objective of maximizing economic efficiency in the exploitation of fisheries resources. It has been argued that government management of fisheries should be restricted to ensuring sustainability of the resource through the setting of biologically safe reference points and that the industry, while adhering to such conservation criteria, should be responsible for harvesting the

resource as it sees fit.

The present institutional arrangements place the AFMA at risk of bias towards the fishing industry at the expense of other community sectors. To counter this, the AFMA has given effect to its corporate plan intention to broaden membership of the MACs to include members from environmental, recreational and community groups. Greater stakeholder involvement in the direct management of individual fisheries would appear to be an inevitable and desirable outcome of this development. Indeed, the provisions relating to MACs (1991 Fisheries Administration Act, sections 56 to 67) clearly envisage a gradual devolution of decision-making responsibilities to individual MACs.

The Department of Primary Industries and Energy has a role in monitoring the outcomes of fisheries management and has implemented a programme of independent assessment of the AFMA's management performance. Economic and sustainability indicators to assess fisheries management (or indeed management of any natural resources) are being developed for this purpose.

Source: T. Battaglene, Department of Primary Industries and Energy, Canberra, Australia.

This joint management process has been facilitated by a number of important evolutionary trends. In many countries, the fisheries sector has become better organized and hence more effective in liaising with government and in representing collective viewpoints. A more recent impetus has come from management regimes that establish either real or quasi ownership "rights", such as the right to trade - buy, sell or lease - an entitlement to engage in a managed fishery. In such circumstances, those with an entitlement have more of a vested interest in good management, as the "monetary" value of their entitlement will be directly influenced by the performance of the fishery. Accordingly, titleholders have demanded a major role in the formulation of management.

Another important and related trend concerns the financing of fisheries research and management. An underlying concept gaining wider acceptance is that financing should come from those who benefit, including fisheries participants in the case of managed fisheries. Again, there has been added impetus from the creation of "rights-based" fisheries, where it would clearly be anomalous for governments - using funds from the broader community - to be the sole financing entity. Accordingly, the joint financing of fisheries governance has been most readily accepted in the case of rights-based fisheries. As might be expected, fisheries participants have demanded a role in deciding how the

money is spent, leading to more focused spending and systems of accountability. The consequence has invariably been better governance.

A recent trend in management-oriented research is for the scientific arm of management to have more autonomy when providing advice and for there to be more transparency as to what action is taken on the strength of that advice. There has also been a related move towards "privatizing" certain functions of governance, a development that is most advanced in the case of fisheries research institutions, which are becoming progressively more reliant on non-government sources of finance. There have been rare instances in which countries have hired out the functions of licensing and enforcement to private sector entities, although the government has invariably taken a major shareholding in the entities selected. This has met with mixed success so far, but probably reflects the direction that governance will take in the future. Fisheries governance is now benefiting from computer-assisted "networking", for example through e-mail and the World Wide Web, which allows both researchers and managers ready access to the knowledge and experiences of "outsiders". Although related to private sector services, this development is not exactly part of privatization but rather a consequence of globalization.

These trends are most apparent in countries whose capacity for governance is well evolved. The approaches nevertheless are globally applicable. A major constraint to their wider application in practice is a lack of organization within fishing communities, including an insufficient understanding of the potential benefits to be gained through good management. The paradox for some countries is that systems of community-based management, which provided cohesion in the past, have now disappeared. Aid and financial assistance projects as well as other efforts are now aimed at reversing this process, often through the conferring of "rights" exclusively on active members of the community or on the community as a collective. Such an approach will be most problematic - if not impossible in the short term - in areas where there is a high population density and acute poverty because of the high social cost to those excluded from fisheries. The priority in this event is to enhance the welfare of the wider community (e.g. through job creation), and this is a task that requires intervention from "outside" agencies, non-governmental organizations (NGOs) and the international community.

RECENT ACTIONS

The promotion of traditional or community-based management practices has gained momentum in artisanal and small-scale fisheries, which often involve thousands of fishers, hundreds of fishing communities and a plethora of landing points. The communities involved have very little mobility and are liable to be extremely disadvantaged by the social and economic consequences of bad governance. Management that is directed at safeguarding a community's welfare is most likely to be sensitive to issues at the local level, and hence to the importance of improving benefits from fisheries

without causing undue social disruption. The community-based management approach therefore seeks to build on existing customary and traditional practices, adopting the concept of territorial use rights in fisheries (TURFS).

The Secretariat of the Pacific Community (SPC) is promoting the revival of traditional marine tenure and resource allocation mechanisms in the region. As part of this effort, SPC puts out an information bulletin dealing with traditional marine resource management and knowledge. However, the pace of socio-economic change in the region is such that it is uncertain what the need for fish resources will be when all population groups have become urban wage earners.

Recent advances in the management of industrial fisheries at the national level have focused on the conferring of rights. Most commonly, these rights have included the ability to trade (buy, sell or lease) the entitlement to fish in a particular managed fishery. In most cases, entitlements have been provided in the form of individual transferable quotas (ITQs) or as a subset of a limited number of licences to fish. This strategy is being introduced successfully in a growing number of countries, including Australia, Canada, Iceland, New Zealand and the United States. The adoption of rights-based management is also being encouraged by international institutions such as the World Bank.

Chile has introduced experimental ITQs in its deep-water shrimp and its toothfish fisheries, making it the only country in Latin America to have a functioning ITQ system. The government would like to expand the system to other fisheries but it faces resistance from operators in the fisheries concerned.

A High-Level Panel of External Experts in Fisheries, which met at FAO headquarters in January 1998, stressed the relevance of the Code of Conduct for Responsible Fisheries[1] for governance. The participants concluded that the Code and its guidelines are technically credible to fisheries experts and readily understood by non-experts and, therefore, constitute an important reference for improved fisheries governance.

The 1996 annual meeting of the South Pacific Forum (SPF), held in the Marshall Islands, recommended the development of comprehensive arrangements for the sustainable management of the region's fisheries across the full geographical range of stocks, including those of high seas. This recommendation reflects countries' increasing concern about the governance of high seas resources.

Countries in the Pacific are working together with Distant-Water Fishing Nations (DWFNs)[2] to develop a mechanism for the conservation and management of highly migratory fish stocks in the Central and Western Pacific Ocean. It is envisaged that the negotiations will result in a commission for the management of the stocks concerned.

Southeast Atlantic countries are discussing, among themselves and with DWFNs, the establishment of a regional fisheries organization to manage fish stocks in the high seas of the Southeast Atlantic.

Members of the South Pacific Permanent Commission[3] are negotiating how to conserve and manage high seas resources in the Southeast Pacific.

GLOBAL PERSPECTIVE

The conclusion that the world's main commercial fisheries need more and better management is neither surprising nor necessarily derogative of national governance worldwide. Ultimately, all fisheries require management as, where it is lacking, wastage of fish resources and fisheries inputs is inevitable. The benefits realized from good governance are most obvious in the developed countries and this has been the case for some time because their capacity for governance is more evolved. Furthermore, these countries have much to gain from improved of fisheries performance. Much of the global fishing capacity and most of the world's mature fisheries - with stocks near to being or already fully exploited - are located in the fishing zones of these countries or in other zones exploited by them.

With increasing fishing pressure and a better knowledge of stocks, the joint management of shared stocks will become a priority in the future (see Box 6, Shared stocks - how to improve management).

BOX 6
Shared stocks - how to improve management

There are more than 500 maritime boundaries in the world between adjacent EEZs, and significant proportions of the world's fish stocks lie

across these boundaries and are fished by two or more nations.

Good examples are the four major stocks - salmon, cod, herring and sprat in the Baltic, which are shared among the nine riparian states. Other well-known shared stocks are: hake (Argentina, Uruguay); North Sea herring (the Faeroe Islands, Iceland, Norway); Pacific salmon (Canada, the United States); pilchard (Angola, Namibia); and sardinella (Côte d'Ivoire, Ghana, Togo).

The vast majority of shared stocks are not managed jointly by neighbouring states, despite a call for cooperation by the United Nations Convention on the Law of the Sea. However, some are jointly managed - a few successfully and some with moderate success, while still others are the subject of almost permanent conflict. With fishing pressure increasing, the need for the management of shared stocks will increase. Effective systems for joint consultations and management need to be formulated and, although there are no magic recipes, a good start would be acceptance by the states concerned of the basic principles and sequence for management development and implementation described here:

Basic principles

i) Before engaging in international negotiation about shared stocks, each state should establish the criteria for allocation of rights to the shared resources in its own EEZ.
ii) Fish stocks must be managed as unit populations.
iii) No party should agree to a cooperative arrangement that will provide it with less than it could achieve by acting alone, entirely non-cooperatively.
iv) In spite of financial commitments made in the fisheries sector of each nation, sharing arrangements cannot be "chiselled in stone" and should be updated regularly to avoid losses to all parties.
v) Allocation mechanisms and the negotiation of shares need to be addressed frontally, with clear rules established by negotiation, possibly including the use of an independent arbitrator to assist in the review of sharing and joint management arrangements.
vi) Recognizing the trade-offs between fisheries and other sectors may be integral to a successful negotiation. A negotiated solution may be achieved more easily if it is favourable to the state placing the highest valuation on the fishery, in return for some form of compensation to its neighbours.

Sequence for development and implementation

The development and implementation of joint management of shared stocks generally proceed stepwise. Isolated stock assessments, carried out for only part of the stock, and incompatible management measures have little value, especially where resource life histories are migratory. Thus, one priority consists in joint stock assessments and the sharing of resource data among all states within whose jurisdictions the stock is fished. The following sequence is often appropriate:

· cooperation in research and data gathering;
· initiation of cooperative management, first through technical measures, then access and allocations;
· bargaining over management strategies and harmonized regulations;
· agreement over surveillance and control.

States may wish to negotiate an agreement specifying matters such as the standardization of data collection and cooperation in research and stock assessment. Joint training of personnel in standard management procedures, common marking of vessels, the use of standard radio call signs and the exchange of registries of vessels authorized to fish the resource should follow shortly. Such an agreement could lead to defining standard procedures to follow in the case of infringements by fishers of the other party.

Even if an initial agreement does not lead to a fully effective mechanism for management of common stocks, there are advantages in going at least part of the way towards such a goal. The information exchange can result in each party making management decisions in the light of full knowledge of the situation of the fishery exploiting the shared stock in the other country.

Source: J. Caddy, FAO Fisheries Department.

As developing countries are becoming major participants in global fisheries, the focus is likely to shift to include improvements in their fisheries governance. This will require the enhancement of technical and administrative capabilities, enabling the formulation and implementation of appropriate fisheries management plans and assessments of the outcomes and needs for follow-up action. A fundamental policy consideration in this regard is capacity building and institutional strengthening within the fisheries institutions. At the same time, it must be accepted that improved benefits will not be an immediate outcome from better governance. The structural adjustments that are required in many fisheries will take a long time to become effective. Fisheries management is a process that evolves over time in response to changing circumstances.

In line with recent trends, the governance of fisheries will progressively include the direct involvement of fisheries participants, the conferring of user rights, the devolution of management functions away from government - without detracting from its stewardship role - and the financing of governance from within the sector.

CREATING AN ENABLING ENVIRONMENT FOR SUSTAINABLE AQUACULTURE

THE ISSUE

Few countries have appropriate legal frameworks and policies for aquaculture. Often, comprehensive policies and associated legal frameworks have been overlooked because development has been seen mainly in technical terms and support has been largely focused on technical aspects of production. Also, policy-makers have often treated aquaculture in isolation from other sectors, thus ignoring important linkages, including externalities. The need to incorporate political, economic, social, environmental and legal aspects has been neglected, usually with negative consequences for the sector. The recent emergence of industrial aquaculture, the growing competition for resources and the continuing rapid growth of the sector have focused attention on the need for policy measures and regulatory frameworks.

It is essential for appropriate operational conditions to be established at all levels (international, regional, national, local and farm) to make the exploitation of aquaculture in a sustainable manner attractive to farmers, fishers and other entrepreneurs. Governments need to create and maintain a suitable climate for sustainable growth of the sector, i.e. they need to provide an "enabling environment". Such an environment comprises economic, legal, social and physical components and should ensure, *inter alia*, fair access to resources, mechanisms for conflict resolution and access to information, credit and markets. This presupposes that there are functioning channels of communication with institutions and representatives of other competing sectors of the economy.

In creating an "enabling environment", it is essential to strike a balance between the need for development and growth and the need for ecosystem conservation. In this context it is necessary to recognize and deal with the increasing competition for resources. The diminishing role of the public sector as a promoter of development and the globalization of markets must also be taken into consideration.

POSSIBLE SOLUTIONS

The complex task at hand is to put the principles of the Code into operation; i.e. to clarify how sustainability choices might work in practice; to incorporate the Code's principles into development policies and plans; and to elaborate specific codes of responsible practice containing norms, standards and guidelines agreed on by all stakeholders. Given the diversity of aquaculture practices and of the political, social and economic conditions in which they take place - not to mention the different perceptions of sustainability -

balanced and informed approaches are required to address developmental and environmental issues effectively at any one location. Furthermore, the applicability of various approaches needs to be assessed carefully, particularly where many small-scale farmers are involved and also in view of the often highly decentralized nature of the aquaculture industry.

Existing administrative and legal frameworks need to be reviewed and adjusted to address the specific characteristics and needs of the sector and to set forth clearly the privileges and responsibilities of aquaculturists. However, because aquaculture is frequently regulated by many agencies under a variety of laws, developing a comprehensive regulatory framework for the sector is often legally and institutionally complex. Typically it involves drafting or amending legislation that addresses a variety of issues and establishing institutional arrangements to ensure the cooperation and coordination of many different institutions with jurisdiction over natural resources, animal and public health, environment, etc.

Although new national laws to regulate aquaculture comprehensively may be desirable in many countries, other options are now being explored because developing and passing new comprehensive legislation often takes several years, while the prospect of rapid development of the sector has created an urgent need for regulation. These options include the enactment of regulations under existing legislation, and voluntary approaches such as guidelines and codes of practice.

The formulation of appropriate regulations in many countries is constrained by a shortage of information on the interaction of aquaculture production systems with the environment and on the environmental and financial efficiency of alternative approaches to production management. Even where information is available, reliable predictive models for aquaculture-environmental interactions still require considerable improvement with regard to their accuracy, general applicability and affordability.

There is also an associated need to strengthen institutional capacity to manage the sector and to expand the knowledge base in order to enable sustainable development policies and plans. There is a general recognition of the need for interdisciplinary and intersectoral approaches to development and resource management in aquaculture. Moreover, it is becoming increasingly clear that sustainable aquaculture development cannot be regulated solely by governments but must involve many interest groups at the national, regional and international levels, including new institutional arrangements and partnerships (consultative frameworks). This is being highlighted by ongoing structural change, namely privatization and the contraction of governments' role in development.

Consequently, there is a growing and urgent need to create new knowledge and to synthesize information from a broad spectrum of disciplines so that decisions can be based on a much broader perspective and understanding. It is also important to ensure a flow of information among different sectors and interest groups.

International trade, including in aquaculture products, is governed, *inter alia*, by the Agreement on the Application of Sanitary and Phytosanitary Measures (the SPS Agreement). This agreement recognizes the right of World Trade Organization (WTO) members to apply legitimate measures to protect the life and health of their populations from hazards in food, but stipulates that these measures must not be unjustifiably trade-restrictive. SPS measures must be based on risk assessment, taking into consideration the techniques being developed by relevant international organizations. In regard to food safety, the relevant international body is the FAO/WHO Codex Alimentarius Commission (CAC); in regard to animal (including fish) health and disease, the relevant organization is the International Office of Epizootics (OIE). International safety standards and procedures specific to aquaculture products are increasingly being developed in the context of these instruments. It is important to note, for example, that application of the Hazard Analysis and Critical Control Point (HACCP) system to fish processing operations is becoming mandatory in a number of countries. The application of the same system to large-scale and/or intensive aquaculture production systems is currently being explored and applied in some countries. However, use of the HACCP system in small-scale and subsistence aquaculture is far from a reality at present, as the application of aquatic animal health and disease control regulations is constrained by poor diagnostic capacity (including trained human resources, standardized diagnostic techniques and infrastructure) in many developing countries as well as a lack of reliable information on pathogens and diseases of concern to traded species.

In regional and international trade in aquaculture products, friction over differences in environmental standards among countries is best attenuated through improved coordination and harmonization. If environmental standards are to be raised over time, countries - particularly those with less demand for environmental goods - will need to be encouraged to raise their standards through a variety of appropriate support mechanisms, for example guarantees for expanded access to the markets of countries with higher standards.

The expected increase in competition for, and regulation of, natural resources clearly calls for greater production efficiency and the conservation of critical inputs. This should be a priority topic for systems research. Efficiency in resource use may also be achieved by integrating aquaculture with irrigation systems and agriculture as well as by utilizing inland surface waters and floodplains for certain forms of aquaculture production.

New forms of integrated aquaculture-agriculture systems as well as other innovative systems that can effectively respond to resource and environmental challenges need to be developed. In this connection, attention should be given to resolving the economic and environmental challenges of stock enhancement and ranching as well as of offshore cage culture.

The reduced role of government in financing fisheries and aquaculture has resulted in the cessation of public support to resource-poor fish farmers, the negative effects of which may be counteracted by special policy instruments designed to promote training and

equitable income distribution and to facilitate access to information, credit and inputs needed in production.

RECENT ACTIONS

The Code is beginning to have a worldwide influence on the development of an enabling environment for sustainable aquaculture; however, much remains to be done. More progress can be expected as guidelines are developed on how to strike a balance among economic, social and environmental concerns, how sustainability choices apply in practice and how to analyse the economic cost of resulting actions.

Certain states have initiated national measures such as workshops to promote the Code and some NGOs, including producer groups, have developed or are developing codes of conduct and practice for particular aspects of aquaculture. Examples of these are: an implementation plan for the code for marine fisheries and marine aquaculture in the United States;[4] a code of practice for mangrove protection by the Global Aquaculture Alliance (GAA);[5] a code of practice for Australian prawn farmers;[6] codes of practice for cage culture of finfish and pond culture of shrimp in Malaysia;[7] and guidelines for sustainable industrial fish farming.[8]

Over the last few years, there has been a growing interest in many countries to develop a comprehensive regulatory framework for aquaculture that will protect the industry, the environment, other resource users and consumers. This interest is being driven by a variety of factors, including: greater political attention as the economic importance and potential of aquaculture become more apparent; greater awareness that inappropriate laws and institutional arrangements can significantly constrain the development of the sector; evidence of environmental damage and social disruption as a result of rapid and largely unregulated expansion of some high-value species in certain coastal areas; and a growing emphasis on assuring the quality and safety of aquaculture products in international trade. Some of these issues were debated at an FAO Technical Consultation on Policies for Sustainable Shrimp Culture, held in Bangkok at the end of 1997.

Progress is also being made in the establishment of legal and regulatory frameworks for aquaculture in individual countries. Among these are Bulgaria, Cyprus, Madagascar, Malaysia, Mozambique, Papua New Guinea, Sri Lanka and Suriname. The Government of India has set up an Aquaculture Authority, which will license the adoption of improved technology for increased production and the establishment of new farms within and outside the Coastal Regulation Zone. In India, the Tamil Nadu Aquaculture

(Regulation) Act of 1995 sets out conditions to improve siting and management of aquaculture facilities and establishes an Ecorestoration Fund, supported by deposits from aquaculturists, to remedy environmental damage caused by aquaculture farms.

Concerning quality and safety of aquaculture products, FAO is currently involved in revising the FAO/WHO Code of Hygienic Practice for the Products of Aquaculture under the auspices of the Codex Committee on Fish and Fishery Products. International meetings continue to be held as part of efforts to develop risk analysis for food safety, synthesize and disseminate information on food safety (including food production from aquaculture) and address any related issues.[9]

Meetings focused exclusively on aquaculture have covered subjects such as the use of chemicals,[10] environmental impacts of coastal aquaculture[11] and food safety issues associated with products from aquaculture.[12]

In the United States, the industry and government have succeeded in developing comprehensive HACCP plans for cultured catfish, crayfish and molluscs. A similar approach is being introduced in Australia, Chile, New Zealand, Norway and Thailand. The EC currently imposes detailed conditions on the handling, slaughter, inspection, processing, packaging, identification and storage of fishery products,[13] and applies stringent controls to the animal health conditions applicable to the marketing of aquaculture animals and products.[14] FAO, the Network of Aquaculture Centres in Asia-Pacific (NACA) and OIE are collaborating to develop guidelines on aquatic animal quarantine and health certification to be applied in Asia when moving live aquatic animals.

There is increasing interest and hence a growing experience in the incorporation of aquaculture activities in resource management for coastal and inland areas. Integrated resource management forces long-term planning (e.g. through the designation of zones where different users will have priority), which provides predictability required for any long-term investment while also reducing conflicts among actual and potential users. A variety of tools are being used in the planning process, including: geographic information systems (GIS); predictive systems for assessing carrying capacity (particularly for finfish cage culture and mollusc culture); and environmental and social impact assessments.

An example of what can be done to integrate aquaculture into resource use plans is provided by the Australian State of Tasmania. Under new legislation (notably the 1995 Marine Farming Planning Act and the 1995 Living Marine Resources Act), marine farming development plans must be designed to cover areas rather than sites, and broad community participation in the preparation of such plans is also provided for by laws. An environmental impact assessment must be carried out and a marine farming zone established before leases are granted to marine farms. (Box 7 provides an example of environmental management of aquaculture in the Republic of Korea.)

Progress towards participatory planning has been reflected in the growing participation of NGOs, farmers' associations, researchers and public officials in national, regional and international fora, particularly for the development of codes of practice and conduct and the formulation of regulations and legislation. There has also been progress in the development and testing of participatory rural appraisal (PRA) and rapid rural appraisal (RRA) methodologies, and of concepts and possible local structures for community management of resources.

BOX 7
Managing the interactions between aquaculture and the environment in the Republic of Korea

Since 1964, marine aquaculture has grown to become a widely practised activity in the Republic of Korea. Production in 1996 included 538 990 tonnes of seaweeds, 306 738 tonnes of molluscs, 11 402 tonnes of finfish and 382 tonnes of crustaceans. The laver culture is carried out by means of a pole and floating net system, while sea mustard and kelp are cultured by long-line systems. Molluscs are farmed using two different culture methods: a long-line system for oysters and mussels and a bottom planting system for clams and arkshells. Most of the culture of finfish - halibut, jacopever, yellowtail and seabream - is carried out in floating net cages, while the culture of prawns - oriental and karuma - is done in embanked ponds.

All aquaculture farms in the country require licensing by municipal authorities. Additionally, all cage culture and other aquaculture involving more than 1 000 m^2 in surface area must be registered with the Ministry of Environment and operated according to the Aquatic Environment Protection Law.

Provisions seeking to minimize the pollution from cage culture include: the use of low-phosphate foods with a sinking rate that does

not exceed 10 percent within a two-hour period; and the installation of feed fences with a height of 10 cm above the sea surface to prevent the dispersal of food outside the cages. Culturists are also required to: prevent the difference in oxygen levels within and outside the cages exceeding 20 percent; remove dead fish immediately and report incidences of diseased fish to the local fisheries administrations; and attach facilities to the cages in order to retain human faecal material. The use of antibiotics and drugs for the control of fish diseases is also regulated under the Aquatic Environment Protection law. Licensing provisions require, furthermore, that the seabed under and immediately adjacent to farms is cleaned - of debris - with dredges more than once every three years.

The Regulations Governing Sanitary Control of Shellfish and their Growing Areas, administered by the Ministry of Maritime Affairs and Fisheries, also provide for the administration of water quality standards and the control of water pollution arising from aquaculture. The National Fisheries Research and Development Institute monitors water quality within the shellfish culture areas as well as the incidence of contaminants in the flesh of the aquaculture products. This entails routine sampling of sanitary indicator bacteria, nutrient salts (to assess eutrophication levels), pesticides and heavy metals. The median coliform most probable number (MPN) of the water should be less than 70/100 cm^3, and not more than 10 percent of the samples taken should have an MPN greater than 230/100 cm^3 during the most unfavourable hydrographic and pollutant conditions. The incidence of red tides is also monitored in association with the early warning of culturists when toxic species are identified.

The Environment Impact Assessment Law requires the preparation of environmental impact assessment (EIA) prior to the construction of city and industrial complexes, port development, land reclamation and water resource development. The establishment of aquaculture ventures is not currently subject to EIA, although this is planned in the near future. The transport of aquatic animals and plants, including the introduction of new species, the quarantining of imported species and the prevention of infected or recessive exotic species into Korean waters, are all subject to regulation by the Ministry of Maritime Affairs and Fisheries. Regulations under the Marine Pollution Control Law provide for government compensation to culturists in the event of economic loss owing to abnormal environmental changes such as harmful algal blooms. Compensation may also be sought from private entities and public utilities arising from pollution (including oil spills), reclamation and industrial activities.

Major pollution control and abatement measures under way or planned since 1991 include: the classification of coastal areas according to intended use (fisheries, recreational, agricultural and industrial); the strengthening of water quality standards and the control of industrial and municipal effluent into coastal waters; a national seawater quality monitoring system (for which 280 sampling sites were designated in 1996); investment in treatment facilities for sewage, industrial wastewater and excretion (for the equivalent of US$3.1 billion during the period 1992-1996); the requirement to undertake EIA for all coastal development activities; and the designation of special conservation areas in which most development activities would be prohibited.

Source: Hak Gyoon Kim, National Fisheries Research and Development Agency, Republic of Korea, in FAO/NACA. 1995. Regional Study and Workshop on the Environmental Assessment and Management of Aquaculture Development (TCP/RAS/2253). NACA Environment and Aquaculture Development Series No. 1. Bangkok, NACA. (updated August 1998 by Seong-Kwae Park, Korea Marine Institute, Seoul)

GLOBAL PERSPECTIVES

Sustainable development is the overriding strategic issue and challenge to all economic sectors, including aquaculture, and will continue to be so in the foreseeable future. Issues of sustainability can be expected to change our perceptions of desirable forms of aquaculture development and management, and new ways of farming that strike a balance between food security and the environmental and resource costs of production will have to be adopted. In the future, and with the growing trend towards ecolabelling, the longstanding goal of producing particular species at competitive prices is, in itself, likely to be insufficient for realizing full market potentials. In the future, acceptable sustainability credentials will probably be as essential as quality and safety standards are today.

In the short term, the elaboration of legal and regulatory frameworks, particularly in developing countries, will be the probable outcome of local social pressure and environmental and public health standards associated with trade in aquaculture products (e.g. in the case of shrimp and Atlantic salmon). This development will provide a window of opportunity to begin the process of providing the sector with a specific identity in national development - which could eventually be expanded to cover the entire sector.

Politically, food production will remain an overriding priority, and intensification as well as diversification in food production will both constitute important approaches to

development. The move towards intensification in aquaculture is evident in many countries, and this trend will probably continue. This will promote investment in research, which will eventually lead to improved production efficiency, as in the case of Atlantic salmon and American catfish. It will also enhance integration with agriculture for the compatible multiple use of resources and for the utilization of by-products and unconventional inputs in general. In industrialized countries, competition for quality freshwater and suitable production sites will lead to an increased use of recycling systems and to more intensive research in open sea aquaculture. The extent of the challenge to aquaculture development will depend on the nature and magnitude of available resources as well as on the existing competition for these resources and the aquaculture development policies adopted at the national level. Finally, increasing privatization and the contraction of the role of governments in development are likely to worsen the situation of resource-poor artisanal and subsistence fish farmers.

INTEGRATING FISHERIES INTO COASTAL AREA MANAGEMENT

THE ISSUE

The World Resources Institute (WRI) reported in 1996 that about 34 percent of the world's coasts are at high potential risk of degradation and another 17 percent are at moderate risk.[15] As an estimated 90 percent of the world's marine capture fisheries production is dependent on coastal habitats, the relevance to fisheries is obvious. Moreover, coastal fishing communities are typically characterized by intense competition for scarce resources (e.g. for access to and use of fishing grounds, water or land), which is often associated with unregulated access to these resources.

The known consequences of habitat damage include a loss or lowering of productivity and the associated threat to local food security; contaminated aquatic food products; reduced economic viability; increased levels of conflict involving fishers; sometimes physical displacement of communities; increased unemployment; and the loss of trade opportunities. Heightened anxieties within the communities affected lead to frequent disputes - and in extreme cases physical violence.

While fisheries is the sector that is most frequently disadvantaged, it is also a contributor to environmental damage and to the exacerbation of conflict. The use of bottom trawls, dredges and explosives and the careless anchoring of craft are examples of fisheries practices that have a negative impact on aquatic habitats. They may negatively affect bottom fauna such as sea grass beds and coral reefs. Likewise, some aquaculture practices have caused negative environmental effects, such as the physical destruction of ecologically sensitive habitat, excessive nutrient and organic enrichment of seabeds owing to the release of wastes from cage and pond farms, and the introduction of harmful alien species.

Conflicts over coastal fisheries resources occur between groups of fishers. A frequently occurring example is conflict over the use of shrimp trawlers in the near-shore areas

frequented by artisanal fishermen using traditional methods. Apart from reduced catches, the artisanal fishers risk damage to their gear. In such cases, their response may not always be rational, as when they intensify their exploitation of juvenile fish in nursery areas or employ destructive fishing methods to maintain their livelihoods.

Often, the fisheries sector and its institutions do not have the necessary economic and institutional clout needed to guide and coordinate management. Many instances exist where government agencies have insufficient expertise to undertake the necessary integrative evaluations and planning. There may even be a lack of basic knowledge about the fisheries in question.

However, as other economic sectors expand in the coastal zone, the relative economic importance of fisheries declines, a process that may be speeded up as a result of damage to habitat and spatial competition. Naturally, this acts to weaken further the influence of the fisheries agencies in determining policy.

POSSIBLE SOLUTIONS

Integrated planning and institutional coordination are frequently listed as the primary requirements for effective coastal management. In practice, both have proved difficult to achieve and both entail significant costs. These difficulties relate to what are often cumbersome bureaucratic structures and procedures of government agencies; the complexity of the scientific, technical and economic issues involved; and the potentially large number of informed decisions that need to be taken. Notwithstanding, there are few coastal management schemes where the interests of the fisheries sector are not considered.

Coastal management can be properly addressed through the formulation of soundly based management plans, the provision and enforcement of appropriate environmental legislation, a transparent consultative process involving users and potentially affected groups and monitoring of the subsequent development impact. The role of fisheries agencies should include participation in:

- the planning and implementation of environmental impact assessment and monitoring schemes;
- the spatial planning process (e.g. coastal land use planning);
- decisions concerning permits issued for construction, excavation, etc. (e.g. in the case of port development);
- the drafting of laws and regulations; and
- relevant interagency and interdisciplinary fora.

The costs of a formal process of preparing a management plan are almost always justified. However, as a rule it will be essential to strengthen expertise in environmental impact assessment, the economic evaluation of alternative resources uses, rapid appraisal techniques and ecological-economic modelling.

Experience shows that fisheries interests are best served when they are represented early on in the coastal management process. Therefore, the delegation of responsibility to elected bodies of lower government levels can also be important in ensuring greater awareness at the local level (see Box 8, Participatory approach to the management of lagoon fisheries in Benin). Ideally, municipal governments should have considerable influence in matters relating to fisheries and aquaculture, in the way that they normally do with respect to siting and specifications of any industrial, commercial or housing structure. However, the municipal decision-makers will need to be provided with the appropriate technical expertise and an understanding of fisheries matters - which is something that can be done by specialist agencies, research institutions and NGOs.

BOX 8

Participatory approach to the management of lagoon fisheries in Benin

Little more than 40 years ago, the lagoon fishers still observed the simple rules for conservation of environment and fisheries resources that their ancestors had established some three centuries earlier. Based on taboos, these customary rules forbade all capture of fingerlings or juveniles. They also designated rest days when no one was allowed to fish for fear of incurring the wrath of the gods. There is still in fact a section of the Ouidah coastal lagoon, between Hio and Avlékété, called *vodounto* (a sacred lagoon traditionally inhabited by the deities that is also a refuge for fish). Fishing in this area is strictly forbidden so that stocks can recover. The area is guarded by *dagbo hounon*, the chief fetisheer of the region, who inflicts heavy fines on offenders.

However, the advent of outside religions eroded the authority of the traditional chiefs and upset the balance between increased number of fishers and available fish resources: children follow their parents as fishers in the lake and lagoon areas. The ecological equilibrium has therefore been disrupted, and the rapid increase in fishing gear and the employment of illegal practices have resulted in:

· a smaller size at recruitment for the main target species;
· the destruction of natural spawning grounds;
· a lower catch per unit effort;
· more disputes between fisher groups.

In 1992, recognizing that the legislative framework had not enabled the fisheries board to bring about rational fisheries management, and acting on the instigation of the local authorities, the government set up some 20 Fishing Committees on an experimental basis in villages or

groups of villages bordering the lagoon of Porto-Novo. Each committee is made up of fishers' representatives who are democratically elected for a three-year term, which can be renewed in the General Assembly. Each committee has nine to 15 members, including an executive of five elected members who are briefed on fisheries legislation by the administration and are expected to pass on the information to the other fishers.

Committee members must be full-time fishers of sound character and good social standing. They receive no payment. Each fisher in the village has to pay a minimum monthly contribution of 150 CFA francs (about US$0.3) towards the committee's operating costs. The basic function of the committee is to see that the lagoon is used rationally for the conservation of its resources and ecosystem. More specifically, the Fishing Committee is expected to:

· raise awareness of fisheries rules and regulations;
· ensure compliance with traditional practices that are aimed at protecting resources and the aquatic environment;
· in conjunction with the Fisheries Administration, ensure that the regulations and the decisions reached in the fisher's general assembly are applied;
· serve as a forum of discussion, analysis and conciliation for the settlement of disputes;
· support any lagoon management and use programmes considered necessary by the administration.

The Fisheries Administration gives its support to all the committees' activities so long as these comply with regulatory provisions. The committees cannot apply sanctions; their role is more to alert their respective communities to the possible dangers of failing to observe fisheries regulations.

In August 1996, in an effort to ensure sustainable fishing on Benin's inland waters, the Fisheries Administration adopted a plan of management with the following strategic thrusts:

· the implementation of institutional mechanisms for participatory management;
· the management of fisheries resources within an appropriate legal framework;
· the identification and promotion of activities to develop alternative sources of income.

In 1997, the government issued Interministerial Decree No. 312 on the

institution, organization, functions and operation of the Fishing Committees in the Republic of Benin in order to give them juridical status. There are now 90 Fishing Committees involved in comanaging the principal water bodies of three southern departments of Benin.

Source: Plan of Management of Inland Water Bodies of Southern Benin, August 1996.

The process of management requires trade-offs between competing uses, with the negotiation of trade-offs normally involving consideration of the respective contributions from the competing users to national economic and social well-being. This in turn requires consideration of the current and potential (i.e. optimally managed) economic value of resources. It is important for all the potential impacts to be valued, not just those that are easily determined. For example, those discharging untreated sewage into the sea should bear the cost of associated catch losses to any nearby fishing community.

Some countries have enacted planning legislation that assigns priority to coast-dependent development. Its application provides a first rationale for allocating scarce coastal resources by giving added weight to uses (or sectors) that, by their very nature, are dependent on the inherent attributes of the coastal zone. Capture fisheries and aquaculture clearly fall within this category whereas many activities of other sectors may not.

RECENT ACTIONS

A major international workshop on integrated coastal management (ICM) in tropical countries was held in 1996 in Xiamen, China, to discuss experiences with and lessons drawn from ICM efforts. The workshop generated an overview of the processes of formulating, designing, implementing and extending ICM within East Asia as well as other regions. It also produced a set of Good ICM Practices.[16] In addition, the IMO/FAO/UNESCO - IOC/WMO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) has provided guidance on the role of science in coastal management. There has also been an assessment of the current objectives of and methods for evaluating coastal management projects and programmes that are funded by international donors.[17]

A group of experts recently compared the coastal management guidelines used by five different international entities (the World Bank, the World Coast Conference, UNEP, the World Conservation Union [IUCN] and the Organisation for Economic Co-operation and Development [OECD]) and subsequently wrote a "Consensus set of ICM guidelines".[18]

International concern for the management of coastal (and catchment) areas was given formal recognition at the 1992 United Nations Conference on Environment and Development (UNCED). In the same year, the International Conference on Responsible Fisheries called for the development of a Code of Conduct for Responsible Fisheries. The Code includes principles and provisions to encourage states and their agencies to consider and implement legal, institutional, policy and economic measures. This is in order to promote the proper integration of fisheries interests into coastal management planning and development.

In its efforts to strengthen the capacity of governments, NGOs and the private sector in coastal zone management, FAO has collaborated with a range of institutions, including the International Centre for Living Aquatic Resources Management (ICLARM), NACA, the United Nations Statistics Division, IUCN and other UN agencies sponsoring GESAMP activities.

The joint initiatives mentioned have included the testing of alternative management approaches through pilot projects and the publication of guidelines on managing the environmental impact of aquaculture, integrated economic and environmental accounting, objectives and strategies of coastal fisheries management and the application of scientific methods to coastal zone management. There have also been jointly sponsored technical consultations attended by stakeholders and other interested parties.

GLOBAL PERSPECTIVE

Where there is no constraint on levels of exploitation (i.e. in situations of open access), the utilization of natural resources - whether by fishers or others - is inconsistent with their sustainable use. In the case of fisheries, an emerging consensus is that sustainability can be best achieved through the establishment of specific use or property rights. This is valid despite the many difficulties in defining and enforcing rights-based management. Some countries have modified fisheries law to accommodate the formal allocation of user rights to fishing communities, and this trend is expected to continue, allowing such communities greater control over the factors affecting their well-being.

In the absence of appropriate action by governments and users, the overexploitation and degradation of coastal resources will increase further as a result of population pressure and associated levels of economic activity. The greatest progress in coastal management can be expected in the developed countries, as developing countries that suffer acute poverty and unemployment within their coastal zones will need to strengthen their national economies substantially before much attention can be paid to coastal management.

CONTROL AND REDUCTION OF FISHING CAPACITY

THE ISSUE

Several of the world's most important fisheries are subject to excess fishing capacity, and this a cause of growing concern. Excess capacity means that, in many of the world's fisheries, fleets are not only larger than they need to be to catch and land (at the lowest cost) the volumes of fish currently available, but they would also exceed the requirements for fishing in the event of stocks being permitted to recover in size. Not only does this threaten the sustainability of the fish stocks being exploited but it also constitutes a potential threat to other stocks. This situation has resulted from investors purchasing additional vessels to generate more returns - even when the fleet size is optimal from a general socio-economic point of view. Excess fishing capacity is thus caused by a lack of control over fishers' access to fish stocks. Additionally, in some countries, it is also brought about by public funding of investments in new vessels and/or the rehabilitation of old ones, although recent FAO studies on public funding of the fishing industry indicate a declining trend in these expenditures.

Overcapacity is generally caused by excessive investments and an indiscriminate use of fishing inputs. Two manifestations of excess capacity are poor economic performance, or inefficiency, and biological overfishing. Overcapitalization in capture fisheries wastes investment capital and therefore leads to high fishing costs. Similarly, overexploitation of stocks wastes fish resources.

Attempts to control overfishing can be negated - at least partially - by the practical difficulties associated with the measurement of fishing capacity, whether expressed as inputs (fishing units) or output (potential catch). A lobster fishing vessel with 60 pots, for example, has more effect, or fishing capacity, than a vessel with 20 pots; added to this are factors such as the size of the pots and whether they are emptied more than once during a shift. Subtleties such as these have made it difficult to control fishing capacity by applying checks to fisheries inputs, and this has been one of several factors leading to an increased interest in the control of capacity through limits on fisheries outputs, i.e. on landings of fish (see Box 9, Capacity control in Australian prawn fisheries).

BOX 9
Capacity control in Australian prawn fisheries

The Northern Prawn Fishery of Australia produced about 8 500 tonnes of prawns in 1997. Banana and tiger prawns are the main targeted species. While the managed area is about 1 million km^2, less than 10 percent of this area is trawled commercially. The commercial harvesting of prawns began in the early 1960s, after which the fishing effort rapidly increased. The fishery remained unrestricted until 1977,

when a limited entry regime was introduced and 292 vessels were endorsed to participate in the fishery.

The fishing effort continued to increase because of improved technology, bigger vessels and more fishing time, despite the control on vessel numbers, and this raised concern over the future of the fishery from an economic and biological point of view. Management measures including strengthened vessel replacement policies, a voluntary buy-back scheme, the permanent closure of prawn nursery grounds, seasonal closures and gear restrictions were progressively implemented from 1984. These proved to be only partially effective in improving the performance of the fishery.

In 1984, operators were assigned saleable units based on the fishing capacities of their vessels, with approximately 130 000 Class A units allocated. Operators were endorsed to engage in the fishery provided that they obtained the applicable number of Class A units and a Class B unit. Class A units were determined according to the size of the vessel and the engine, while Class B units permit operation in the fishery. By 1985, nearly 300 vessels were authorized to operate in the fishery.

Restructuring began in 1985 with the introduction of the voluntary buy-back scheme, the aim of which was to reduce the number of vessels and hence fishing capacity. This scheme was partly funded by a $A 3 million government grant, with a further $A 5 million borrowed from the National Fisheries Adjustment Scheme. The latter was to be repaid from levies charged against the operators in the fishery. Operators were invited to sell units under the scheme through the lodging of tenders. While the initial tenders received were somewhat inflated, 12 000 units were purchased by September 1986 at an average price of
$A 200 per Class A unit and a total cost of $A 2.5 million. Further purchases resulted in 100 000 Class A units and 222 vessels remaining in November 1989.

In 1989, competition from farm produced prawns from Southeast Asia caused a deterioration in prawn prices. This, together with advice from the national research agencies, led to the government approving another restructuring package in 1990. The new scheme was an enhanced version of the earlier scheme. The government provided a $A 5 million grant over three years and guaranteed up to $A 40.9 million to pay for units removed under the scheme. The borrowings were to be repaid by the remaining operators over ten years. The restructuring was conditional on the attainment of the target of 54 000

Class A units by 13 December 1992, to be followed by a compulsory reduction of units across all unit holders before the start of the 1993 season if the target was not met.

The second scheme was less successful than the first, which can be attributed to the fact that the buy-back prices offered by the scheme were less than the open market value for Class A units. At 1 September 1992, there were 72 216 Class A units and 162 vessels remaining in the fishery. By December 1992, the Northern Prawn Fishery management plan was amended to provide for compulsory surrender of Class A units. On 1 April 1993, 18 000 Class A units and 25 vessels were retired from the fishery without compensation, leaving 54 000 Class A units and 137 vessels.

Although the legality of this action was challenged in the Federal Court, an appeal confirmed the government's powers to reduce fishing effort without the payment of compensation. This legal action resulted in the industry focusing on the security of fishing access rights and pressing for greater security over these rights. This and other aspects were incorporated within a formal fisheries management plan completed in 1995. In this, the previous fishing licences were replaced by statutory fishing rights, which provide assurance to the owners of long-term access to the fishery. This has created a more secure environment for management, within which the owners can plan their future operations and investments.

The large reduction in fishing capacity and the higher prices received for prawns have resulted in a turnaround to substantial profitability for the fishery. Estimates of pre-tax profit show an increase of $A 19 million per year for the fishery from the restructuring programme. In order to maintain the economic benefits, it will be important for management to contain the future expansion of fishing capacity. As it is an input- controlled fishery, it can be expected that additional reductions in the fishing capacity will be required in the future. The AFMA (see Box 5) and the industry are investigating the use of gear units rather than vessel units as a way of defining fishing capacity. Conceptually, the use of gear units should provide more precision in the control of fishing capacity; however, it remains to be seen whether or not there are practical advantages. In December 1997, the AFMA agreed that the fishery would move to a gear unit management system in 1999, with the allocation of gear units being proportional to the holding of Class A units.

Source: M. Harwood, former Assistant Secretary, Fisheries and Aquaculture Branch, and T. Battaglene, Director, Commonwealth

Fisheries Policy, Australian Department of Primary Industries and Energy, personal communication.

A fundamental problem for many countries is the lack of reliable data on the numbers and characteristics of craft and gear. Also important is the extent to which the vessels may be moved between fisheries, as action taken to reduce capacity in one fishery may be the direct cause of overcapacity in another, owing to the rapid relocation of the excess capacity. Unfortunately, this has been a common outcome in countries that have sought to reduce capacity solely on a fishery-by-fishery basis. The problem has been recognized in some countries, for example New Zealand, and country groupings, such as the EC, which have chosen to reduce capacity concurrently in each fishery as well as globally at aggregated fleet levels. The necessary precursor in these instances has been to undertake an evaluation of capacity levels in all the relevant fisheries.

From a broader view, efforts made by some developed countries to reduce fishing capacity have led to the relocation of vessels in the fisheries of other (usually developing and least developed) countries. On a global scale, this does not constitute a reduction in capacity. Furthermore, there are several reasons why these relocations might be detrimental to many of the importing countries. For instance, the vessels are usually purchased at a low price, and hence can be operated profitably (at least temporarily) even when fish stocks are depleted - a situation that is conducive to the further depletion of stocks. There have been many cases of local conflicts arising over the fact that such imported vessels - which are usually of an industrial type - operate in direct competition with artisanal fleets.

Fishing capacity is in excess in most regions of the world. For example, with increasing fishing pressure in South Asia, many coastal pelagic and demersal fish stocks in the Bay of Bengal, the Gulf of Thailand, and the South China Sea are fully exploited or overfished. This is evident, *inter alia*, in the increasing proportion of low-value species and juveniles of high-value species being caught.

The open-access nature of high seas fisheries creates a particularly difficult situation with respect to the control of fishing capacity. In the 1982 United Nations Convention on the Law of the Sea, in particular, the issue of fishing capacity is largely ignored. The 1995 UN Agreement[19] reinforces the obligation of flag states to adhere to the management regimes of the regional fisheries organizations, but does not empower the organizations to deny the access of vessels from non-member states that agree to respect the conservation and management measures in place and do not undermine the work of the regional fishery organizations. Furthermore, there are important high seas stocks that do not come under the purview of the existing regional organizations. In the event of any future efforts to exert controls on the capacity of the high seas fleets, the collation of vessel information at the global level, provided for under the FAO Compliance Agreement, should prove useful.

POSSIBLE SOLUTIONS

Effective control of fishing capacity presupposes an understanding of its links with related issues, of which the most important are: the impact of subsidies, the effects of fleet mobility and the effects of the methods that can be used to regulate access to fish stocks. While considerable experience has been acquired in the management of fisheries, most of the methods or tools used control catch or effort, and not capacity *per se*. The relative effectiveness of these methods in controlling fishing capacity is now better understood, and it is clear that effective control needs regular assessments of stock biomass and an understanding of fleet dynamics, based on a monitoring of the fleet size and its use.

In the developed countries, considerable experience has been built up in the use of alternative fisheries management methods to control fishing capacity. A consensus is emerging in favour of using ITQ management where practicable. In its common form, ITQ management entails limiting the number of fishing units (e.g. vessels), allocating a quota (or share of the TAC) in respect to each and allowing the sale or lease of the right to quotas. A virtue of this system is that it creates an incentive for the voluntary reduction of excess capital by the vessel owners, as attention is drawn away from increasing catches and focused more on reducing costs as the means of enhancing income. This would occur, for example, if an owner purchased and merged the quota entitlements from two boats, with one of the boats being retired. ITQ management can nevertheless prove difficult, particularly when applied to mixed species fisheries, for which it is usually necessary to have complex schemes to offset the increased incentive to discard by-catch.

Not all fisheries are amenable to quota management, however. The difficulties in enforcing adherence to quotas can be substantial. The most frequent alternative has been licence limitation, particularly as applied to controlling the number and power of the fishing units. In most cases this has been done in association with allowing the sale or lease of the rights to a licence. This is of relevance in the purchasing and retirement of licence entitlements - through buy-back schemes - as a means to reduce fishing capacity. It also facilitates (as in the case of ITQ management) the voluntary reduction of capacity by vessel owners. This would occur, for example, when several gear entitlements are merged into a single craft. Voluntary reductions in capacity are usually slow, however, so some form of government intervention is usually required.

Where the control of fishing capacity is exerted through fisheries inputs, experience suggests that capacity is likely to continue increasing, despite the best efforts of the management agencies. This arises because, while it is not difficult to limit the number and size of the units of fishing capacity, it is extremely difficult to control the fishing power of the units. Fishers are continuously striving, often with success, to increase fishing power. There are many examples where agencies have adopted - paradoxically - management measures aimed at reducing the power of the fishing units to offset the gains in fishing power achieved by fishers.

To handle this issue, the management body must monitor the development of technology and its impact on fishing capacity, and do so in concert with the industry. Indeed, management through control of fisheries inputs has been most successful and gained the widest acceptance where the industry has participated in a substantial comanagement role with government.

The majority of countries in the Asia and Pacific region have fisheries management frameworks of varying degrees of efficiency. In general, they are in need of substantial improvement (see Box 10, Improving fisheries management frameworks).

BOX 10
Improving fisheries management frameworks

A recent FAO study of the fisheries management frameworks of the countries bordering the South China Sea concluded that there is a need for strong political will on the part of governments to conserve fisheries resources through improved and more effective fisheries management systems. Governments must shift the aim of fisheries management policies from that of maximizing production to optimizing the net socio-economic benefits over the long term. They must also emphasize the importance of preventing and controlling environmental degradation. In addition, the study concluded that governments could:

· for the benefit of the private sector, the fishing industry and fishers, explain - in clear and simple terms - the existing laws and regulations and management measures adopted by governments;
· use a precautionary approach, in both inshore and offshore fisheries, when timely information and data are not available;
· emphasize research on the development of locally appropriate resource assessment models, bio-economic analysis of exploited fish stocks and the management of transboundary stocks;
· facilitate technology transfers through improving methodologies and the capacity of staff in extension work and by encouraging closer cooperation among administrators, scientific and academic institutions, the fishing industry and fishers.

A number of key issues for improved management can be tackled at the regional level, including: the strengthening of scientists' and administrators' capacities; the development of timely and reliable fisheries information and statistical data as well as the setting up of a regional network; research and management considerations for shared or transboundary fish stocks; the development of methodologies for

stock assessments; the prevention and control of degradation; and the monitoring of large ecosystems such as the South China Sea or the Gulf of Thailand.

Source: FAO. 1997. *Fisheries management frameworks of the countries bordering the South China Sea*. Bangkok, Asia and Pacific Fisheries Commission, FAO Regional Office for Asia and the Pacific.

It is in the highly populous countries suffering from acute poverty and unemployment that controlling capacity is most problematic. In the case of artisanal fisheries, even when fisheries agencies can establish that economic benefits would accrue from reduced capacity, an appreciation of the negative social consequences has invariably prevented such action being taken. A lack of alternative employment opportunities encourages the attraction of fisheries as an employer of last resort, and it is in circumstances such as these that fisheries agencies have shown interest in management that empowers the local communities themselves - in particular through the allocation of user rights - to make the difficult decisions concerning fishing capacity and the sharing of the benefits generated by fisheries. This approach is now commonly referred to as "community-based management". (See Box 11, Community-based management in the Negombo Lagoon, Sri Lanka).

BOX 11

Community-based management in the Negombo Lagoon, Sri Lanka

Negombo is a town located 30 km north of Colombo. Close to Negombo is a lagoon encompassing an area of 31.64 km^2. The catch from the lagoon in 1997 was estimated to be nearly 1 700 tonnes, including 538 tonnes of shrimp, and was valued at SL Rs 100 million (US$1.7 million). Frame survey results have indicated a total of 1 305 vessels (non-motorized), crewed by about 2 000 fishers. The net monthly remuneration per fisher is thought to be about SL Rs 4 000 (US$67).

Community-based management is well established at Negombo. Perhaps the most interesting example concerns the use of stake nets inside the entrance to the lagoon. These are trawl-like nets staked to the lagoon bottom during outgoing tides at night. There are about 60 stations - the number varies slightly according to changes in the topography of the entrance - and, at each, there are several sites that

can be fished. The stations are well known and gazetted in the fisheries regulations. Fishing occurs in all months and, in 1997, involved the use of about 200 craft, with two fishers per vessel (at least one fisher on each vessel is required to be a society member), and a total catch of 308 tonnes, of which 211 tonnes were shrimps.

On the basis of several decades of traditional practice, the management of the stake net fishery is principally undertaken by four independent local societies. Nearly all the 60 stations are distributed among these societies. The entitlements to operate stake nets at each station are allocated among the society members at large annual gatherings organized by each society. The initial process of allocation involves a ballot, whereby the entitlements to fish at a station are distributed randomly. This is followed by a bidding process - a form of auction administered by each society - to determine the distribution of the sites at each station. A member who is successful in the ballot but unsuccessful in bidding for a productive site may choose not to take a site known to be of low productivity.

As the number of members in the societies is greater than the number of sites, each site is allocated to more than one member. In recent years, the entitlement to a site has been allocated to an average of three members, with access being rotated so as to allow each member to occupy a site once every three days. Under this arrangement, each member can engage in stake net fishing for ten days of each month as well as being able to participate in different types of fishing on other days. Only one member of a family may have membership, and the transferral of membership - when a member dies, for example - is hereditary. It may only be passed on to a male member of the immediate family. Where there is no male member, the entitlement lapses.

Additional memberships may be issued, although only to married males between the ages of 18 and 50 years who are descendants of stake net fishers and are Christian. They must also demonstrate that they have access to the necessary craft and gear and are competent fishers. The societies impose penalties in the case of breaches of the rules. The church, which is allocated several sites, obtains a modest revenue from the fishery and it uses this in local welfare activities. This reflects its major role in the evolution of the current regime.

Most of the other examples of community-based management existing throughout Sri Lanka in the past have now disappeared. The contributing factors have included increased mobility of the fishers owing to the motorization of vessels, the influx of displaced persons

from conflict-affected zones in the north of the country, and some loss of cohesion within the coastal communities.

Sources: UNDP/Government of Sri Lanka/FAO Marine Fisheries Management Project SRL/91/022; various published and unpublished papers.

RECENT ACTIONS

A growing number of countries have acted to make substantial reductions in their fishing capacity. In the EC, Multi-Annual Guidance Programmes (MAGP) have been in force since the mid-1980s. Initially, they were designed to control and restrict fleet expansion; more recently they have been designed to reduce capacity. The MAGP targets for fishing capacity are set in terms of vessel tonnage and engine power which, between 1991 and 1996, were reduced by 15 and 9.5 percent, respectively.

In New Zealand, reductions in fishing capacity since the mid-1980s were undertaken in association with ITQ management. In the subsequent decade, the number of vessels engaged in the country's inshore fisheries was halved (see Box 4). The reductions in fishing capacity achieved in Australia are more at the individual fishery level. Some countries, in particular Japan, have strengthened regulations concerning fleet disposal and access to high seas fisheries.

In Latin America, Argentina, Chile and Peru have recently introduced programmes aimed at reducing fishing capacity. To date, however, these countries have met with considerable resistance from industry associations, with which negotiations related to these programmes are proving complex and time-consuming.

From 1995 to 1997, FAO undertook an assessment of the economic viability of selected fleets (see Box 12) shows that fishing remains profitable in most major fisheries. This would seem to indicate that reduced yields have been compensated by higher prices and lower costs, the latter caused by technological improvements, but still in some cases through transfers of public funds to the sector.

The longer-term objective for FAO is to develop, within the framework of the Committee on Fisheries (COFI), an international Plan of Action for the Management of Global Fishing Capacity. As a step towards developing such a plan, in April 1998 an FAO Technical Working Group of international experts met in La Jolla, United States, to review issues concerning fishing capacity.[20] Countries considered the results of these discussions at a meeting held at FAO headquarters from 22 to 24 July 1998.

BOX 12

Economic viability of marine capture fisheries

In cooperation with fisheries research institutions and agencies in Asia, Africa, Latin America and Europe, between 1995 and 1997 FAO carried out studies on the economic and financial viability of the most common fishing vessels and gear combinations. At the same time, information was also collected on the level of exploitation of the associated resources as well as on government policies regarding fisheries management, subsidies and fiscal policies.

The countries covered include Argentina, Cameroon, China, France, Germany, Ghana, India, Indonesia, Malaysia, Peru, the Republic of Korea, Senegal, Spain, Taiwan Province of China and Thailand. Together, they accounted for about 50 percent of the total marine capture fisheries production in South America, Europe, Africa and Asia, which in turn accounted for 84 percent of global marine capture fisheries production in 1995. FAO considers the studies a useful empirical contribution to the discussion on the economic viability of marine capture fisheries. They should be continued and expanded to cover more countries, as recommended by the workshop, with a view to validating the findings and monitoring changes that occur over time.

The findings of the studies were discussed at an interregional workshop, held in Kuala Lumpur, Malaysia, from 15 to 18 December 1997. The general conclusion was that, in spite of fully and sometimes overexploited fisheries resources, most marine capture fisheries are economically and financially viable. In other words, they generate sufficient income to cover costs - including allowances for depreciation as well as the opportunity cost of capital, with adequate levels of remuneration to the owners and crews and a surplus remaining for reinvestment.

In the African countries studied, only small-scale encircling gillnetting

and deep-sea fish/shrimp trawling in Senegal generated a negative net cash flow, while all other fishing vessel and gear combinations studied generated a positive net surplus. In Latin America, large-scale trawling in Peru had a negative net cash flow, while purse seiners generated a positive net surplus. In Argentina, both trawlers and purse seiners generated a positive net surplus.

In Asia, all fishing fleet segments covered in Malaysia, the Republic of Korea and Taiwan Province of China generated a positive net surplus, as did five out of the seven typical medium- and large-scale fishing units in China, and seven out of the eight typical fishing units in Indonesia. In Europe, out of the 23 types of small-, medium- and large-scale fishing vessels studied in France and Spain, only two types of deep-sea trawlers operating in France had negative net results, while the other 21 types of vessels generated a positive net surplus.

It was also observed that the number of subsidies in developing countries has been greatly reduced in recent years. The remaining subsidies are for offshore fishing, artisanal fisheries and fisheries cooperatives as well as for fishing operations in remote and underdeveloped areas. They were mainly available in the form of capital subsidies and reduced duty on fuel, and even these were in the process of being further reduced.

Source: FAO. *Economic viability and sustainability of marine capture fisheries - Findings of a global study and recommendations of an interregional workshop.* FAO Fisheries Technical Paper No. 377. (in prepa-ration)

GLOBAL PERSPECTIVE

Many developed countries and a small number of developing countries have successfully taken the important and difficult steps needed to control and, where needed, reduce fishing capacity effectively. Other countries can be expected to follow. Notwithstanding, the reduction of capacity in some countries has not necessarily led to a reduction of the global fishing capacity, owing to the relocation of capacity and the continuing expansion of capacity in other countries. In the short term, the control of capacity will occur mostly in EEZ waters other than those of the highly populous and least developed countries where the control of fishing capacity will remain secondary to employment considerations. In a few countries, commercial fisheries will be displaced as preference is given to recreational activities and tourism.

Resolving the excess capacity in the high seas fisheries is bound to be a protracted process because of the "open access" nature of these fisheries, the difficulty of adopting and enforcing internationally (or regionally) agreed measures to control fishing capacity and the need to establish additional regional management organizations for those fish stocks outside the purview of existing regional fisheries management bodies. An emerging issue stems from the increasing participation in high seas fisheries by coastal states (e.g. countries bordering the Indian Ocean) that often use lower-technology vessels and gear than the existing distant-water fleets. These countries
are unlikely to collaborate with attempts by regional organizations to control fishing capacity while they are still in the process of establishing their offshore fleets. Ultimately, they might seek to displace the distant-water fleets.

REDUCTION OF BY-CATCH AND DISCARDS

THE ISSUE

By-catch occurs because most fishing gears and practices are not perfectly selective for the species and sizes being targeted and because target species exist in habitats occupied by a wide range of other species. The target species themselves may be considered as by-catch if they are of the wrong size, the wrong sex or the wrong part of the animal. Shark carcasses are an example of the latter when it is only the fins that are targeted. The definition of "wrong" in these cases is determined either by the market or through regulations applied to the fishery. Similarly, the by-catch of non-target species may be either marketable or non-marketable. In most cases, unmarketable by-catch is discarded, the key exception being where discarding is forbidden.

The discarding of by-catch has long been recognized as wasteful, although inevitable by virtue of the nature of fishing. It constitutes a loss of valuable food, has negative consequences for the environment and biodiversity and can be aesthetically offensive. By-catch was propelled to the forefront of public debate in reaction to the incidental capture of dolphins in tuna purse seine nets, turtles in shrimp trawls and marine mammals, birds, turtles and fish in high seas squid driftnets. The outcome for all the fisheries concerned was dramatic, and not always perceived as rational from the viewpoint of fisheries interests.

An order of magnitude for the quantities of fish discarded was provided for the first time in an assessment published by FAO in 1994.[21] Annual discards from the world's fisheries were estimated to range from 17.9 million to 39.5 million tonnes. A subsequent re-evaluation of these estimates, together with adjustments allowing for subsequent reductions in discarding, indicates that current levels are at the lower end of the range. The most recent FAO estimate of 20 million tonnes, if correct, is equivalent to 25 percent of the reported annual production from marine capture fisheries, which are those from which most of the discards derive.

In the Pacific artisanal and subsistence fisheries, fishers generally discard very little of their catch. Most discards in this region are generated by the tuna fisheries, particularly

the tuna long-line fisheries for albacore and, to a lesser extent, by the purse seine fisheries for skipjack and yellowfin tunas.

In most respects, the decision by fishers to discard components of their catch is driven by economic factors. In an unregulated fishery, fishers have an incentive to discard if the expected net price, i.e. the real price less landing costs, is negative and if the resultant costs incurred in landing are greater than those incurred by discarding. Furthermore, there is an incentive to discard if the boat has a limited holding capacity. In such cases, fishers tend to discard the low-value components and retain those of higher value, a practice that is often referred to as "high grading".

Management involving the use of catch quotas commonly increases the incentive to discard. This is particularly so in mixed species fisheries where several of the species are subject to a quota. Three forms of discarding can be associated with quota management: the discarding of catch taken in excess of the quota, high grading and price dumping. The latter occurs where all or part of the catch of a species is discarded if a low price is expected. This could occur on the return journey to port, for example, when a fisher may decide to discard the day's catch so as to save the quota for a day when the price is higher.

Discarding is a feature of any management system that does provide for its specific and effective prohibition. In this event, there remains the issue of whether or not the added cost of enforcement is justified in lieu of the benefits and who should pay. In fact, most of the measures aimed at reducing the quantities being discarded carry substantial implementation costs. The rational argument that is gaining general acceptance is that the costs of implementation should be a cost against the fisheries and should therefore be borne - directly or indirectly - by those who clearly benefit directly from those fisheries.

POSSIBLE SOLUTIONS

The incentives to discard do not change with the introduction of licence limitation. Nevertheless, if the number of vessels is reduced as a result of licensing, there is likely to be at least a short-term increase in the stock of the by-catch species. Minimum size requirements would normally increase the discarding, particularly if enforcement is carried out at the point of landing. The benefit from enforcement at the point of capture - which is not always practical - is to "encourage" fishers to operate on grounds where there are fewer undersized fish and to employ more selective gears and practices.

Restrictions applied to the number of days at sea can lead to less discarding. This may occur simply as a consequence of reducing the fishing effort, in which case the effects are the same as those brought about by reducing the number of vessels. Additionally, there may be insufficient fishing time to enable the space to be filled with only the higher-value components of the catch, a situation that arises if storage space is limited. In such cases, more of the less valuable components could be retained and hence discarding could be reduced.

At the fishery level, the management measures that seek to reduce discarding fall into two broad categories. The first achieves lower quantities of by-catch through the use of more selective gears and practices, area and seasonal closures and increased by-catch utilization. The second category includes measures aimed at reducing the discarding of by-catch. These may be direct - such as when discarding is prohibited - or take the form of economic incentives to alter discarding behaviour.

The measures to reduce discarding in fisheries under quota management have gained increased prominence, as progressively more fisheries have been placed under ITQ management regimes. They include allowing above-quota catch to be traded - i.e. sold to those with unfilled quotas - as an alternative to discarding. Permissible levels of quota overrun allow fishers to exceed quotas in one year in return for a reduction in quotas for the following year. In New Zealand, permitted quota overruns are limited to 10 percent of the original quota for all species. Also in New Zealand, fishers can land species for which they do not hold a quota and record it against the quota held by other fishers. The voluntary surrender of above-quota catch without penalty is another option. In this event, the fisher may sell the catch in the normal manner, but must pay the "deemed" value (the value realized in excess of the cost of landing) to the management authority.

Norway has imposed a system where the discarding of quota species - including sizes that might otherwise have been discarded - is prohibited and all the catch is deducted from the quota (see Box 13). Individual fishers are responsible for ensuring that they have sufficient unfilled quotas to allow for any by-catch of quota species when targeting other quota species. They are also required to leave a fishing ground if there is a perceived risk of exceeding quotas or if there are abundant juveniles. This aspect of the Norwegian approach has provided a strong incentive to develop and apply more selective gears. In the United States, the North Pacific Fishery Management Council has resolved to prohibit the discarding of walleye pollock, Pacific cod, yellowfin sole and rock sole. This has commenced for the first two species and is to be phased in for the others over a five-year period.

BOX 13
Controlling by-catch and discards: Norway's experience

A few decades ago, most fisheries in Norway produced a by-catch. This was particularly so in bottom trawling for roundfish and pink shrimp (*Pandalus borealis)*. At the time almost no regulations dealt explicitly with by-catch. However, both the quantity and composition of the catch were influenced by regulations aimed at preserving the target species. Such measures included (minimum) mesh size regulations and a ban on retention onboard as well as landing of fish below an established minimum size (minimum landing size [MLS]). Thus, the management system in place made the practice of discarding

both target and non-target species unavoidable.

In 1983, a Marine Fisheries Act was adopted in parliament, then regulated and applied. The intention behind the new act was to initiate and promote a process leading to a lower volume of killed and discarded fish. This applied to both target and non-target species. The Act clearly states that any illegal catch should be thrown immediately back into the sea to give the fish a chance to survive. However, the time needed to bring the catch onboard and to sort it generally resulted in most fish being out of the water too long to survive even if they were not dead when first thrown back overboard.

It was soon recognized that the Act and its regulations had shortcomings, and these have been addressed by several administrative measures during the last 15 years. The purpose has been to regulate the fishing, not the landings, and therefore to concentrate enforcement on the fishing operation itself.

One of the first administrative measures was the introduction of a surveillance programme in 1983/84. Chartered commercial fishing vessels surveyed the most important fishing ground to monitor the by-catch of illegal-sized fish and species of which fishing was prohibited. The surveillance programme was soon followed up by regulations establishing specific criteria for a maximum allowable by-catch.

As these criteria were implemented by the Norwegian Coastguard, it immediately became evident that the authorities would temporarily have to close several productive fishing grounds. It is now standard practice for the grounds to be closed for shrimp trawling if the catch contains more than one individual juvenile cod and/or haddock per kilogram of shrimp, or if undersized shrimp account for 10 percent or more of its weight. Likewise, bottom trawl grounds are closed when catches contain more than 15 percent (in number) of juveniles of the target species. Purse-seining for saithe cannot be carried out when 10 percent or more of the saithe caught is below the MLS.

Other important measures introduced since 1983 include: i) an obligation to leave the fishing grounds when the mixture of undersized fish caught exceeds certain levels; ii) temporary closures of sensitive areas; iii) the prohibition of onboard sorting machines (e.g. in the mackerel fishery); and iv) a requirement to use more selective gears.

The most revolutionary step, however, is probably the ban on discards. Norwegian fishers are obliged to land all catches of important commercial species. Even if such fish are caught unintentionally, both

mature and undersized fish must be landed. This "illegal" catch should be taken ashore and deducted from the TAC of the species concerned. In general fishers support the ban on discarding, as experience has taught that by-catches - particularly of juveniles - lead to fewer fish in future years.

Fishers soon realized that, by using more selective gears and methods - i.e. catching only individuals of the target species that are above the MLS - they could fish while also abiding by the rules. The Norwegian fishing authorities have shared this view and have been supportive in terms of providing funds for developing selective fishing gear.

A grid system to avoid by-catch of fish juveniles in trawl fisheries as well as of bigger non-target fish was developed in less than two years and its use is now widespread in the North Atlantic. The grid is mounted at 45 degrees in the trawl and set behind a guiding funnel. It has proved to be an excellent selectivity device in shrimp fisheries. More than 90 percent (in weight) of the by-catch in shrimp fisheries is released, and the loss of shrimp is less than 2 percent. The device was made compulsory for shrimp trawling in the early 1990s. Encouraged by the positive results of selectivity work on shrimp trawls, grid work on bottom trawls and seine nets was started. After several years of voluntary use, in 1997 a grid system was made compulsory for vessels using these gears in the Norwegian and Russian EEZs. At this stage, the system was readily accepted, as most fishers were already accustomed to using the grids.

Source: B. Isaksen, Norwegian Institute of Fisheries Research, Bergen, Norway.

RECENT ACTIONS

The 1995 UN Agreement for the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks seeks to minimize pollution, waste, discards, catch by lost or abandoned gear and catch of non-target fish and non-fish species. This should be achieved, *inter alia*, through measures such as the development and use of selective, environmentally safe and cost-effective fishing gear and techniques. These obligations were reiterated with reference to all fisheries in the Plan of Action produced by the International Conference on the Sustainable Contribution of Fisheries to Food Security, held in Kyoto, Japan, in 1995.

The Code specifically states that: "States, with relevant groups from industry, should encourage the development and implementation of technologies and operational methods that reduce discards. The use of fishing gear and practices that lead to the discarding of catch should be discouraged and the use of fishing gear and practices that increase survival rates of escaping fish should be promoted." Where selective and environmentally safe fishing gear and practices are used, they should be recognized and accorded priority in establishing conservation and management measures for fisheries.

The Technical Consultation on the Reduction of Wastage in Fisheries,[22] held in Japan in October 1996, provided an important forum for a discussion of this issue by international specialists. The participants concluded that there had been significant reductions in discarding worldwide during the past decade. This had come about as a result of less fishing effort, time and area closures of fishing grounds, the use of more selective gears, the utilization of previously discarded by-catch, enforced prohibitions on discarding, and consumer-led actions. There were recommendations made with regard to information gathering, the future estimation of discards, options for fisheries management, the impacts on small-scale and recreational fisheries, gear selectivity and the utilization of by-catch.

At the March 1997 session of COFI, several delegations reported on successful by-catch reduction programmes. Papers[23] presented at the international workshop on Solving By-Catch: Considerations for Today and Tomorrow, sponsored by the United States and held in Seattle in 1995, provided many examples of by-catch reduction across a wide range of fishing gears and practices. The by-catch and discard issue, particularly regarding the collection of by-catch data, is being addressed by the regional fisheries organizations, for example by placing observers (from member countries) on the offshore tuna fleets.

The Inter-American Tropical Tuna Commission (IATTC) is continuing its substantial involvement in research on dolphin by-catches. The International Commission for the Conservation of Atlantic Tunas (ICCAT) is increasingly active with respect to the by-catch of sharks (see Box 14).

BOX 14

International actions to reduce shark by-catch in the Atlantic tuna and tuna-like fisheries

At the Ninth Meeting of the Conference of the Parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), held in Fort Lauderdale, United States, in November 1994, it was proposed that several shark species be listed in the CITES Appendix as endangered species. The International Commission for the Conservation of Atlantic Tunas (ICCAT) took notice, as sharks are a major component of the by-catch of many tuna fisheries. Sharks are also targeted from some tuna fishing vessels, using slightly modified gears. CITES did not adopt the proposal; however, it did pass a resolution on the Status of International Trade in Shark Species.

At the 1994 meeting of the ICCAT Standing Committee on Research and Statistics (SCRS), it was decided to conduct a survey to determine the species of shark being caught as by-catch in the tuna fisheries. The results were reported at the 1995 meeting of the SCRS. In the same year, from an examination of its enabling International Convention for the Conservation of Atlantic Tunas, ICCAT confirmed that it was responsible for the collection of information on the catches of sharks and other fish species caught coincidentally from fishing effort directed at tuna and tuna-like species. It also agreed to assist in any stock assessment of pelagic sharks, as the methodology is similar to that used for tunas and the scientific expertise available is therefore applicable.

In accordance with the CITES resolution, at its 1995 session, the ICCAT Commission adopted the ICCAT Resolution on Cooperation with FAO with regard to Study on the Status of Stocks and By-Catch of Shark Species. This recognized that FAO should be the international coordinating entity for disseminating data on shark catches and that all other regional agencies should collaborate with FAO.

The 1995 ICCAT session also decided to:

· establish a Sub-Committee on By-Catch to guide research and data analysis, and a Working Group on Sharks to deal with issues concerning incidental and targeted capture of sharks;
· amend ICCAT's statistical database to include information on by-catch and encourage more comprehensive data collections;
· conduct stock assessments, with priority given to the pelagic sharks (e.g. blue, mako, thresher, silky).

The first meeting of the ICCAT Working Group on Sharks was held in Miami, United States, in February 1996. It finalized a list of the by-catch species associated with tuna fisheries and, after reviewing a summary of the shark catch and trade data in the FAO database, developed a plan for improving the data collection systems. It also formulated a plan to collect and incorporate shark by-catch data into the ICCAT statistical database as well as a new reporting format. An important outcome was the endorsement of a data collection form for reporting shark by-catch, and its distribution through the ICCAT secretariat to more than 80 countries engaged in tuna fishing in the Atlantic. The completed forms would be returned annually to ICCAT.

The second meeting of the Working Group on Sharks took place in Shimizu, Japan, in March 1997 before the Tenth Conference of the Parties to CITES. The Working Group focused on updating its list of shark species caught by tuna fisheries, and reviewed additional data provided to ICCAT on the catch and catch per unit effort (CPUE) of shark for the Atlantic. The responses of other international bodies to the request from CITES to collaborate in the collection of shark research and trade data were also examined. This resulted in ICCAT requesting CITES to seek improved collaboration among the regional agencies and additional data from the tuna-fishing countries.

At its 1997 meeting, the SCRS developed mathematical equations, or conversion factors, enabling the estimation of weight from length for the major species of shark in the Atlantic. Such equations are necessary for the conversion of different types of statistics being provided for inclusion in the ICCAT database. Also in 1997, implementation of the national observer programmes for tuna long-liners, purse seiners and bait boats became binding on ICCAT Contracting Parties. As reported in October 1997, observers were being deployed on some tuna vessels by 11 Contracting and non-Contracting Parties (Brazil, Canada, Chinese Taipei, France, Japan, Italy, Mexico, Spain, the United Kingdom, the United States and Venezuela).

Notwithstanding the progress, there are still difficulties impeding the establishment of a comprehensive database for sharks. This includes problems encountered in the collection of historical shark by-catch data and the identification of species by fishers, with the result that catches are often reported without species breakdown. Particular difficulties are raised by the interest in shark-fin products, a subject related to world trade. Sometimes the carcasses are discarded at sea and only the fins are kept while, at other times, both may be landed but sold in different markets. The latter can result in "double counting", for

example in cases where both the fins and the carcass weights are converted in the estimation of whole weights. The trade of shark fins is also complicated by the common practice in some countries of re-exporting after importing.

Source: P. Miyake, ICCAT secretariat, Madrid, Spain.

GLOBAL PERSPECTIVE

The process of resolving the by-catch and discards issue will be driven by forces at several levels. The community at large will continue to take offence, particularly where the problem is widely publicized and includes species with a high "aesthetic" value. The continued large-scale use of drift gillnets, for example, whether on the high seas or elsewhere, can be expected to remain a target of dissent. The substantial challenge for fisheries governance is to achieve balanced outcomes that are sensitive to community values but avoid unnecessary losses of benefit from the fisheries themselves. This will require the public to be correctly informed and those responsible for fisheries - including fisheries participants themselves - to establish credibility through continued efforts to reduce by-catch and discarding.

In the highly populous countries, particularly in Asia, where fisheries are characterized by many gears and several species in catches, relatively little of what is caught is not consumed or used as feed in aquaculture. Where wastage does occur, it is not so much the consequence of discarding but rather of some species - possibly many - generating more economic benefit when captured at a larger size. Where this can be established, the best management approaches are likely to include area and time closures and more selective gears. Nevertheless, this situation generally arises in countries where management is intrinsically difficult because fisheries often act as the employer of last resort. Improving the well-being of the fishers in one community would be a short-lived solution if there was a consequential inward movement of fishers from the surrounding communities.

[1] Adopted by the Twenty-eighth Session of the FAO Conference in October 1995, the Code of Conduct for Responsible Fisheries is referred to throughout this publication as "the Code".
[2] The EC, Japan, Norway, the Russian Federation and the United States.
[3] Chile, Colombia, Ecuador and Peru.
[4] Government of the United States. 1997. *Implementation Plan for the Code of Conduct for Responsible Fisheries*. United States Department of Commerce, National Oceanic and Atmospheric Administration and National Marine Fisheries Service. 20 pp.
[5] Anon. 1997. Global Aquaculture Alliance formed to guide industry toward environmental sustainability. *World Aquaculture*, September 1997, p. 48.
[6] D.J. Donovan. 1997. *Environmental Code of Practice for Australian Prawn Farmers*. July 1997. 32 pp.

[7] O. Pawaputanon. 1997. *Manual for harmonization of good shrimp farm practice.* ASEAN Fisheries Network Project.
[8] Anon. The Holmenkollen Guidelines for Sustainable Aquaculture. In *Proceedings of the Second International Symposium on Sustainable Aquaculture*, Oslo, 2-5 November 1997. Trondheim, Norway, Norwegian Academy of Technological Sciences. 9 pp.
[9] See FAO. 1997. *Risk management and food safety.* Report of a Joint FAO/WHO Expert Consultation, Rome, 27-31 January 1997. FAO Food and Nutrition Paper No. 65. Rome; and FAO. 1998. *Animal feeding and food safety.* Report of an FAO Consultation, Rome, 10-14 March 1997. FAO Food and Nutrition Paper No. 69. Rome.
[10] SEAFDEC/FAO/CIDA. *Report and proceedings of SEAFDEC/FAO/CIDA Expert Meeting on the Use of Chemicals in Aquaculture in Asia*, 20-22 May 1996, Southeast Asian Fisheries Development Centre, Iloilo, the Philippines. (in preparation)
[11] FAO. 1997. *Towards safe and effective use of chemicals in coastal aquaculture*. GESAMP Reports and Studies No. 65. Rome. 40 pp.
[12] FAO/NACA/WHO. *Food safety issues associated with products from aquaculture.* Report of a Joint FAO/NACA/WHO Study Group on Food Safety Issues associated with Products from Aquaculture, Bangkok, Thailand, 22-26 July 1997. WHO Technical Report Series No. 883. Geneva, WHO. (in press)
[13] Directive 91/493/EEC as amended by 95/71/EC.
[14] Directive 91/67/EEC as amended by Directives 93/54/EC and 95/22/EC.
[15] WRI. 1996. *World Resources 1996-1997*. WRI/UNEP/UNDP/World Bank. Oxford, UK, Oxford University Press. 365 pp.
[16] International Workshop on Integrated Coastal Management in Tropical Developing Countries: Lessons Learned from Successes and Failures. 1996. *Enhancing the success of integrated coastal management: good practices in the formulation, design, and implementation of integrated coastal management initiatives.* MPP-EAS Technical Report No. 2. Quezon City, the Philippines, GEF/UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas/Coastal Management Center.
[17] J. Sorensen. 1997. National and international efforts at integrated coastal management: definitions, achievements and lessons. *Coastal Management*, 25: 3-41.
[18] B. Cisin-Sain, R.W. Knecht and G.W. Fisk. 1995. Growth in capacity for integrated coastal management since UNCED: an international perspective. *Ocean and Coastal Management*, 29(1-3): 93-123.
[19] The Agreement on 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.
[20] See *FAO Fisheries Department Report of the Technical Working Group on the Management of Fishing Capacity*, La Jolla, United States, 15 to 18 April 1998.
[21] FAO. 1994. *A global assessment of fisheries by-catch and discards.* FAO Fisheries Technical Paper No. 339. Rome.
[22] I.J. Clucas and D.G. James, eds. 1997. *Papers presented at the Technical Consultation on Reduction of Wastage in Fisheries.* Tokyo, 28 October-1 November 1996. FAO Fisheries Report No. 547, Suppl. Rome, FAO. 338 pp.
[23] *Solving By-Catch: Considerations for Today and Tomorrow.* Alaska Sea Grant College Program Report No. 96-03, University of Alaska, Fairbanks.

PART 3
Highlights of special FAO

Over the past two years, inland fisheries resources and the state of the world's fishers and fishing vessels have been studied closely by the FAO Fisheries Department. Highlights from the analyses and assessments carried out are presented in the following two sections.

INLAND FISHERIES RESOURCES: THEIR STATUS AND USE[1]

THE STATE OF INLAND FISHERIES RESOURCES

Our knowledge of the state of inland fisheries resources is poor. The main reasons for this are the large number, dispersion, variety and dynamic nature of inland water bodies and the diversity of their aquatic fauna. These characteristics mean that the collection of data is costly. Some 11 500 fish species (41 percent of all fish) are exclusively freshwater and about 300 (1 percent) are diadromous. To a large extent, therefore, existing knowledge about resources is based on inferences derived from studies of inland water systems and from the monitoring, where possible, of effort and yields in inland fisheries.

Inland water systems: type and magnitude

Fish and other aquatic resources are captured from a great variety of inland systems, including perennial lakes,[2] which have a combined surface area of about 1.7 million km^2, nearly 1 million km^2 of which are accounted for by large lakes (>100 km^2). North America possesses by far the greatest large lake surface. Swamps, marshes and other wetlands throughout the world amount to about 4 million km^2, of which the CIS and the Baltic states claim the greatest portion.

The world's main channel river lengths amount to about 269 000 km. The highest density of rivers occurs in South America, the lowest in Oceania (Figure 20).

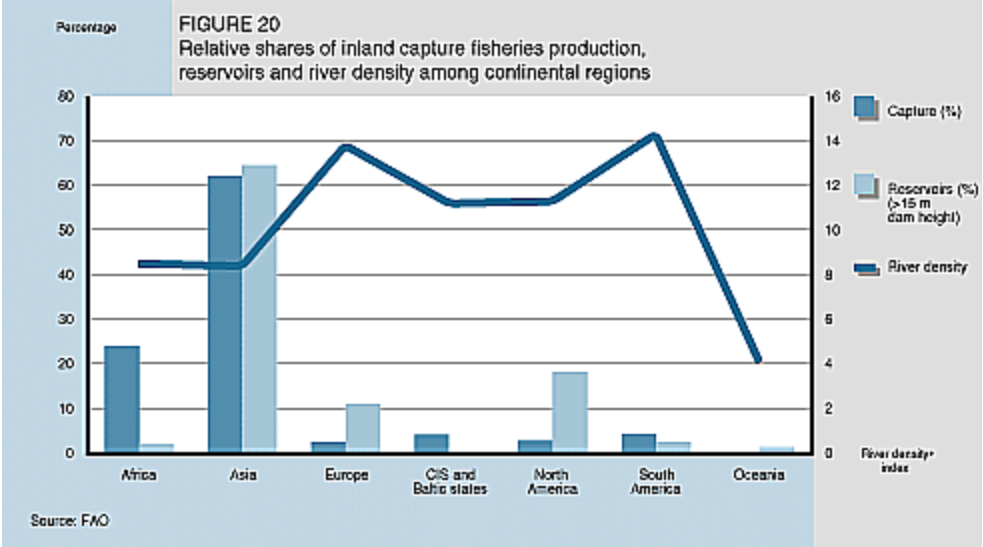


FIGURE 20
Relative shares of inland capture fisheries production, reservoirs and river density among continental regions

Fished artificial water bodies range from large hydroelectric reservoirs to multipurpose community and family ponds, irrigation canals, rice-fields, borrow pits and even roadside ditches.

Large reservoirs (>15 m dam height) generally date from after the Second World War. Most are in China, and nearly 65 percent of the global total by number are located in Asia (Figure 20). In all, there are 60 000 such reservoirs in the world, totalling 400 000 km^2 in water surface and about 6 500 km^3 in volume.[3] The construction of large dams in the United States peaked in the 1950s and 1960s,[4] while in Africa, where the reservoirs are comparatively smaller, the peak was reached during the 1970s.[5] The trend today is towards smaller reservoirs. Nevertheless, it is remarkable that reservoir storage has attained about seven times the standing stock of water contained in rivers.[6]

In addition to the larger, better-known systems, there are millions of small multipurpose water bodies around the globe that are not always accounted for. Such systems could make a greater contribution to food production if they were managed appropriately and in a way that is compatible with their other uses.

Inland water systems: the aquatic environment

The state of inland fisheries resources is very much reflected by the state of the terrestrial environment in general and by that of the aquatic environment in particular. There are two major influences: climatic cycles and human-induced changes.

Climatic cycles, expressed as variations in rainfall, affect inland fisheries resources by providing more or less living space, more or fewer nutrients via inundation and rainfall runoff and higher or lower vulnerability to fishing as a result of concentration and dispersal. For example, about 57 percent of the large inland water body surface in Africa

consists of systems that have quite widely varying surface areas, both seasonally and interannually. In these systems, the availability of fishery resources for exploitation varies greatly and the impact on food supply may be very serious in times of drought or when especially high rainfalls cause extensive flooding.

Similarly, climatic cycles expressed as variations in temperature also affect inland resources. For example, temperature can be a lethal factor. At sublethal ranges, it controls metabolic rates. It affects not only the growth rate of fish but also their behaviour. Temperature changes also trigger fish movements and fish reproduction.

These climatic effects manifest themselves in the amount of fish available for capture. Therefore, long-term climatic changes, such as those brought on by global warming, are a concern for the future of inland fisheries resources.

Human-induced changes to inland resources are manifold. In fact, the greatest threat to the sustainability of inland fisheries resources is not overexploitation, but degradation of the environment. As mentioned earlier (see State of inland fish resources), the global situation regarding inland aquatic resources is not encouraging, mainly owing to land and forest degradation, loss of biodiversity, the scarcity and pollution of freshwater and hence the degradation and loss of habitats. Another measure of the state of the inland aquatic environment has been provided by the analysis of the stress exerted in 145 large watersheds around the world. Their combined land surface area accounts for 55 percent of the total land surface, not including Antarctica.[7] Stresses were found to be especially severe in watersheds that were already substantially modified or degraded. In particular, China, India and Southeast Asia stood out as areas where pressures on watersheds are intensifying. This is a cause of concern, as they are the world's most important areas for inland fish production. Other major watersheds such as the Amazon and the Congo are less degraded. Nonetheless, these are also beginning to experience rapid change.

A worldwide study has been carried out on river basins that support a high level of aquatic biodiversity. The study concluded that 30 of the basins should be managed very carefully because they have a rich diversity of fish species but are highly vulnerable to future pressures.[8] Of these river basins, 39 percent (by total area) are in Africa, 35 percent in Asia and 26 percent in Latin America.

Human-induced changes are also reflected in the composition of the inland fish fauna. In fact, introduced species are relatively important in the capture of freshwater fish. For example, Nile tilapia and other tilapias are important in Asia, Latin America and Oceania. In Europe, Latin America and North America, common carp is important. According to the FAO Database on Introductions of Aquatic Species,[9] common carp, rainbow trout, Mozambique tilapia, grass carp and Nile tilapia are the most frequently recorded introductions. In the recreational sector, on average, non-native sport fish provided 38 percent of recreational fishery use in the United States.[10]

In conclusion, it is apparent that most freshwater fish faunas of the world are in serious decline and in need of immediate protection. Among the heavily fished faunas, fish losses

appear to be highest in: i) industralized countries; ii) in regions with arid or Mediterranean climates; iii) in tropical regions with large human populations; and iv) in big rivers.[11]

EXPLOITATION OF INLAND FISHERIES RESOURCES

Inland fisheries resources are exploited for food and other products - mostly by fishers earning a living from their activity - and for pleasure by recreational fishers.

Recreational fisheries

The use made of fishery resources by recreational fishers is underreported. Of almost 200 countries and territories approached by FAO, only 30 responded with recreational capture estimates. These amounted to 476 500 tonnes in 1990.[12] Total recreational catch, however, may be in the order of 2 million tonnes.[13] Two examples reported more recently indicate the importance of recreational fisheries:

- Among 22 European countries, there are an estimated 21.3 million anglers.[14]
- In the United States, 29.9 million anglers paid US$447 million for fishing licences in 1996.[15]

Recreational fisheries are not confined only to developed countries. In fact, the promotion of recreational fishing as a national and international income-generating activity is being contemplated or is already practised in many developing countries, among them Brazil, Malaysia and Zimbabwe.

Fisheries for food

In 1996, recorded landings[16] - mostly commercial or artisanal - of inland fisheries resources amounted to 7.6 million tonnes, equal to 7.8 percent of total capture. Landings consisted mainly of finfish, although molluscs, crustaceans and aquatic reptiles may be locally important (see Inland capture fisheries production).

The contribution of inland fisheries resources to food production is certainly greater than that reported because of the dispersed and informal nature of many fisheries. For example, official Brazilian inland capture fisheries statistics in 1991 reported a production volume of 193 000 tonnes from *all* of the country's waters. However, an independent study commissioned by FAO for the same year suggests a production figure of about 319 000 tonnes for the Amazon Basin portion of Brazil alone.[17] Similar results have been found for Paraguay. These studies confirm already published FAO estimates that, for the world as a whole, actual harvests of inland fisheries resources may be at least twice those reported to FAO.[18]

In contrast to marine fisheries, in which substantial fisheries are pursued exclusively for the purpose of providing raw material for animal feeds, inland fishers - whether artisanal or commercial - target food fish. There are very few discards, as fishing gears are

generally stationary and more selective than those used in marine fisheries and virtually all the catch is for direct human consumption. This is often - but not always - facilitated by short distances between the place of capture and the consumer. Thus, disregarding the obvious underreporting for inland fisheries, inland capture fisheries in 1996 accounted for nearly 12 percent of the fish provided by all capture fisheries for direct human consumption.

Species groups and capture by country

Species naturally vary with the region of production. The section Inland capture fisheries production lists the dominant species produced in Africa, Asia, Europe, the CIS and the Baltic states, Latin America and North America. As is also mentioned in that section, six of the top ten producer countries are in Asia, together accounting for about 62 percent of world inland capture (Figure 21).

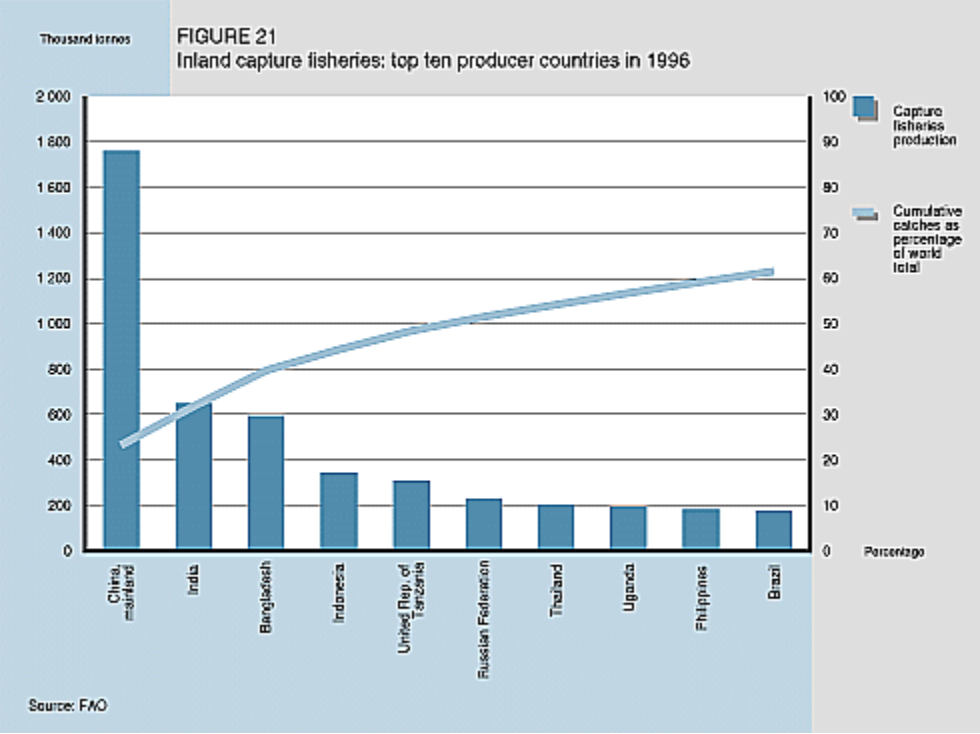


FIGURE 21
Inland capture fisheries: top ten producer countries in 1996

THE FUTURE USE OF INLAND FISHERIES RESOURCES

Trends in use

Based on total inland capture for the period 1984-1996, it is clear that increasing use is being made of inland fisheries resources. The average annual increase is about 130 000 tonnes (about 2 percent per annum).

Asia is by far the most important continent for inland capture fisheries (Figure 22), and it is here that the largest increase in inland resource use has been occurring. Since 1992, an average growth rate of more than 8 percent per annum has been recorded. In Africa, the second most important region, the overall trend is for a very slight annual increase.

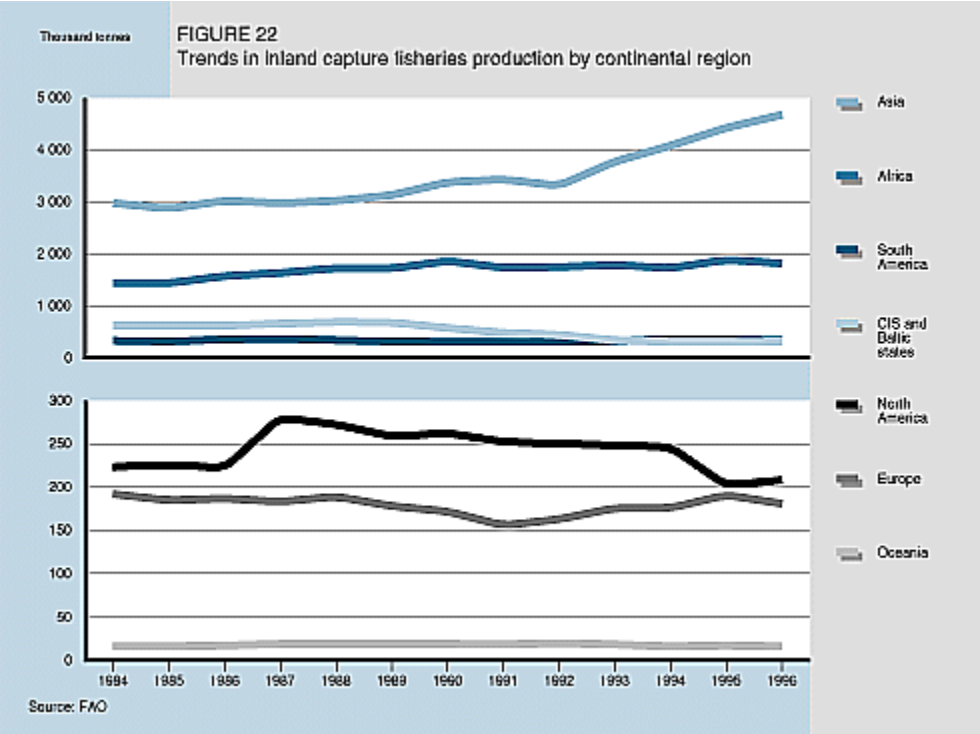


FIGURE 22
Trends in inland capture fisheries production by continental region

In contrast, inland capture is decreasing in the CIS and the Baltic states and in North America. In the first group of countries, this decline is due to overexploitation (e.g. of Caspian Sea sturgeon) and loss of habitat (e.g. in the Aral Sea) and is also linked with the region's political and economic changes that call for new approaches to resource management. In North America, the declining trend may be indicative of the continued displacement of commercial fisheries by recreational fishing. The recent trend for Europe is for an increase, while South America and Oceania have been fairly stable over the long term.

An FAO study[19] was undertaken recently to characterize inland fishery enhancements by type and species in Africa, Asia and the Pacific and Latin America. Preliminary results of the study suggest that stocking and introductions are by far the most important enhancements being employed and that the most frequent objective is to produce food and income. Although incomplete, data submitted to FAO show that, over the period 1984-1995, the highest numbers of world stocks were for coregonids, salmonids and the common carp.

Extent and intensity of use

The shares of inland capture production by continent do not relate closely to the relative amounts of land and water present in the same continents (Figure 8). For example, Asia produces nearly 65 percent of inland capture but has only a 20 percent share of the total continental area; a 23 percent share of swamps, marshes and other wetlands; a 7 percent share of lake area; and an intermediate index of river density. However, it does have a relatively large number of reservoirs (Figure 20).

A variety of factors are responsible for Asia's disproportionate share of inland capture; however, much is due to the heavy exploitation of virtually all the available water surface and the widespread use of fishery enhancements, mainly stocking, to increase food fishery yields. A large part of the water surface in North America and the CIS and the Baltic states is in cooler regions. Furthermore, in contrast to Asia, inland fisheries resources in much of North America and Europe are managed to produce game fish, not food fish. Other differences can be explained by cultural attitudes towards inland fish. For example, in South America only a relatively few species of large-sized inland fish are appreciated on urban markets.

Trends in inland fisheries management

There are a number of clear trends that will affect the exploitation of inland fisheries resources in the medium term, including the following:

- an increasing use of enhancements, mainly stocking, to improve yields;
- increasing attention to environmental impacts on fisheries and to the impacts of fishery enhancement on biodiversity;
- the increasing importance of recreational fisheries and of conflicts over the allocation of resources between food and sport;
- increasing community-level responsibility for management in general and control of access in particular;
- an increasing awareness of the value of inland fisheries resources and the need for fisheries to be included in cost-benefit analyses of multiple uses of water resources.

FISHERS AND FISHING FLEETS[20]

EMPLOYMENT IN THE FISHING AND AQUACULTURE INDUSTRIES

During the past three decades at least, employment in fishing and aquaculture worldwide has grown faster than employment in agriculture. At the same time, the share of agriculture in employment is generally declining: in terms of their share in the economically active population, those employed in agriculture accounted for 67 percent in 1950, 56 percent in 1970 and 49 percent in 1990.[21] However, employment in fishing and aquaculture has accounted for an increasing share of the employment in the agricultural sector[22] as a whole. In 1970, fishing and aquaculture accounted for 1.5

percent of those employed in the agricultural sector. In 1990, the 28.6 million people who found employment in capture fisheries and aquaculture accounted for about 2.3 percent of all of those earning a living in the agricultural sector.

In many parts of the world, fishing is a seasonal or part-time occupation, peaking in the months of the year when coastal and offshore resources are more abundant or available, but leaving time for other activities in seasonal lows. For this reason, when reporting on employment in the fishing industry, FAO distinguishes between full-time and part-time fishers. [23]

In the 20 years from 1970 to 1990, the number of full-time fishers and aquaculturists grew faster than the world's population, and the number of part-time fishers grew even faster (Table 5). As a result, numbering 11.8 million, full-time fishers accounted for 41 percent of all fishers in 1990, down from 51 percent in 1970.

TABLE 5
Number of fishers and aquaculturists in the world

Category of fisher/aquaculturist	**1970**	**1980**	**1990**
	(thousands)		
Full-time fishers	6 108	7 988	11 896
Index	*100*	*131*	*195*
Part-time fishers	3 659	4 784	9 708
Index	*100*	*131*	*268*
Other fishers[1]	2 639	3 792	6 977
Index	*100*	*143*	*264*
Total	**12 406**	**16 564**	**28 511**
Index	***100***	***134***	***230***

[1] Occasional fishers and aquaculturists as well as fishers whose occupation has not been further specified.

It is worth noting that, for all categories of fishers, the increase in numbers was much more rapid during the 1980s than during the 1970s. The reasons for this are not clear. In part, it may simply reflect a view that the oceans were one of the few natural resources that had not yet been fully exploited as a source of food and employment. Therefore, a prime concern in many parts of the world at the time was increased production, not the control of existing fishing capacity. Although the employment data for the period 1990-1995 are incomplete, the data that are available indicate a slower increase in the numbers of fishers. FAO estimates the number of fishers and aquaculturists in 1997 to have been about 30 million.

Closely reflecting the distribution pattern of the world's population, 84 percent of fishers and aquaculturists in 1990 were active in Asia (Figure 23), and the vast majority of them in China. However, India, Indonesia and Viet Nam also reported more than 1 million full-time fishers in 1990.[24]

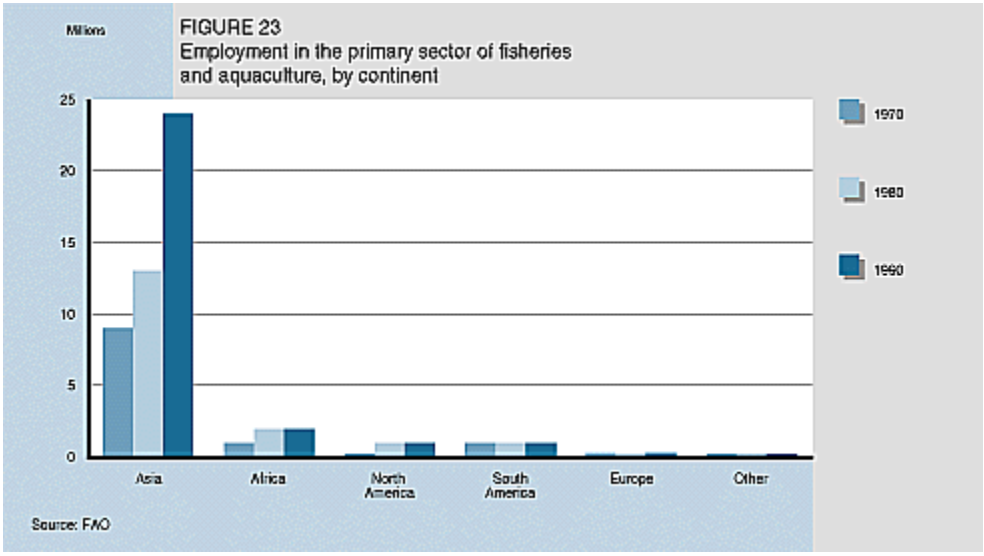


FIGURE 23
Employment in the primary sector of fisheries and aquaculture, by continent

While the number of people employed in fishing and aquaculture has been growing steadily in most low- and middle-income countries, in industrialized economies the numbers of fishers have been declining or are stationary. In Japan and Norway the numbers of fishers were halved between 1970 and 1990.

Although employment cannot be taken as the sole indication of the importance of fisheries to the national economy, it is noteworthy that, in 1990, fishers represented more than 5 percent of the economically active population in the agricultural sector of 38 countries, in 15 of which the percentage was above 10 percent.

Between 1970 and 1990, the number of fishers expanded faster in Asia than anywhere else. In 1970, Asian fishers accounted for 77 percent of the world total; in 1990 they accounted for 83 percent. During the same period in Africa, where artisanal fisheries still dominate, the number of fishers also grew but at a slower rate than in Asia. African fisheries accounted for some 6.5 percent of the world total in 1990. South American fishers accounted for about 3 percent of the world total throughout the period whereas, in Europe, there were more fishers in 1970 than in 1990. In the last year they accounted for only 1.4 percent of the world total. However, the number of European fishers increased in absolute terms between 1980 and 1990 owing to the emerging aquaculture industry. In Oceania, the numbers of commercial fishers are considerably fewer than 1 percent of the world total. On the other hand in the smaller islands they often account for a significant part of the economically active population.

It is also worth noting that the number of part-time fishers has grown more rapidly than the number of full-time fishers for the world as a whole: in 1990, for every ten full-time fishers, there were nine part-time fishers. Twenty years earlier, the relationship had been six part-time to ten full-time fishers.

However, this is largely an Asian phenomenon. For the rest of the world, the increase in part-time fishers between 1970 and 1990 was relatively small. The data for Asia support the view that fisheries may indeed have been an occupation of last resort during this period.

The rapid increase in the number of fishers in Asia, together with the growing proportion of part-time workers, also explains to some extent why the average productivity per fisher (all categories) in terms of total production volume declined from just above 2 tonnes per year in 1970 to less than 2 tonnes in 1990 (Table 6).

TABLE 6
Average fish production per person employed in fisheries and aquaculture

Continent	**1970**	**1980**	**1990**
	(tonnes per year)		
Africa	2.71	2.72	2.76
Asia	2.23	2.28	1.90
North America	11.59	12.69	11.35
Latin America	28.47	15.19	18.40
Europe	26.61	33.59	29.35
Oceania	4.42	1.86	5.20
Global total	**4.97**	**4.36**	**3.47**

It would seem that the global economic growth during the 1970s and the 1980s did not result in the increased productivity of those employed in fisheries and aquaculture. Average physical productivity declined from nearly 5 tonnes per caput per year in 1970 to about 3.5 tonnes in 1990. This relatively large fluctuation is mainly explained by the decline in the average productivity per fisher and aquaculturist in Asia. However, the situation in Asia is complex. The downward trend there is a result of diminishing yields for capture fishers, the growing share of part-time fishers and an expansion of aquaculture production and employment. The diminution for the rest of the world, which has been less pronounced, is largely the result of a drastic drop in the availability and catch of small pelagic species, and hence it affects a relatively small number of fishers.

Among countries in Asia, there are of course wide variations in fishery labour productivity, partly as a consequence of differences in the amount of capital available to each fisher. There are highly industrialized and often capital-intensive fisheries in the region, particularly in Japan and the Republic of Korea, resulting in a high tonnage per

person employed. There are also fisheries that produce less than 1 tonne per fisher per year.

Among the continents, Europe shows the highest productivity, recording a higher rate than Japan in volume terms. However, there are also noticeable differences across Europe. For instance, in 1995 each of Iceland's 5 000 fishers produced an average of 280 tonnes of fish, whereas an annual rate of 6 tonnes or less per fisher is true for the fishers of all Mediterranean countries other than France and Italy.[25] Part of this difference is explained by the importance of high-volume, low-value fisheries for small pelagics that provide raw material for fishmeal industries in Iceland.

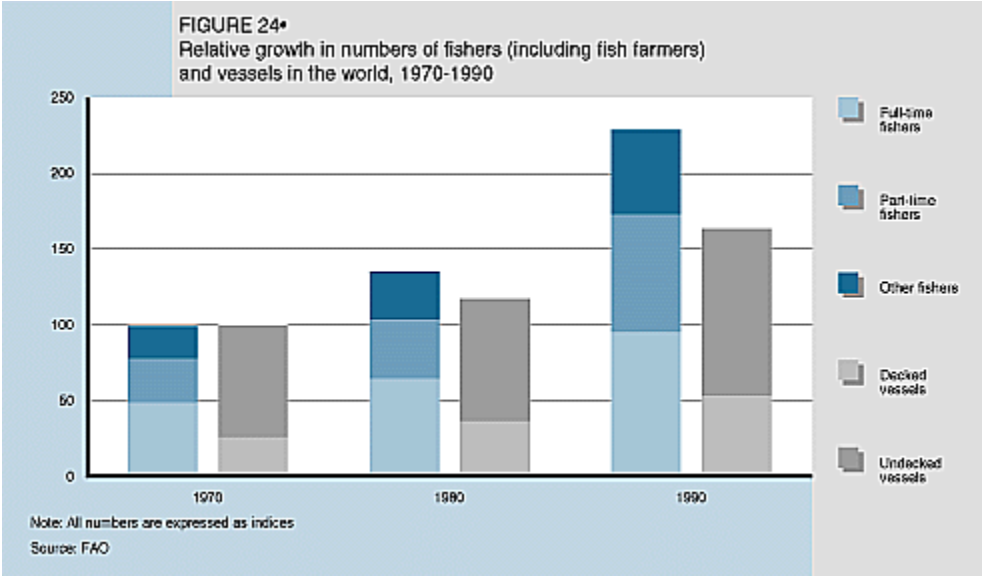
THE WORLD FISHING FLEET

In 1995 the world fishing fleet numbered about 3.8 million vessels. About one-third of these were decked[26] vessels, the remaining two-thirds were undecked vessels, generally less than 10 m in length. While almost all decked vessels are motorized, only about one undecked vessel in three is equipped with an engine.

Most of the world's fishing vessels are operating in Asia. The proportion of non-motorized vessels is higher in Africa (about 80 percent) than in any other continent, while Europe has the highest proportion of decked vessels (about 70 percent in 1995). In the Asian fleet, slightly fewer than 40 percent are reported to be decked vessels.

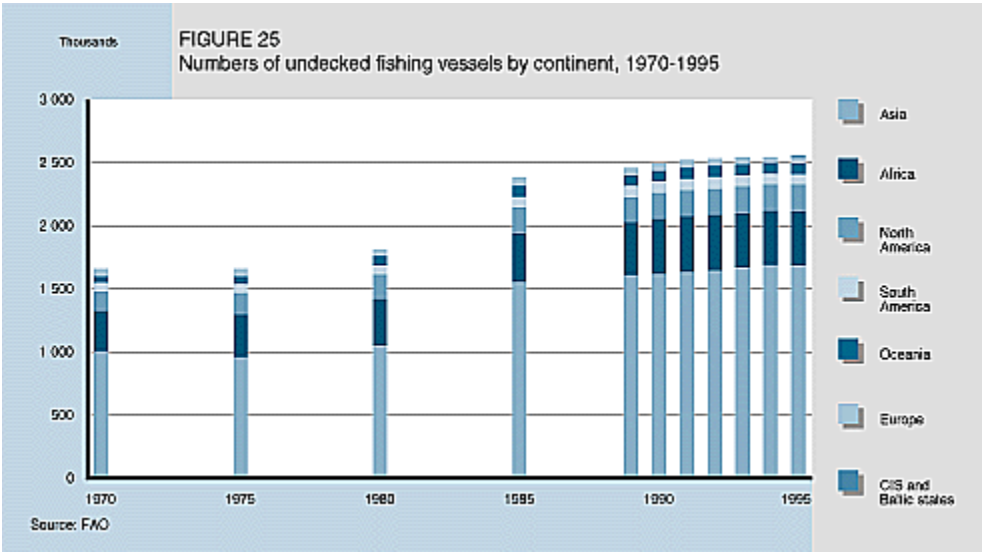
The average size of decked vessels in 1995 was about 20 GT. Those larger than 100 GT (or longer than 24 m) amounted to about 37 000 or just about 1 percent of the world fishing fleet. China has approximately 40 percent (15 000) of these vessels, while no other country has more than 10 percent of this fleet and about 20 countries together account for 50 percent of the total.

The world fleet is not likely to have grown as fast as the number of fishers (Figure 24), although this cannot be established with certainty because the various employment categories used for reporting statistics include both capture fishers and aquaculturists. Nevertheless, there has been an upgrading of the fleet inasmuch as the proportion of decked vessels increased from about one in four in 1970 to about one in three in 1990.



Undecked fishing vessels

The number of undecked vessels increased in the 1980s, mainly as a result of higher numbers in Asia. However, this increase was followed by a levelling off (Figure 25) during the first part of the 1990s.



The vast majority of undecked fishing craft in Asia and Africa are not powered by engines (Figure 26). Given that decked craft are relatively few in Africa, the typical African fishing vessel is undecked and non-motorized. In Asia, the typical vessel is different, as the proportion of decked fishing craft is comparatively high.

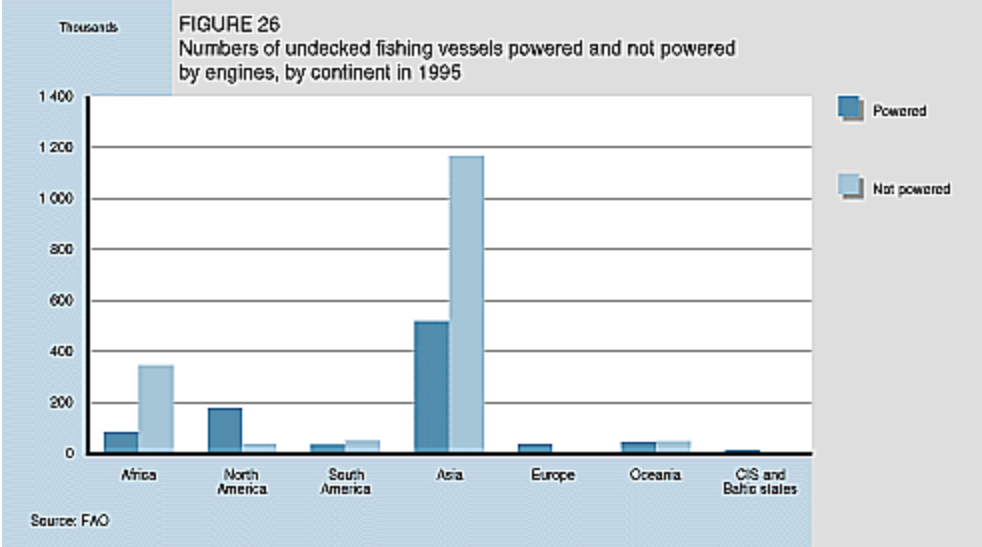


FIGURE 26
Numbers of undecked fishing vessels powered and not powered by engines, by continent in 1995

Decked fishing vessels

Following two decades of rapid growth, particularly in Asia (Figure 15), growth in the number of decked fishing vessels has been slow since 1990. In fact, had it not been for the increase in the fleet of decked fishing vessels in China (Figure 16), the number of decked fishing vessels in the world fleet would have remained stable between 1980 and 1995.

Instead, there is some evidence of an increase in terms of average tonnage of vessels since 1990 (Figure 27), although it is not certain whether this increase is real. It may be the result of reporting vessel size in GT instead of GRT. This change in the system of measuring vessel size inflates the tonnage estimate, as the resulting numeric estimate of size almost invariably is higher when stated in GT. Therefore, the increase in tonnage of the fleet resulting from this reclassifiction of vessels does not necessarily reflect an increase in the fishing capacity of the same fleet (see Box 3).

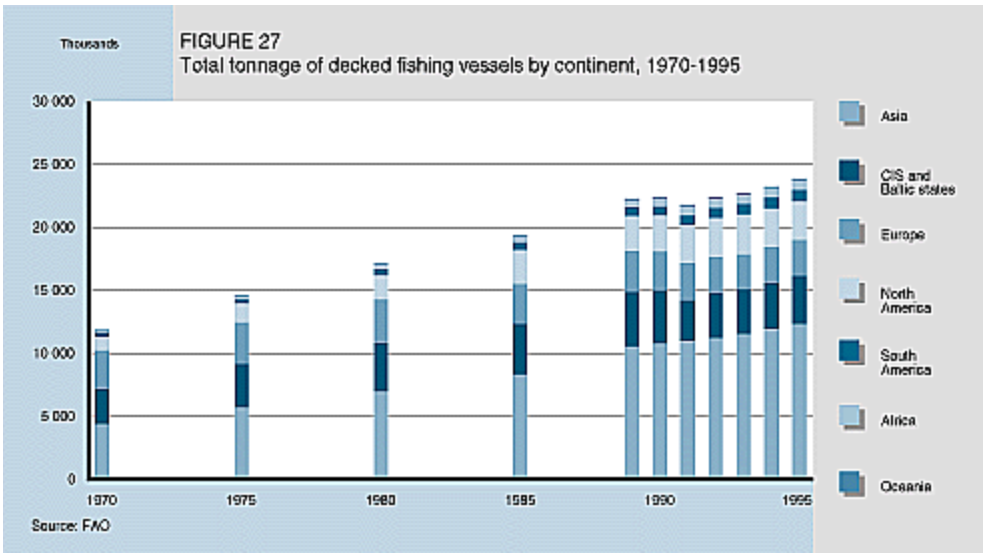


FIGURE 27
Total tonnage of decked fishing vessels by continent, 1970-1995

In line with the Chinese policy to develop offshore and distant-water fisheries, the average tonnage of decked Chinese vessels has increased. In fact, the proportion of Chinese vessels of more than 24 m in length increased from about 1.5 percent in the late 1980s to about 3 percent in 1996, which is three times the world average. China's fishing fleet, totalling about 6 million GT (in 1996), is now by far the largest in the world. It is followed by the fleet of the Russian Federation, with a tonnage of about 3 million GT.

Gillnetters and vessels fishing with lines account for a considerable proportion of the world fleet of decked vessels (Figure 28). Trawlers tend to be larger and more powerful vessels and they dominate in terms of tonnage, accounting for about 40 percent of the GT of the fleet (Figure 29).

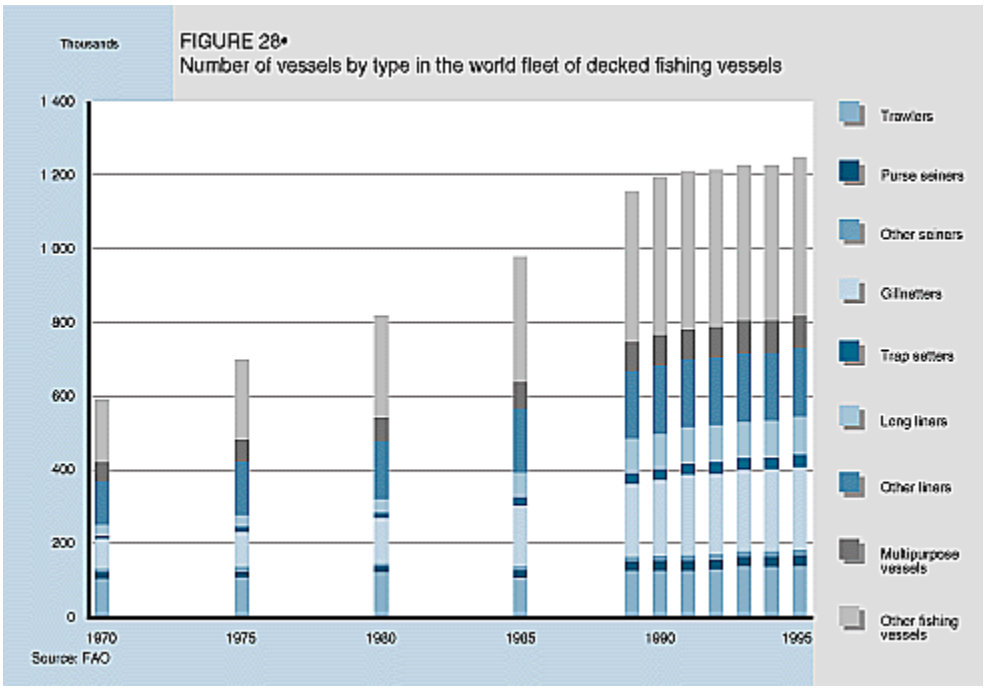


FIGURE 28•
Number of vessels by type in the world fleet of decked fishing vessels

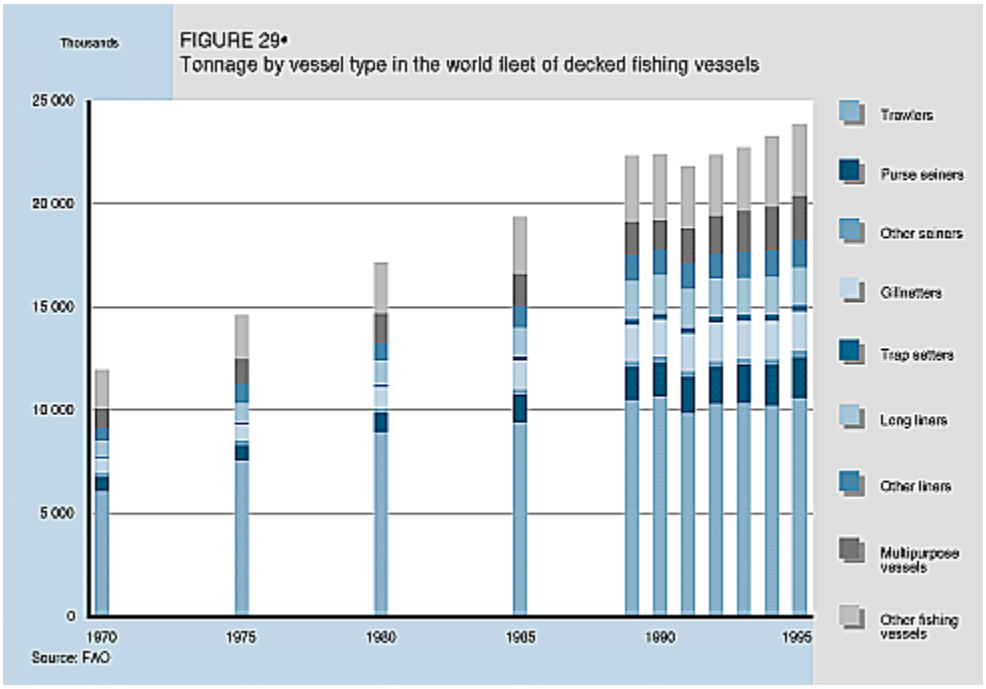


FIGURE 29•
Tonnage by vessel type in the world fleet of decked fishing vessels

DECKED FISHING VESSELS ABOVE 100 GRT

The global fleet

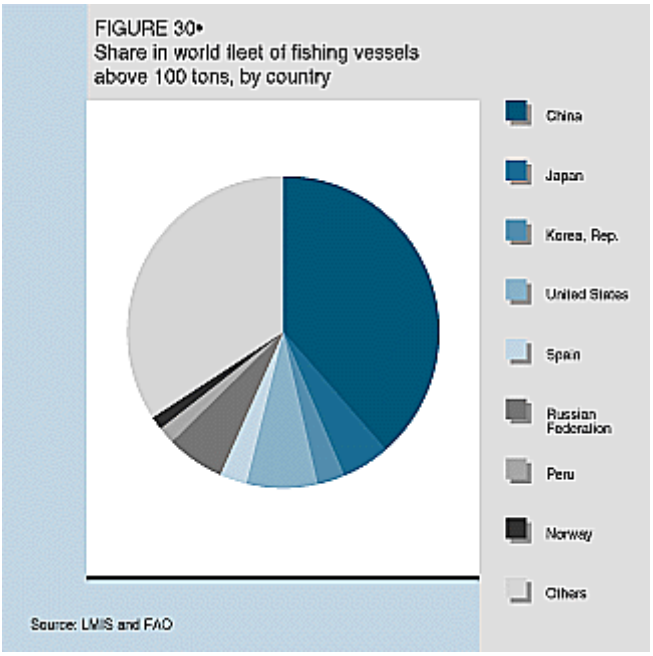
Vessels of 100 GRT or more are approximately equivalent to vessels of 24 m or more in length. They are generally capable of fishing on the high seas but it is estimated that at least half of this fleet never does so. Detailed information on individual vessels in this category is maintained by Lloyd's Maritime Information Services (LMIS), which obtains data under exclusive licence from Lloyd's Register of Shipping.

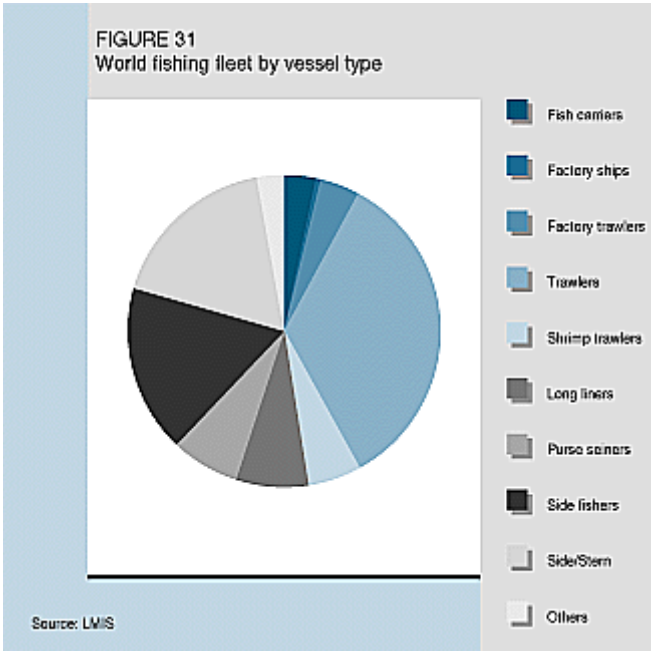
In 1997, fishing vessels in Lloyd's Register of Shipping numbered 22 668. However, LMIS databases contain virtually no information on vessels registered in China, the Democratic People's Republic of Korea or Taiwan Province of China. For the remaining countries, they record about 80 percent of the number of vessels reported to FAO by member countries.

Mainland China reported 15 000 vessels in this category in 1996. Thus, the fishing vessels in this category are likely to have numbered between 43 000 and 45 000 in 1997.

The fleet reported in Lloyd's Register

Eight states had 500 or more fishing vessels constituting 65 percent of the fleet. The remaining 35 percent of the fleet was shared by 164 other flag states (Figure 30) in 1997. More than half were trawlers of various types, about 10 percent were seiners and the rest were line and trap fishing vessels (Figure 31).





The conventional wisdom is that the average tonnage and horsepower (HP) of the world fleet of large vessels are increasing. However, an analysis of the fleet of vessels above 100 tons by their date of construction does not support this hypothesis (Figures 32 and 33). In fact, the average tonnage of vessels built during the last three years has been below the 30-year average (621 GRT). In terms of horsepower, the last three-year average is 1 265 HP compared with the 30-year average of 1 151 HP, a mere 9 percent increase.

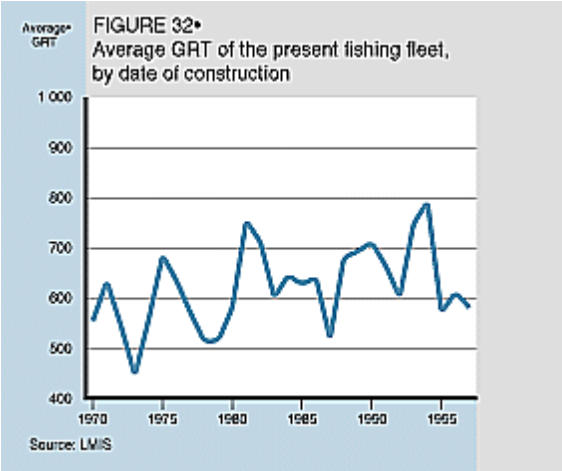


FIGURE 32
Average GRT of the present fishing fleet, by date of construction

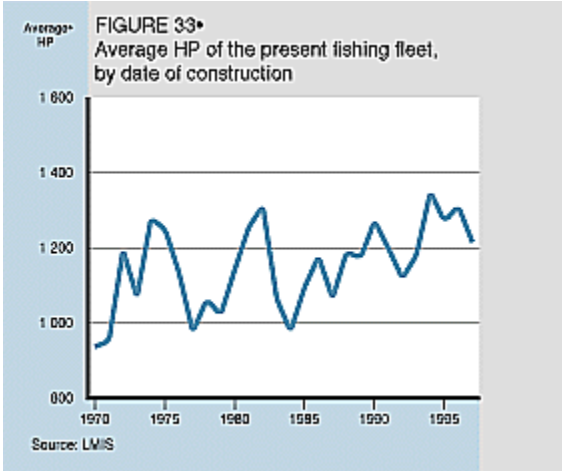


FIGURE 33
Average HP of the present fishing fleet, by date of construction

The world fleet of vessels of 100 GRT or more, as recorded by LMIS, grew until 1991 and has declined since then (Figure 34). This is probably representative of the world industrial fishing fleet, with the notable exception of China whose fleet has grown steadily during the same period.

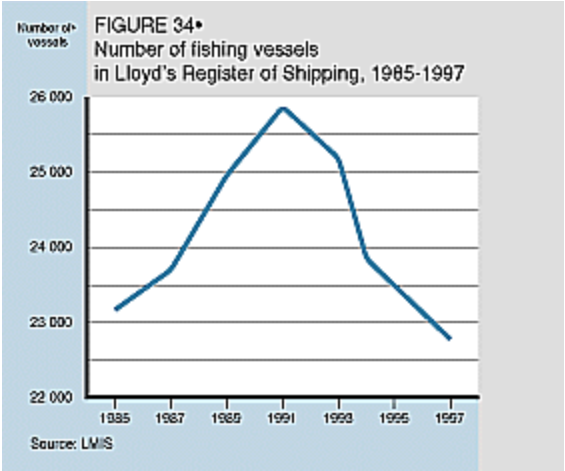


FIGURE 34
Number of fishing vessels in Lloyd's Register of Shipping, 1985-1997

The overall decline has been brought about by a slowdown in construction as well as by the ageing of the fleet, which results in a growing number of vessels being denied certificates of seaworthiness and consequently having to cease fishing activities.

Construction. As reported in Part 1, Numbers of fishers and fishing vessels, LMIS databases indicate a long-term slowdown in the building rate for vessels of more than 100 GRT. Only 155 vessels were reported to have been built in 1997, although this is a provisional estimate and the final number is likely to be nearer to 200.

With respect to new fishing vessels, more than 50 percent of the 155 constructions in 1997 were reported from four countries - Japan (28), Spain (23), Peru (20) and Chile (10). It is worth noting that Japan and Spain both reduced their fleets during this period, reflecting active restructuring policies that include the replacement of their existing fleets. The new vessels built for Peru and Chile were mainly purse seiners built to replace a rapidly ageing fleet. Purse seiners, beam trawlers and shrimp trawlers formed a disproportionately high percentage of the new constructions relative to their numbers in the existing fleet, which would indicate that the fisheries using these vessel types are expected to remain - or become - more financially viable than other fisheries.

Decommissioning and losses. As a rough estimate, vessels removed from Lloyd's Register of Shipping before they are 20 years old are likely to have been lost at sea, whereas vessels older than 20 years have probably been scrapped if they are no longer listed. Figure 35 shows that vessels tend to be removed from the database owing to scrapping at just under 30 years, although there are about 1 266 vessels in the register that were built before 1960. A large part of these have wooden hulls, which are easier to keep up to safety standards than steel hulls of older vessels. Vessels removed from the register - whether lost at sea or scrapped - amount to more than 5 percent of the vessels in the total fleet.

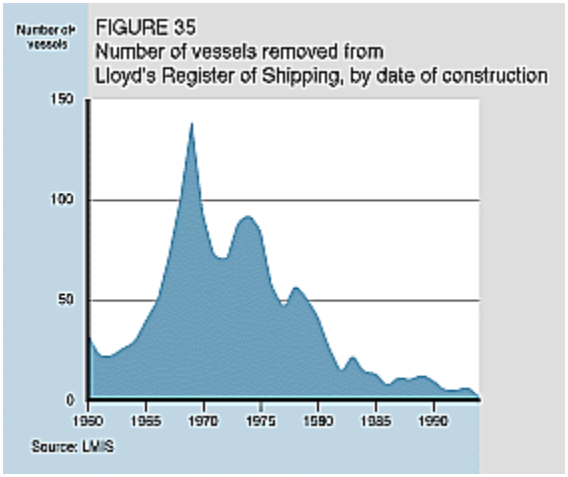


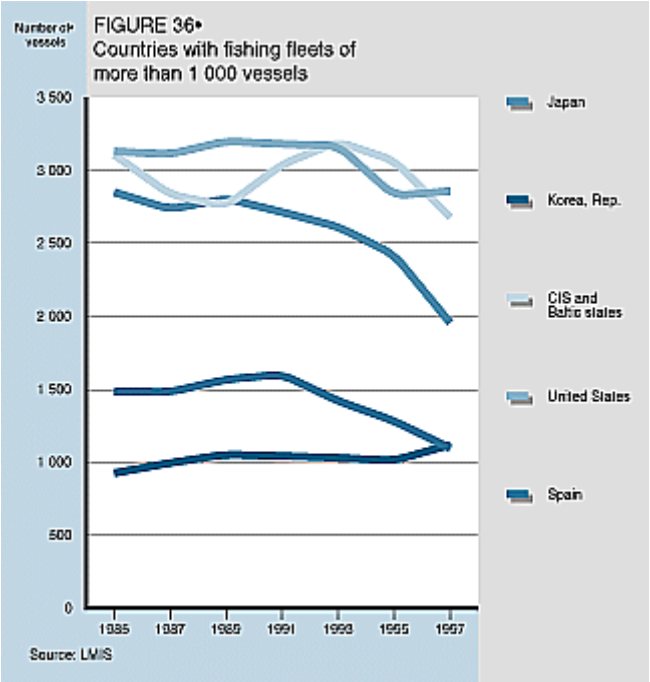
FIGURE 35
Number of vessels removed from Lloyd's Register of Shipping, by date of construction

This suggests that, in order to take losses into account, the overall expected life cycle of a vessel has been about 20 years. Countries aiming to maintain stable fleets in terms of numbers will need to replace, on the average, 5 percent of their fleet every year.

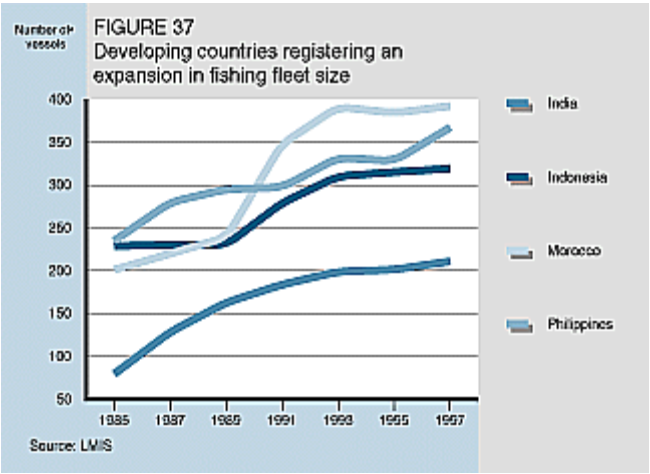
CHANGES IN THE FLEETS OF MAJOR FISHING COUNTRIES

In 1997 there were four countries with more than 1 000 vessels reported in Lloyd's Register: Japan, the Republic of Korea, Spain and the United States. The countries of the CIS and the Baltic states, when taken together,[27] also fall into this category (Figure 36). The increase in the Republic of Korea's fleet since 1994 is believed to be due to vessels

that were previously flagged under open registers being reflagged under their national flag.



Contrary to the development of these five fleets, those of some major fish producers among the developing countries have been expanding. This is true for several countries in Latin America, for India, Indonesia, Morocco and the Philippines (Figure 37). In many cases, a substantial part of the buildup has been due to older vessels being bought from developed countries.



Several European countries had fleets of between 100 and 600 vessels above 100 GRT in 1997. In many cases, these European fleets have shown a substantial decrease as a result of the EC's decommissioning policies (Figure 38). The United Kingdom's fleet was also augmented by vessels owned in Spain and the Netherlands being reflagged to the United Kingdom as part of the so-called "quota hopping" exercise.

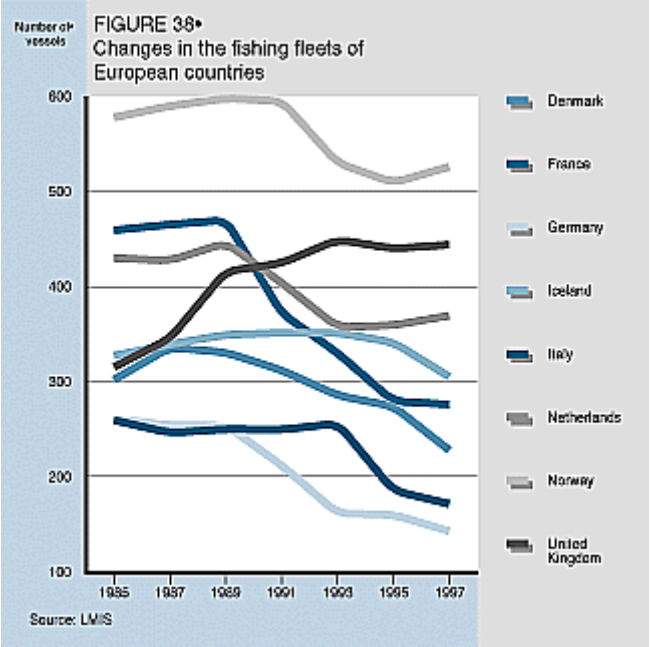


FIGURE 38•
Changes in the fishing fleets of European countries

The fleets of the main Latin American fishing countries continued to increase, with Mexico being the main exception (Figure 39).

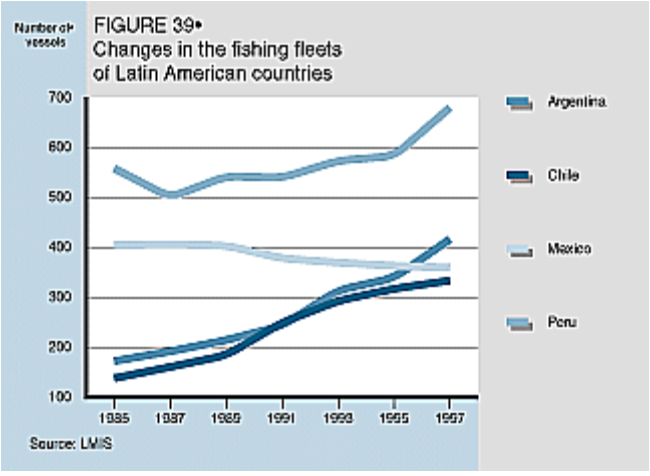


FIGURE 39•
Changes in the fishing fleets of Latin American countries

The number of vessels flagged under open registers or "flags of convenience" has continued to increase, albeit at a slower rate than in the early 1990s. Although the number of fishing vessels registered in Panama and Honduras has decreased, there has been a continued increase in registrations in Belize (158 in 1997), Cyprus (32), St Vincent and the Grenadines (139) and Vanuatu (35). Of the fishing vessels built in 1997, only three were entered in an open register.

Possible developments in the world fleet of vessels above 100 GRT

The future size of the world fishing fleet of vessels above 100 GRT will be determined by the rates of decommissioning, losses and construction of new vessels.

Decommissioning and losses. Figure 40 shows the age structure of the present fleet of fishing vessels above 100 GRT in Lloyd's Register of Shipping. Thus, in 1997, the databases recorded 11 675 vessels that were more than 20 years old, most of which can be expected to be scrapped in the next ten years, while a smaller number will be lost at sea (about 200 per year).

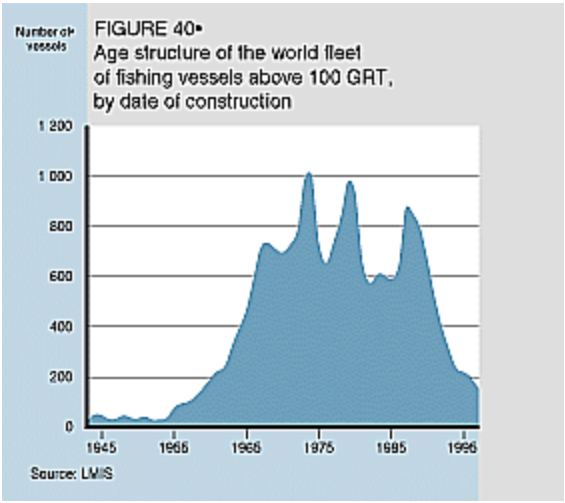
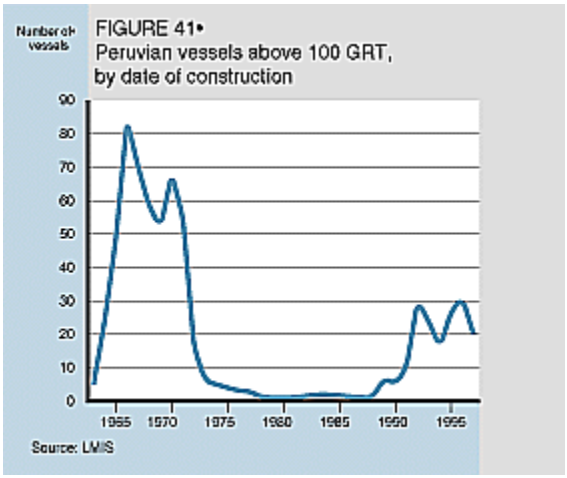
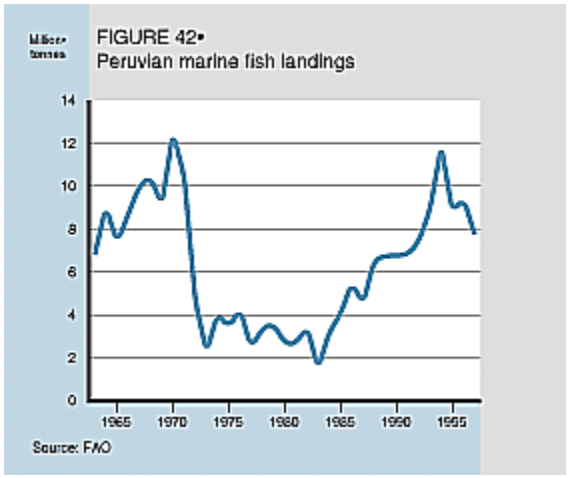


FIGURE 40
Age structure of the world fleet of fishing vessels above 100 GRT, by date of construction

Construction. It is more difficult to estimate future rates of construction. There will of course be a tendency to replace old ships, which will be strengthened or weakened depending on the investors' view of the state and prospects of the fishery concerned. The history of the Peruvian fleet illustrates this situation, with the peaks in additions to this fleet (Figure 41) clearly being linked to the availability of fish stocks (Figure 42), especially anchoveta, and the need to replace a rapidly ageing fleet over the last few years.





The future

Will large vessels be replaced with other large vessels? Are large vessels in fact needed, or are those used for fishing at present simply a legacy of the pre-UNCLOS era? Certainly, in the foreseeable future, high seas tuna fishing will be conducted from vessels of 100 GT or more. Likewise, in the case of fisheries stocking small pelagics, fishing activities conducted inside the EEZs will be carried out using large vessels. Fisheries that are situated far from processing facilities will also need very large vessels.

On the other hand, some of the fisheries off the coasts of Africa that are currently exploited as part of distant-water fishing activities could also be fished from Africa itself, thereby allowing the use of smaller vessels. In some parts of West Africa, however, the absence of port facilities, including shore infrastructure for servicing fishing vessels, is a constraint to the introduction of semi-industrial fleets (comprising vessels of about 100 GRT or a little smaller). Since the construction of port facilities and associated infrastructure is a drawn-out process, it is probable that relatively large vessels (i.e. above 100 GRT) will continue to be in use for some time.

In many fisheries - particulary in those of developing countries - the cost involved in replacing old vessels is such that there will be a tendency either to use smaller vessels or to continue to buy second-hand larger vessels. However, given the disappearance of wood as a building material for the hulls of these larger vessels, together with the annual loss of at least 1 800 to 2 000 steel-hulled vessels by scrapping,[28] the supply of second-hand vessels of 100 GRT or more will be small.

An extrapolation of all the present trends (decomissioning, losses and construction) to the present fleet of between 43 000 and 45 000 vessels suggests that, in ten years' time, the world fleet of fishing vessels above 100 GRT will number about 27 000 craft. That implies a reduction of about 40 percent, which is unlikely to eventuate. In reality, the number will most probably drop to somewhere between 27 000 and the present level.

[1] Main contributor: J.M. Kapetsky, FAO Fisheries Department.
[2] FAO. 1998. Geography and constraints on inland fishery enhancements. By J.M. Kapetsky. *In* T. Petr, ed. *Inland fishery enhancements*, p. 37-64. FAO Fisheries Technical Paper No. 374. Rome.
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[14] P. Hickley and H. Tompkins, eds. 1998. *Recreational fisheries. Social, economic and management aspects*, Table 1.1, chap. 1. Oxford, UK, Fishing News Books. 310 pp.
[15] *BRIEFS*, 26(5): 5 (Newsletter of the American Institute of Fishery Research Biologists).
[16] Only about 100 fish species or species groups are listed in FAO statistics on inland capture. Therefore, most species are not identified in FAO production statistics and about 45 percent of the inland catch is reported as unspecified freshwater fish, 7 percent as unspecified freshwater molluscs and 6 percent as unspecified crustaceans.
[17] FAO/World Bank Cooperative Programme in collaboration with the Fisheries Department. 1998. *Fisheries and aquatic biodiversity management in the Amazon. Desk Study*. Report No. 98/055 CP-RLC. 2 September 1998. 55 pp.
[18] Coates, op. cit., footnote 13.

[19] B. Born. *An overview of inland fishery enhancements from a global perspective*. FAO. (in preparation)
[20] Main contributors: A. Crispoldi, R. Grainger and A. Smith, FAO Fisheries Department.
[21] *Source:* ILO. Economically active population, 1950-2010, 4th ed., December 1996. (on diskette)
[22] The agricultural sector is referred to here in the broad sense, i.e. including fisheries and forestry.
[23] Those deriving at least 90 percent of their income from fishing or aquaculture are classed as full-time fishers, whereas those deriving between 30 and 89 percent of their income from fishing or aquaculture are classed as part-time fishers. Readers should be aware that the data provided to FAO often do not meet the required specifications. Overall, trends appear to be more reliable than the absolute data.
[24] For details see FAO. 1997. *Numbers of fishers.* FAO Fisheries Circular No. 929. Rome.
[25] FAO. 1997. *Les pêches en Méditerranée: éléments d'information sur le contexte halieutique et les enjeux économiques de leur aménagement.* By C. Breuil. FAO Fisheries Circular No. 927. Rome.
[26] A decked vessel is one with a fixed structural deck covering the entire hull above the deepest operating waterline.
[27] Data are aggregated in order to permit comparisons with the situation in the 1980s.
[28] This calculation is based on an extrapolation from the fleet reported in Lloyd's Register of Shipping to the fleet as a whole.

PART 4
Outlook: expected trends in supply and demand

OVERVIEW[1]

SHORT-TERM OUTLOOK

The slowdown in the growth of fish supplies that started in 1997-1998 is likely to continue for a few years. The main reasons for this are the stable or decreased landings from marine capture fisheries and a slower rate of growth in aquaculture production than that recorded for the early 1990s. The negative impact of El Niño on capture fish production was already evident in 1997. In 1998, landings are likely to have declined even further, and production is expected to take some time to recover. Supplies - particularly those from aquaculture - will be affected by a drop in demand over the next two to four years, particularly in Japan and in other Asian economies. The production of high-value aquaculture products will stagnate, as will international trade in those products.

MEDIUM-TERM OUTLOOK

The State of World Fisheries and Agriculture 1996 predicted increasing real prices for fish[2] over the next 15 years. This projection was based on exploratory calculations of supply and demand for fish in the year 2010, using data from 1992.

A review of these projections in 1998 shows that the pressure for increased real prices for fish in the coming decade is decreasing. It seems clear that demand will not grow as rapidly as foreseen in mid-1995, while supply has been increasing more rapidly than expected and, after a few years of relative stagnation, may resume growth in the early years of 2000-2010. The slowdown in demand is due to a slower population growth rate than that predicted, projections of slower economic growth and, possibly, the increased competitiveness of poultry and pork.

Supply projections for fish have improved mainly on the strength of the continued and rapid expansion of aquaculture production but also because improved capture fisheries management means there is less likely to be a decline in capture fisheries production.

GLOBAL FOOD SUPPLIES AND FISH

The growth rate of world agricultural production is slowing down. From an anuual rate of about 3 percent in the 1960s, it dropped to about 1.6 percent during the decade 1986-1995 (mainly because of the drastic production decline in countries formerly comprising the USSR) and is expected to be in the order of 1.8 percent for the period 1990-2010. Furthermore, since the 1950s, the average real price of agricultural products has declined globally.

A different situation is true for the fisheries sector, as both production and real prices have increased over the past three decades. Production increased at a compound rate of 3.4 percent per year in the period 1960-1990, and this growth rate has been maintained over the past decade. During the last 15 years, this growth has essentially been a result of the rapid increase in aquaculture output, which recorded an annual increase of 11.8 percent in the period 1984-1996. Although information on prices is weak, indications are that prices have increased somewhat in real terms. This has occurred in parallel with a slow increase in per caput supplies, supporting the idea that fish generally falls into the category of preferred food items along with other livestock products, in particular poultry and pork.

Thirty to 40 years ago, developing countries as a group were significant net exporters of food. The situation has since changed and, by early next century, developing countries as a group can be expected to become net importers of food. For the poorest of these countries - most of which are found in sub-Saharan Africa and South Asia - the financing of food imports will be a high priority, and capture fisheries and aquaculture will come under strong pressure to provide exportable products.

DEMAND FOR FISH AND FISHERY PRODUCTS

The future demand for fish will basically be determined by the number of consumers and their eating habits and disposable income as well as by prices of fish.

DISPOSABLE INCOME

The economic and financial crisis that has engulfed Asia and is also being felt in other parts of the world has led to a downward revision of economic growth projections for most Asian countries as well as for a growing number of countries elsewhere. In fact, some of the larger Asian economies are expected to contract over the next two to three years. An unavoidable consequence in the immediate future will be a reduction in the demand for fish in Japan and in emerging Asian economies, and fish exports to the latter will most probably decrease in volume. At the same time, the fisheries sectors of developed Asian economies will face increasingly stiff competition from developing economies whose currencies have undergone devaluations.

In Africa and Latin America, too, consumers will experience stagnation and, in some cases, a decline in their disposable income. This will reduce demand for fish and fishery products. However, the decline will be small in absolute terms, as consumption is relatively modest at present. Consumption in North America is sensitive to economic growth and, even with a degree of growth in disposable income, there may be room for some expansion in the immediate future - at least in quantity terms. European demand will not change much under the predicted slow economic growth scenario.

Projections of demand made by FAO in 1995 for the year 2010 assumed that economic growth would have only a slight influence on the per caput consumption of fish in Africa, Europe, Latin America and Oceania; in Africa because of slow - or zero - per caput growth, and elsewhere because changes in income were not seen to have a major influence on demand. For Asia and North America, the assumptions were different. The average per caput consumption had been projected to grow considerably owing to expected growth in disposable income. By late 1998, there was still no global consensus on when the economic fortunes of Asia would improve. However, for the purpose of developing a supply and demand scenario for the year 2010, it is assumed that growth will resume early in the next decade.

DEMAND

In the first few years of the next century, the demand for fish in Europe and North America is likely to shift downwards as competing livestock products - particularly poultry and pork - become significantly cheaper. This is expected to come about as a consequence of projected modifications to the European Community's (EC) Common Agricultural Policy (CAP). The modifications are aimed, *inter alia*, at reducing grain prices and subsequent livestock production costs. Given that poultry and, in some areas, pork are preferred food products, it seems likely that consumers in Europe and North

America will eat less fish than they would have done in the absence of a modified CAP. This shift in consumer demand will occur gradually after the year 2000.

NUMBERS OF CONSUMERS

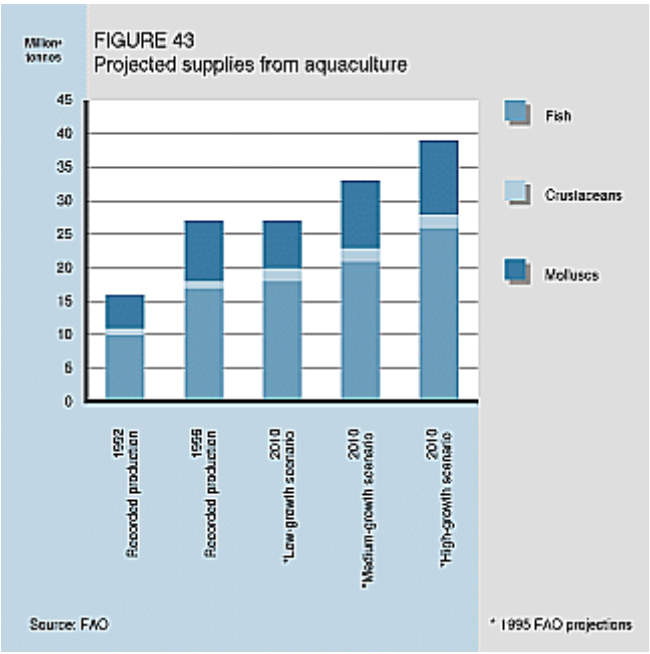
In October 1996, the UN projected that the world's population in the year 2010 would be about 140 million (i.e. 2 percent) less than it had predicted two years earlier. This downward revision is the consequence of lower population growth rates, particularly for Asia which accounts for a reduction of about 100 million in the revised projections. In brief, the effect of a slower population growth in the *short term* will be a decline in demand for high-priced aquatic products, although some of this demand may be shifted to lower-priced fish products.

It also seems prudent to revise downwards the *medium-term* projections of world demand for food fish. Based on a scenario of modest reductions in the per caput demand in Europe (down by 6 percent compared with 1995), North America (-4 percent) and Asia (-8 percent), and incorporating the effect of a smaller population, the demand for food fish in 2010 may be 105 million to 110 million tonnes (live weight equivalent), whereas FAO's 1995 prediction was 110 million to 120 million tonnes.

SUPPLY OF FISH AND FISHERY PRODUCTS

AQUACULTURE

The supply of cultured finfish, crustaceans and molluscs has continued to expand rapidly, and growth has been much faster than was envisaged only a few years ago (Figure 43). Asia continues to dominate production, with its growing share in total world output reaching 55 percent (in volume terms) in 1996, up from 51 percent in 1994. Within Asia, China is by far the largest producer; in volume terms, its finfish production accounted for a major share of the world total. Almost all of China's production is for domestic consumption, however. In terms of export revenue, the culture of penaeid shrimps is the most important aquaculture activity in Asia, with shrimps accounting for 26 percent of the value of the region's fish exports in 1996.[3]



Chinese aquaculture production started to increase rapidly in the mid-1980s in response to very precise policy measures intended to stimulate production. Households were given the authority to manage their own aquaculture activities, prices for high-value aquaculture species were freed and the government supported farmers through research and extension. It is generally believed that production will continue to increase, although in some parts of the country it will change in nature as farmers attempt to generate more value-added products from their plants - possibly by selecting more expensive species. In the northern and inner parts of China, production will probably increase mainly through the expansion of carp culture.

There are several reasons why Chinese aquaculture should be able to withstand the present slowdown in the world economy. First, since consumption is predominantly domestic, exports play a relatively small role and hence the sector is little affected by world market forces. Furthermore, consumption patterns observed during the recent period of economic growth indicate that fish (and livestock) products are strongly preferred food items. Technologically, Chinese aquaculture activities are self-reliant and use few imported inputs. Although the country has become a major importer of fishmeal, a share of which is used in aquaculture, access to imported fishmeal is not likely to be an obstacle for the bulk of Chinese aquaculture in the medium term. It is most likely, therefore, that Chinese aquaculture production will continue to grow in volume and that the culture of higher-priced marine products will also develop.

Carp

Culture provides more than 90 percent of the world's carp supplies and carp account for about 14 percent of all finfish produced by both culture and capture fisheries. China

produces more than four-fifths of this amount. In China, as is the case elsewhere, carp is consumed locally. With a few exceptions, producers of Chinese and major Indian carps have been unable to find markets outside Asia. In fact, carps as a group are not traded globally to the same extent as shrimps and salmon.

Carp culture in China, but also in India and countries of the CIS, will probably continue to increase steadily - at least in the near future - in response to population growth. In the long term, a substantial increase in the culture of Chinese and major Indian carps will depend on the development of carp products for which there is a demand in world markets.

Tilapia

Among the finfish produced in aquaculture, tilapias seem to be assured a future owing to their specific production characteristics. First, there are several different culture technologies available for these species, some of which permit farmers to produce tilapia at a relatively low cost. Second, the flesh of tilapia is generally white and can be used to produce white fish fillets, one of the basic products in the international fish trade. Third, tilapia has spread outside Africa and is common in Asia, Latin America and the Caribbean.

Tilapia has an established and rapidly expanding market in the United States and is also being sold in Japan and in European countries. World cultured production has risen steadily (at an average annual rate of 12 percent[4]) for the past 12 years (Figure 44). The expansion of tilapia production can be expected to continue for the following reasons:

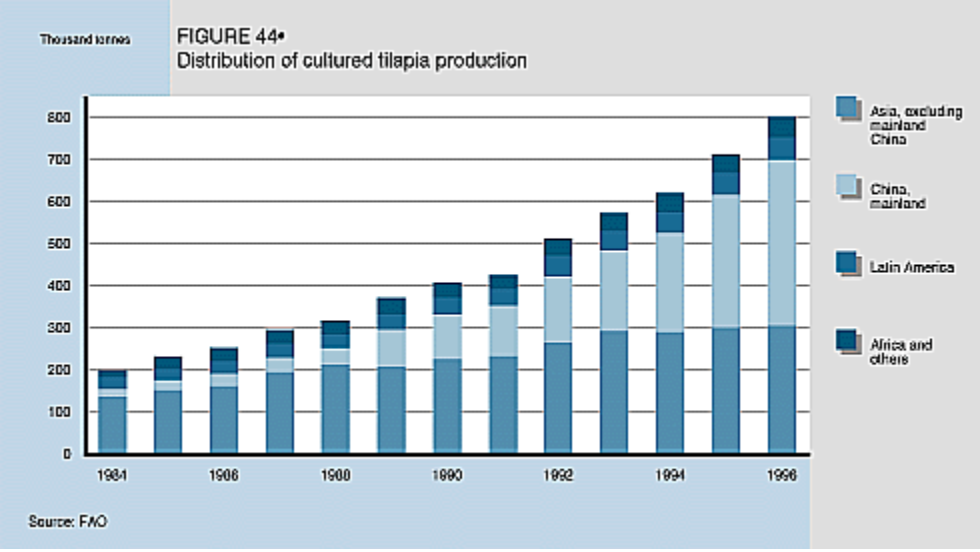


FIGURE 44•
Distribution of cultured tilapia production

- tilapia can be produced by most developing countries with tropical or semi-tropical climates, without reliance on imported inputs;

- several developing country producers have become more competitive in the course of 1998 as their currencies have lost value relative to those of Japan, the United States and European countries - a development that is not likely to be reversed in the coming decade;
- tilapia has the most potential to replace marine fish in some white fish products;
- as long as precautions are taken to preserve biological diversity where possible, there need not be significant environmental externalities or costs associated with the culture of tilapia;
- tilapia species can be farmed in various aquatic environments using a number of different technologies;
- selective breeding is already showing positive results.

These arguments apply not only to the present major tilapia producers in Asia but also to prospective producers in Africa, where production may expand rapidly if conducive macroeconomic environments prevail. Furthermore, both developed and developing economies will provide markets for tilapia and its products. In 1996, tilapia accounted for about 5 percent of all cultured finfish; this share is very likely to increase significantly over the next ten years.

Salmonids

The culture of salmon and trout is mostly carried out in Europe and in the Americas. The volume of cultured salmons and trout is now catching up with landings of these fish in capture fisheries, although the rate of expansion in farmed production is slowing down. The industry is advanced, both technologically and commercially, and in many countries is making systematic efforts to open new markets and stimulate further demand in existing ones. Production costs are likely to be further reduced and the industry is also likely to develop different products for new markets. Consequently, there is likely to be a continued expansion of production.

Shrimps

Shrimps are an important source of income and hard currency in many developing economies; they are less significant as a source of food. The total volume of cultured penaeid shrimps is now close to half that produced by capture fishers. In volume terms, the increase in production is tapering off in Asia and Latin America, while production in Africa - although still small - is expanding fast.

There are, however, reasons to believe that growth in the immediate future will slow down significantly and might even come to a halt. The main reason is the short-term prospect of no economic growth occurring in Japan, the world's largest market for shrimps, as well as the slow economic growth expected in the other developed economies. In addition, management of shrimp culture is not at a uniformly high level. Production from areas that have recovered from disease is invariably offset by losses resulting from disease problems affecting other areas - a pattern that is not likely to change for some time. Furthermore, the emergence of stringent environmental regulations

will slow down the expansion of shrimp culture, although production should recover and output should start to expand significantly early in the period 2000-2010.

Molluscs

Mollusc culture is almost always destined for sale, and culture for household needs is very rare. A large part of molluscs are sold to markets located near to the place of production. However, some producers such as Canada, New Zealand and Spain depend on international markets, and international trade in mollusc products is in fact growing. Nevertheless, for mollusc culture - as is also true for carp culture - the economic conditions within the producer country are an important factor. On the whole, it seems that mollusc culture in Asia will not be affected much by the present economic downturn and will continue as a source of growth in aquaculture production.

Conclusion

In the *near future,* the present economic crisis will probably curb the rate of growth in aquaculture worldwide. This is in line with already established trends - excluding those relating to China. Asian production will grow moderately for products consumed in internal markets, which absorb the bulk of the output volume. The projected stagnation - and even decline - of certain aquaculture products that are traditionally exported to developed economies will effect the value of global aquaculture production much more than its volume.

Judging from the situation at the end of 1998, aquaculture seems more than likely to show sustained growth in the *medium term.* In the light of previous studies[5] and recent trends, it seems quite probable that total world aquaculture production will have reached between 35 million and 40 million tonnes of finfish, crustaceans and molluscs in the year 2010.

CAPTURE FISHERIES

Global capture fisheries production in 1996 was slightly greater (+1.6 million tonnes) than in 1995. The preliminary estimates for 1997 are for a contraction of about 0.9 million tonnes (Table 1), mainly owing to the decline in stocks of small pelagic species off the west coast of South America (see Box 15, El Niño: the consequences for fisheries). Between 3 and 5 percent of the reduction in global landings by marine capture fishers can be attributed to the El Niño phenomenon.

BOX 15
El Niño: the consequences for fisheries

The El Niño phenomenon of 1997-1998 is considered to be the second

strongest "warm event" in the tropical and subtropical Pacific Ocean this century. At the time of its maximum strength, it was not as strong as the 1982-1983 event, but it lasted a little longer and had two peaks of maximum warming - one almost immediately after its onset, during May-September 1997, and another in January-April 1998. It was preceded by a cold episode in the Eastern Pacific, lasting from the end of 1995 to the beginning of 1997. To some extent, this turnaround from a cold to a warm episode might have magnified the negative impacts that this latest El Niño has had on certain fish resources.

From the point of view of fisheries, the Eastern Pacific, and particularly the area off western South America, is the area that is most negatively affected by El Niño warming events, and this case was no exception. Rising coastal sea temperatures and a weakening of the upwelling enrichment process caused a severe decline in biomass and total production of small schooling pelagics and other coastal resources that are otherwise readily available off the western coast of South America. This has caused, and is still causing, large losses to the fisheries sectors in the area and a worldwide shortage of fishmeal and fish oil.

Anchoveta fish stocks have declined to very low levels in Peru and Chile. The main direct causes of this decline are: recruitment failure, with at least two consecutive year classes either missing or being much less abundant; poor somatic growth, with a significant loss in average weight; and a possible increase in fishing and natural mortality. The region's anchoveta populations might take several years to recover. In the same area, important sardine stocks were already declining before the onset of the El Niño phenomenon and, although slightly warmer-than-normal conditions are known to favour sardines in this area, prospects of a recovery are likely to have been offset or even lowered owing to the extreme strength of this warming event.

Total production of horse mackerel has also been much lower in 1997/98 than in previous years. This is probably due to an offshore and poleward displacement of existing concentrations, but an actual decline in the total biomass of horse mackerel as a result of heavy fishing, together with the prevailing environmental conditions, cannot be excluded.

So far, the 1997-1998 El Niño is known to have produced a 10 to 20 percent decline in total production from this area in 1997. This is a significant drop, as the region usually produces nearly 20 percent of total world fish landings. An even larger decline is foreseen for 1998. Catches of other small and medium-sized pelagics, coastal demersals

and other species (including salmon, tuna and some invertebrates) have also been affected throughout the Eastern Pacific, from Canada to Chile. While heavy rain and flooding, caused by El Niño in some areas, have resulted in reduced shrimp culture activities and smaller landings of otherwise abundant and common fish species, catches of other, more tropical, pelagic species (e.g. dolphin fish, tropical sharks and tuna) have increased in the tropical and subtropical Eastern Pacific. This is because stocks experienced a poleward displacement at the onset of El Niño. Both types of effect have retreated or are expected to retreat more rapidly with the phasing out of the event.

In some areas, total production of some wild shrimp stocks and shellfish has also increased as a result of the warmer temperatures. In other regions of the world, minor or less dramatic negative effects of El Niño have been reported, for example coral bleaching in the Indian Ocean and the tropical and Western Pacific. Even though declines in the production of some tropical fish stocks might be compensated by an increase in production in other areas, a possible reduction of 5 to 10 percent in total marine fish capture could be attributed to the 1997-1998 El Niño.

Source: J. Csirke and A. Bakun, FAO Fisheries Department.

However, since most of the reduction will be absorbed by the fishmeal industry, supplies for human consumption are expected to have increased by more than 3 million tonnes in 1997, which means that the average per caput supply (including aquaculture) would have risen to a new maximum of about 16 kg. This peak would not have been reached had it not been for the sharp rise in reported Chinese fish production. The world's capture fishery production has probably contracted further in 1998 owing to the ongoing effects of El Niño.

The expansion of fishing capacity, as measured by number of vessels and fishers, slowed during the first part of the 1990s (see the section Fishers and fishing fleets). The change was most noticeable in Asia, with the exception of China where fishing capacity recorded a sharp increase in the same period. There are several plausible reasons for a slowdown in the buildup of fishing capacity in Asia, the most significant being: employment opportunities generated outside fisheries and agriculture by past economic growth; the general realization that available wild stocks in Asia are being reduced through overfishing; and governments' efforts to provide appropriate management frameworks for capture fisheries (see the section National fisheries governance).

The present economic crisis might possibly lead to fisheries again becoming a source of employment for those without work as well as the logical source of livelihood for young

members of fishing communities. If the economic crisis persists over the coming years, managers and management structures will come under increasing pressure to allow and facilitate an expansion of fishing capacity. It is also possible that, after giving a small initial boost to production, such expansion will result in reduced capture fishery landings for developing economies by 2010.

In the developed economies, fisheries governance should improve, making it easier to maintain stocks at a level that permits the maximum sustainable yield (MSY) to be harvested. Furthermore, better fisheries management (a direct result of improved governance) will be supported by technological developments (Box 16, Telecommunications: benefits for capture fisheries). In some developed economies, cheap fish imports are likely to contribute to a reduction in fishing effort. These imports will originate in developing economies whose currencies are losing value *vis-à-vis* those of OECD countries. However, by 2010, better management should have resulted in economically sounder fisheries and improved catch levels in most developed economies. This may lead to strong pressure from national industries for the application of trade measures to control fish imports. On the other hand, several countries are making a parallel effort to promote freer trade in fish and fishery products (Box 17, Agreements regulating international fish trade).

BOX 16

Telecommunications: benefits for capture fisheries

As is the case for many other industries, progress in telecommunications technology has had, and will continue to have, a radical influence on the fishing industry. When the potential impact of satellite technology on marine communications was realized, the international community's initial response was to set up the International Maritime Satellite Organization (INMARSAT). To begin with, the fishing industry was slow to take advantage of the benefits offered but, in recent years, there has been an exponential increase in the number of fishing vessels fitted with satellite communications systems. According to one service provider, there were 2 000 installations in 1996 and 7 500 in 1998. Following are the main benefits accruing to the fishing industry:

i) Increased safety from the Global Maritime Distress Safety System (GMDSS). Unlike conventional radio communications systems, which are highly dependent on atmospheric conditions, the GMDSS virtually guarantees a response to any vessel distress message regardless of the circumstances. Even after a vessel has sunk, a distress message can still be transmitted via an emergency position-indicating radio beacon (EPIRB), which floats free from the vessel as it sinks.

ii) Better fisheries management through improved monitoring of the position of fishing vessels using vessel monitoring systems (VMS). The periodic reporting of the position of a fishing vessel assists in the MSC of all vessels at a central control point. Future systems are likely to incorporate catch reporting in an electronic format that will allow real-time fisheries management decisions to be made.
iii) Information systems linking fishing vessels and fish markets will allow more informed decisions as to where and when to land fish. This will increase vessels' revenue and will avoid any one fishing port having more landings than it can handle on any particular day.
iv) By using global positioning systems (GPS), which are an integral component in most satellite communication systems, messages can be sent to specific users (e.g. information that is of relevance to a given area is sent only to vessels located in that area). When brought down to the level of individual vessels, when a patrol ship wishes to interrogate a fishing vessel in a particular position, the satellite communications system on that vessel will automatically respond with details of the ship and its fishing authorization. This will avoid what are sometimes dangerous and time-consuming boardings by fisheries inspectors at sea. Similar systems, known as automatic identification systems (AIS), are already in operation in the merchant fleet as part of Traffic Separation Schemes. The use of free-standing GPS is well established in larger vessels, but the introduction of hand-held GPS now means that this important navigational aid will also be available to much smaller vessels.

Source: A. Smith, FAO Fisheries Department.

BOX 17
Agreements regulating international fish trade

Fish and fishery products are the most international of all foodstuffs. Annually, between 35 and 40 percent of fisheries production is traded internationally, reaching a value - as traded - of about US$50 000 million. Developing countries currently account for half of this exchange and, in 1996, derived a net surplus (value of exports minus value of imports) in the order of US$17 000 million.

International rules and regulations play a major role in governing the fish trade, especially for developing economies. Two recent international agreements of particular significance are the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS) and the Agreement on Technical Barriers to Trade (TBT). These agreements were concluded under the Uruguay Round of multilateral trade negotiations (MTNs) and are binding on all members of the WTO.

· *The SPS Agreement* specifies, *inter alia*, when food safety concerns are a valid reason for exceptions to the principle of non-discrimination in international trade. The agreement encourages WTO members to use international standards and, in the area of food safety, refers to the Codex Alimentarius. A country's requirement that internationally traded fish products be produced using the HACCP system must only be enforced in a manner that respects the SPS agreement.
· *The TBT Agreement* sets out rules for technical regulations that are not directly related to health. It is intended to ensure, *inter alia*, that requirements related to quality, labelling, methods of analysis, etc., are applied to internationally traded goods in a manner that does not mislead the consumer or discriminate in favour of domestic producers or between goods of different origin. Thus, the TBT Agreement would apply to a country intending to impose the use of ecolabels on internationally traded fish products.

Discussions have started concerning the possible coverage of future MTNs, which may begin towards the end of 1999. Whether these discussions - which will also concern the WTO Agreement on Agriculture - will include fish and fishery products is not certain. However, to be prepared for such an eventuality, several countries have studied a form of subsidy that is channelled to the fisheries sector. At present, the trade effects of such subsidies can be addressed by WTO under its Agreement on Subsidies and Countervailing Measures, as fish and fishery products are not included in the WTO Agreement on Agriculture.

The generally reduced tariff rates for fishery products under the Uruguay Round have resulted in a reduction of the relative tariff concessions granted by the EC under the Lomé IV Convention to a large number of developing countries. Discussions about if and how the effects of this erosion of benefits may be remedied have begun between the EC and the countries concerned.

Source: E. Ruckes, FAO Fisheries Department.

Diverging trends in inland capture fisheries are evident for the different regions. With regard to food fisheries, the rapid expansion in Asia is likely to continue, while growth in other regions is expected to be slower. In the CIS and the Baltic states, this is because of political and economic difficulties; in Latin America because of a lack of demand; and in Africa because of financial, administrative and logistical difficulties. Recreational fisheries are gaining importance mainly, but not exclusively, in North America and Europe. In most regions, the practice of stock enhancement will continue and probably become more widespread. In all regions, inland fisheries yields are being negatively affected by environmental degradation, with Europe and North America also having experienced significant negative impacts in the past.

In conclusion, by about 2010, there should be a slight increase in capture fisheries production as fisheries in developed economies exploit recovered stocks in a more sustainable manner and make increased use of small pelagics, both for human consumption and reduction to fishmeal. The use of small pelagics should be facilitated by advances in electronic technology and artificial intelligence systems that enable the size and species of fish targets to be identified using echo-sounders and sonars. Such systems, which establish more accurately the probabilities and confidence limits of species, will allow skippers to assess their expected catch, by-catch and discards as well as to estimate the profitability of fishing in a particular area before deploying their fishing gear. Ultimately, this increased efficiency should also reduce wastage.

Thus, for 2010, it is not unreasonable to estimate a modest increase in landings from inland and marine capture fisheries to between 95 million and 100 million tonnes.

During the 1990s about 30 million tonnes of total finfish supplies have been converted annually into fishmeal and fish oil. In 1997/98, reduced supplies were mainly a consequence of difficulties in obtaining the raw material. The present downturn in the world economy will reduce growth of the livestock sector (a main user of fishmeal), and the production of fishmeal could well fall below the present level for some years. Early in the period 2000-2010, European livestock producers will probably increase their use of grains slightly, as real grain prices are expected to fall. Fishmeal and fish oil production is likely to recover when stocks of small pelagics again become plentiful off the west coast of South America and fishmeal prices regain competitiveness. In the medium term, it is assumed that about 30 million tonnes of fish will continue to be converted into fishmeal and fish oil.

TOTAL SUPPLIES

Total fish supplies will probably remain below or at the level of 125 million tonnes for the next three to four years and then increase towards the end of the period 2000-2010. At that time, supplies may be in the order of 135 million tonnes, of which 105 million tonnes

would be available as food fish and the remaining 30 million tonnes for the production of fishmeal and fish oil.

CONCLUSION

It is clear that both supply and demand in capture fisheries will remain stagnant in the near future. On the supply side, a low availability of major pelagic stocks is exerting a negative influence. Also in the near future, some export-oriented aquaculture industries will reduce their production in response to weak markets.

The medium-term prospects are somewhat better for both supply and demand. Total demand for capture fisheries was estimated to be between 105 million and 110 million tonnes in 2010. As supplies are estimated to be 105 million tonnes, the demand-induced upward pressure on prices will be weak, especially since the world population is not expected to top 7 billion by 2010. A supply of 105 million tonnes of fish in that year would in fact imply the stagnation of per caput supplies at about 15 kg per year.

This scenario is dependent on several crucial assumptions, with the main one hinging on developments in the world economy. The basic assumption is that the present economic crisis will continue into the next century and will also affect the more developed economies. Technology is another important factor: while it has been assumed that capture fisheries - particularly in developed economies - will benefit from developments in modern communications and electronic technologies, no similar assumption has been made for aquaculture. This may be unduly pessimistic. For example, genetic improvements in salmon, tilapia, catfish, carp and oysters have already been successful in raising production, and work in this area is likely to continue to yield positive results. Furthermore, on-farm management should improve, in both the areas of business and technology. It is not inconceivable, therefore, that the developments in aquaculture technologies will allow production to have increased further by 2010 even without the stimulus of higher real prices.

[1] Main contributor: U. Wijkström, FAO Fisheries Department.
[2] Including finfish, crustaceans and molluscs.
[3] Including intra-Asian trade.
[4] Tilapias and other cichlids as a group.
[5] J.F. Muir. 1995. Aquaculture development trends: perspectives for food security. Paper presented at the Government of Japan/FAO International Conference on Sustainable Contribution of Fisheries to Food Security, Kyoto, Japan, 4-9 December 1995; and FAO. 1997. *Review of the state of world aquaculture*. FAO Fisheries Circular No. 886, Rev. 1. Rome.

PART 5
Fisheries activities of country groupings

ASSOCIATION OF SOUTHEAST ASIAN NATIONS

The Association of Southeast Asian Nations (ASEAN) was established on 8 August 1967 with the signing of the Bangkok Declaration. At present, its members are Brunei Darussalam, Indonesia, the Lao People's Democratic Republic, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Viet Nam.

In 1992, the ASEAN heads of government adopted the Singapore Declaration and the Framework Agreement on Enhancing ASEAN Economic Cooperation, which included a decision to establish the ASEAN Free Trade Area (AFTA) within 15 years. It is now expected that the free trade area will be established by the year 2003. Member countries are gradually implementing the provisions of the Agreement on the Common Effective Preferential Tariff (CEPT) Scheme, which is the main instrument of AFTA.

TABLE 7
ASEAN: fisheries and aquaculture production and trade

	1984	1988	1992	1996
Aquaculture production				
Inland production *('000 tonnes)*	679	852	1 050	1 193
Percentage of world total	16.0	11.9	11.2	7.6
Marine production *('000 tonnes)*	234	326	592	715
Percentage of world total	8.6	7.1	9.7	6.6
Fisheries production				
Inland production *('000 tonnes)*	984	923	939	1 058
Percentage of world total	16.9	14.8	15.0	14.0
Marine production *('000 tonnes)*	6 680	7 878	9 405	10 390
Percentage of world total	9.3	9.6	11.8	11.9
Fisheries and aquaculture production				
Combined total *('000 tonnes)*	8 576	9 980	11 986	13 357

Percentage of world total	10.1	9.9	11.8	11.0
Trade in fishery commodities				
Total imports *(US$ million)*	471	1 142	1 904	2 072
Percentage of world total	2.7	3.2	4.2	3.6
Total exports *(US$ million)*	1 320	3 446	5 777	7 703
Percentage of world total	8.1	10.8	14.4	14.7

FISHERIES: PURPOSE AND ACTIVITIES

The ASEAN Ministerial Understanding on Fisheries Cooperation, signed in Singapore on 22 October 1983, identified areas subject to cooperative action among member countries. The areas identified included: the management and conservation of fishery resources; the transfer of technology to improve the socio-economic status of fishers; raising aquaculture production and fish farmers' incomes; production and marketing; post-harvest technology; the promotion of fish marketing and trade; and the promotion of a common understanding on regional and international matters in fisheries.

The 15th meeting of ASEAN Ministers of Agriculture and Forestry, held in Bandar Sri Begawan, Brunei Darussalam, 28 to 30 October 1993, agreed on a medium-term programme of action for ASEAN cooperation in food, agriculture, fisheries and forestry. The programme is aimed at strengthening food security in the region and is compatible with the Ministerial Understanding on Fisheries Cooperation.

COOPERATION WITH FAO

There is no formal cooperation between ASEAN and FAO in the area of fisheries. However, member countries of ASEAN and its fisheries group do cooperate closely with FAO through the FAO Regional Office in Bangkok.

CARIBBEAN COMMUNITY AND COMMON MARKET

The Caribbean Community and Common Market (CARICOM) was established by the Treaty of Chaguaramas on 4 July 1973, with the principal purpose of enhancing, through cooperation, the economic, social and cultural development of the people of member countries. CARICOM's members are Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Montserrat, Saint Lucia, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Suriname and Trinidad and Tobago.

TABLE 8
CARICOM: fisheries and aquaculture production and trade

	1984	1988	1992	1996
Aquaculture production				
Inland production *('000 tonnes)*	0	2	3	4
Percentage of world total	0.0	0.0	0.0	0.0
Marine production *('000 tonnes)*	0	0	0	1
Percentage of world total	0.0	0.0	0.0	0.0
Fisheries production				
Inland production *('000 tonnes)*	1	2	2	2
Percentage of world total	0.0	0.0	0.0	0.0
Marine production *('000 tonnes)*	72	82	98	102
Percentage of world total	0.1	0.1	0.1	0.1
Fisheries and aquaculture production				
Combined total *('000 tonnes)*	74	86	103	108
Percentage of world total	0.1	0.1	0.1	0.1
Trade in fishery commodities				
Total imports *(US$ million)*	55	57	52	84
Percentage of world total	0.3	0.2	0.1	0.1
Total exports *(US$ million)*	51	80	105	140
Percentage of world total	0.3	0.3	0.3	0.3

FISHERIES: PURPOSE AND ACTIVITIES

In fisheries, CARICOM aims to "promote the development of the fisheries subsector in member states with a view to optimal exploitation of their resources on a sustainable basis". It intends to do this by strengthening the legal and institutional framework, in part through the formulation and implementation of a common CARICOM Fisheries Policy and a CARICOM Regional Fisheries Mechanism.

The CARICOM Fisheries Resource Assessment and Management Program (CFRAMP) was initiated in 1991 with joint funding from the Canadian International Development Agency (CIDA) and 12 participating member countries of CARICOM. The primary goal of CFRAMP is "to promote the management and conservation of the fisheries resources of the CARICOM countries and to permit the exploitation of these on the basis of sustainable yield". The four major components of CFRAMP are the enhancement of national fisheries management capabilities, training, resource assessment and the establishment of a permanent regional fisheries mechanism, which on completion will be the successor to CFRAMP.

COOPERATION WITH FAO

CARICOM and FAO have cooperated closely over the past decades on various aspects of fisheries, including policy and legal matters. FAO has provided specific technical assistance to CFRAMP since its inception in 1991 and, over the past two years, the two have collaborated in implementing joint technical activities through the Western Central Atlantic Fisheries Commission (WECAFC). Such activities have included training in stock assessment and the assessment of major fish stocks (e.g. spiny lobster, penaeid shrimps) in the WECAFC region.

COMMON MARKET FOR EASTERN AND SOUTHERN AFRICA

The treaty establishing the Common Market for Eastern and Southern Africa (COMESA) was signed on 5 November 1993 in Kampala, Uganda, and was notified on 8 December 1994 in Lilongwe, Malawi. Its member countries are Angola, Burundi, the Comoros, the Democratic Republic of the Congo, Djibouti, Eritrea, Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Namibia, Rwanda, Seychelles, Somalia, the Sudan, Swaziland, Uganda, the United Republic of Tanzania, Zambia and Zimbabwe. The aims and objectives of COMESA are to:

- attain sustainable growth and development of the member states by promoting a more balanced and harmonious development of its production and marketing structures;
- promote joint development in all fields of economic activity and the joint adoption of macroeconomic policies and programmes to raise the standard of living of its peoples and to foster closer relations among its member states;
- cooperate in the creation of an enabling environment for foreign, cross-border and domestic investment, including the joint promotion of research and adaptation of science and technology for development;
- cooperate in the promotion of peace, security and stability among the member states in order to enhance economic development in the region;
- cooperate in strengthening the relations between COMESA and the rest of the world and the adoption of common positions in international fora;
- contribute towards the establishment, progress and the realization of the objectives of the African Economic Community.

To enable COMESA to sustain member countries' development efforts, structural and institutional weaknesses in member states should be removed and resources pooled.

TABLE 9
COMESA: fisheries and aquaculture production and trade

	1984	1988	1992	1996
Aquaculture production				
Inland production *('000 tonnes)*	28	56	70	79
Percentage of world total	0.7	0.8	0.7	0.5
Marine production *('000 tonnes)*	0	0	3	10
Percentage of world total	0.0	0.0	0.0	0.1
Fisheries production				
Inland production *('000 tonnes)*	1 025	1 268	1 271	1 251
Percentage of world total	17.6	20.3	20.3	16.6
Marine production *('000 tonnes)*	205	340	627	605
Percentage of world total	0.3	0.4	0.8	0.7
Fisheries and aquaculture production				
Combined total *('000 tonnes)*	1 258	1 664	1 970	1 945
Percentage of world total	1.5	1.7	1.9	1.6
Trade in fishery commodities				
Total imports *(US$ million)*	205	208	188	307
Percentage of world total	1.2	0.6	0.4	0.5
Total exports *(US$ million)*	38	94	144	501
Percentage of world total	0.2	0.3	0.4	1.0

FISHERIES: PURPOSES AND ACTIVITIES

Article 130 of the treaty establishing COMESA contains the following explicit objectives and activities with regard to fisheries:

- the harmonization of agricultural policies of the member states with a view to having a common agricultural policy;
- the development and utilization of land and water resources, particularly shared river and lake basins;
- the exploitation and surveillance of the EEZs with regard to marine fisheries development;
- the marketing and stabilization of agricultural commodity prices, bearing in mind internal agricultural and exchange rate policies in individual member countries.

The agenda is overarching and its implementation will have an impact on fisheries and aquaculture in terms of the investments, production, trade and fish consumption of member states. COMESA aims to deepen and broaden the integration process among member states through the adoption of comprehensive trade liberalization measures, such

as the complete elimination of tariff and non-tariff barriers to trade; the free movement of capital, labour, goods and the right of establishment; standardized taxation rates (including value-added tax and excise duties); promoting the adoption of a single currency and the establishment of a monetary union; and the adoption of a common external tariff (CET).

COOPERATION WITH FAO

The COMESA secretariat has entered into arrangements with FAO in the specialized field of agriculture and fisheries.

COMMONWEALTH OF INDEPENDENT STATES

The Commonwealth of Independent States (CIS) was established in December 1991. It is a voluntary association consisting of the following states: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, the Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. The main purpose of the Commonwealth is to develop and strengthen cooperation and to serve the cause of peace and security.

FISHERIES: PURPOSE AND ACTIVITIES

To date, no common fisheries policy among countries of the CIS has been elaborated. Coordination is achieved through bilateral and multilateral agreements among the member countries, which can be divided into two groups: i) states that have inland water fisheries and aquaculture activities only (Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Turkmenistan and Uzbekistan); and ii) states that have a well-developed distant-water fisheries sector (Russian Federation, Ukraine and - to a certain extent - Georgia).

Most CIS countries have concentrated on the restructuring of their fleets and on the processing and marketing sectors under structural adjustment schemes.

TABLE 10
CIS: fisheries and aquaculture production and trade

	1984	1988	1992	1996
Aquaculture production				
Inland production *('000 tonnes)*	...	307	219	99
Percentage of world total	...	4.3	2.3	0.6
Marine production *('000 tonnes)*	...	0	1	2

Percentage of world total	...	0.0	0.0	0.0
Fisheries production				
Inland production *('000 tonnes)*	...	679	437	310
Percentage of world total	...	10.9	7.0	4.1
Marine production *('000 tonnes)*	...	8 952	5 706	4 852
Percentage of world total	...	10.9	7.1	5.6
Fisheries and aquaculture production				
Combined total *('000 tonnes)*	...	9 939	6 363	5 263
Percentage of world total	...	9.9	6.3	4.3
Trade in fishery commodities				
Total imports *(US$ million)*	...	0	35	500
Percentage of world total	...	0.0	0.1	0.9
Total exports *(US$ million)*	...	0	826	1 877
Percentage of world total	...	0.0	2.1	3.6

Note: ... = data not available.

COOPERATION WITH FAO

To date there is no agreed policy within the CIS countries concerning their cooperation with FAO. Each state acts independently in fisheries matters.

ECONOMIC COMMUNITY OF WEST AFRICAN STATES

The treaty establishing the Economic Community of West African States (ECOWAS) came into force in June 1975. At present, the following countries adhere to the treaty: Benin, Burkina Faso, Cape Verde, the Gambia, Ghana, Guinea, Guinea-Bissau, Côte d'Ivoire, Liberia, Mali, Mauritania, the Niger, Nigeria, Senegal, Sierra Leone and Togo.

The ECOWAS treaty specifies the Community's objective as being the promotion of cooperation and development in all fields of economic activity. Cooperation in the development of agriculture, forestry, animal husbandry and fisheries is one of its primary

aims. The first stage in this cooperation entails the harmonization of internal and external policies, the second stage envisages the adoption of a common agricultural policy.

FISHERIES: PURPOSE AND ACTIVITIES

Based on the recommendations of the Industry, Agriculture and Natural Resources Commission at its meeting in Cotonou, Benin, in April 1980, ECOWAS organized a conference of experts in Dakar, Senegal, to develop national policies to ensure better management and surveillance of waters under the jurisdiction of its member states and also to ensure the conservation of fisheries resources in the region. Several recommendations were made concerning research, surveillance, the harmonization of fishing agreements and legislation, trade in fish and fishery products, data collection, etc. Since then, member countries have made progress in implementing such recommendations.

TABLE 11
ECOWAS: fisheries and aquaculture production and trade

	1984	1988	1992	1996
Aquaculture production				
Inland production *('000 tonnes)*	7	11	17	19
Percentage of world total	0.2	0.2	0.2	0.1
Marine production *('000 tonnes)*	0	0	1	0
Percentage of world total	0.0	0.0	0.0	0.0
Fisheries production				
Inland production *('000 tonnes)*	314	333	331	395
Percentage of world total	5.4	5.3	5.3	5.2
Marine production *('000 tonnes)*	877	995	1 228	1 272
Percentage of world total	1.2	1.2	1.5	1.5
Fisheries and aquaculture production				
Combined total *('000 tonnes)*	1 198	1 340	1 577	1 687
Percentage of world total	1.4	1.3	1.6	1.4
Trade in fishery commodities				
Total imports *(US$ million)*	280	343	358	336
Percentage of world total	1.6	1.0	0.8	0.6
Total exports *(US$ million)*	323	505	499	842
Percentage of world total	2.0	1.6	1.2	1.6

COOPERATION WITH FAO

ECOWAS' formal relationship with FAO is based on an exchange of letters between the Director-General of FAO and the Executive Secretary of ECOWAS. A Cooperation Agreement was established with FAO in December 1984, since which time FAO has been cooperating with the Community in various fields. However, as an organization, ECOWAS is not a member of any of the FAO statutory bodies.

In the mid-1990s, at the request of ECOWAS, FAO carried out a study entitled Economic development of fisheries, which made special reference to aspects of fisheries by foreign vessels off West Africa. In its conclusions, the study emphasized the necessity and the opportunities for regional cooperation in support of fisheries management and regional food security. Furthermore, FAO regional fisheries projects have been cooperating with ECOWAS member states, especially in promoting fisheries management in the artisanal subsector.

EUROPEAN COMMUNITY

The Treaty of Rome established the European Economic Community (EEC) in 1957. In 1993, the Treaty of Maastricht established the European Union (EU) as a broader framework which retained the EEC, now the European Community (EC), as a legal entity. The aims of the EC include the abolition of restrictive trading practices and the free movement of capital and labour within the union. A single market with free movement of goods and capital was established in January 1993. The following countries are members of the EC: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

TABLE 12
EC: fisheries and aquaculture production and trade

	1984	1988	1992	1996
Aquaculture production				
Inland production *('000 tonnes)*	154	198	227	251
Percentage of world total	3.6	2.8	2.4	1.6
Marine production *('000 tonnes)*	622	713	685	907
Percentage of world total	23.0	15.6	11.2	8.4
Fisheries production				
Inland production *('000 tonnes)*	122	111	103	123

Percentage of world total	2.1	1.8	1.6	1.6
Marine production *('000 tonnes)*	6 797	7 040	6 563	6 319
Percentage of world total	9.5	8.5	8.2	7.3
Fisheries and aquaculture production				
Combined total *('000 tonnes)*	7 696	8 061	7 577	7 599
Percentage of world total	9.1	8.0	7.4	6.3
Trade in fishery commodities				
Total imports *(US$ million)*	5 363	12 261	17 270	19 352
Percentage of world total	31.2	34.8	38.2	34.0
Total exports *(US$ million)*	3 117	6 400	8 580	11 015
Percentage of world total	19.2	20.1	21.4	21.0

FISHERIES: PURPOSE AND ACTIVITIES

The Common Fisheries Policy (CFP) of the EC came into existence in 1983, although the first elements of this policy had already been introduced in 1970. Since then, it has been developed and adjusted continuously in accordance with international developments and changes within the EC itself. The CFP covers access to resources, the conservation of fish stocks and the monitoring of fishing activities as well as the marketing of fishery products and research.

The main objective of the CFP is the sustainable conservation and management of the resource. Within this framework, an important element is the structural policy, the main components of which are the Financial Instrument for Fisheries Guidance (FIFG) and PESCA. Since 1993, these structural measures have been integrated into the EC's system of structural funds. PESCA has been designed to strengthen, develop and diversify the economies of regions dependent on fishing. The FIFG can help finance: i) adjustments in fishing effort; ii) fleet withdrawal and modernization of vessels; iii) investment in aquaculture; iv) fishing port facilities and the processing and marketing of products; v) other measures such as the promotion of new outlets for products, the management of fishing quotas by a producers' organization or temporary withdrawals, etc.

In 1997, within the framework of the Multi-Annual Guidance Programme (MAGP IV), targets for fleet capacity reductions were agreed for each EC member state. Targets were expressed as a reduction in tonnage volume (in GRT) and engine power (in kW).

In 1998, the implementation of the CFP entailed the following main measures:

- the development of responsible fishing through the conservation of resources;
- the matching of fishing capacity with resources through the multi-annual guidance programmes for the period 1997-2002 (MAGP IV);

- the control of fishing activity through the introduction of satellite-based vessel monitoring systems;
- enhanced international cooperation through negotiation of fisheries agreements and participation in regional fisheries organizations;
- the promotion of European fisheries research.

COOPERATION WITH FAO

The EC is a full member of FAO. The EC is also a member of most FAO regional fisheries bodies and participates in the work of the European Inland Fisheries Advisory Committee (EIFAC) and the Fishery Committee for the Eastern Central Atlantic (CECAF).

In the course of 1998, the EC provided funds to FAO for the formulation and negotiation of international agreements and plans of action for improved global management of fishing capacity, shark fisheries and incidental catch of seabirds in longline fisheries.

LATIN AMERICAN ECONOMIC SYSTEM

The Latin American Economic System (LAES) is a regional intergovernmental organization that groups 27 Latin American and Caribbean countries: Argentina, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, the Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, Trinidad and Tobago, Uruguay and Venezuela. LAES was established on 17 October 1975 by the Panama Convention.

The objectives of LAES are to promote a system for consultation and coordination aiming to achieve consensus in the form of joint positions and common strategies for the region on economic issues. The common strategies may be for individual countries or groups of countries. LAES also serves to promote cooperation and integration among the countries of the region.

FISHERIES: PURPOSE AND ACTIVITIES

The Action Committees of LAES are flexible cooperation mechanisms and are set up when more than two member states voice their interest in promoting joint programmes and projects in specific areas. These committees are dissolved once their objectives are fulfilled, otherwise they may become Permanent Bodies of the System.

TABLE 13
LAES: fisheries and aquaculture production and trade

	1984	1988	1992	1996
Aquaculture production				
Inland production *('000 tonnes)*	43	60	99	141
Percentage of world total	1.0	0.8	1.1	0.9
Marine production *('000 tonnes)*	82	150	247	422
Percentage of world total	3.0	3.3	4.0	3.9
Fisheries production				
Inland production *('000 tonnes)*	434	497	467	463
Percentage of world total	7.5	7.9	7.5	6.1
Marine production *('000 tonnes)*	11 481	15 722	17 413	21 066
Percentage of world total	16.0	19.1	21.8	24.2
Fisheries and aquaculture production				
Combined total *('000 tonnes)*	12 040	16 430	18 226	22 091
Percentage of world total	14.2	16.4	17.9	18.3
Trade in fishery commodities				
Total imports *(US$ million)*	269	358	472	1 039
Percentage of world total	1.6	1.0	1.0	1.8
Total exports *(US$ million)*	2 118	3 139	4 243	6 615
Percentage of world total	13.1	9.9	10.6	12.6

COOPERATION WITH FAO

There is a long record of cooperation in technical activities between FAO and LAES. Initially, the forum for this cooperation was the Action Committee of Sea and Fresh-water Products. When this action committee was dissolved, the Latin American Organization for Fisheries Development (OLDEPESCA) was established, and this independent body has now become the centre of cooperation. FAO usually attends the annual OLDEPESCA conferences of Fisheries Ministers.

LEAGUE OF ARAB STATES

The League of Arab States, more generally known as the Arab League, was founded in March 1945. It comprises Algeria, Bahrain, the Comoros, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, the Libyan Arab Jamahiriya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Somalia, the Sudan, the Syrian Arab Republic, Tunisia, the United Arab Emirates and Yemen.

The broad objectives of the Arab League are to develop cooperation and strengthen complementarity among the member states in economical, cultural scientific, social and military fields. To do so, the League has set up several specialized agencies. Those of interest to FAO are: the Arab Bank for Economic Development in Africa (Khartoum, the Sudan); the Arab Centre for the Study of Arid Zones and Dry Lands (Damascus, the Syrian Arab Republic); the Arab Fund for Economic and Social Development (Kuwait); the Arab League Educational, Cultural and Scientific Organization (Tunis, Tunisia); the Arab Organization for Agricultural Development (Khartoum, the Sudan); the Arab Academy for Science and Maritime Transport (Alexandria, Egypt); and the Inter-Arab Investment Guarantee Corporation (Kuwait).

FISHERIES: PURPOSE AND ACTIVITIES

The League of Arab States has no subsidiary body or institution that deals exclusively with fisheries matters.

TABLE 14
League of Arab States: fisheries and aquaculture production and trade

	1984	1988	1992	1996
Aquaculture production				
Inland production *('000 tonnes)*	34	63	75	84
Percentage of world total	0.8	0.9	0.8	0.5
Marine production *('000 tonnes)*	0	1	4	10
Percentage of world total	0.0	0.0	0.1	0.1
Fisheries production				
Inland production *(`000 tonnes)*	164	222	210	237
Percentage of world total	2.8	3.5	3.4	3.1
Marine production *('000 tonnes)*	1 065	1 364	1 319	1 472
Percentage of world total	1.5	1.7	1.7	1.7
Fisheries and aquaculture production				
Combined total *('000 tonnes)*	1 263	1 650	1 608	1 803
Percentage of world total	1.5	1.6	1.6	1.5
Trade in fishery commodities				
Total imports *(US$ million)*	284	248	261	359

Percentage of world total	1.7	0.7	0.6	0.6
Total exports *(US$ million)*	385	833	900	1 152
Percentage of world total	2.4	2.6	2.2	2.2

COOPERATION WITH FAO

FAO has participated in several meetings organized by subsidiary bodies of the Arab League. The Organization has attended and partly sponsored meetings of the Arab Federation of Fish Producers (AFFP), which is a subsidiary of the Council for Arab Economic Union. In 1998, FAO was represented at the Conference on the Development of Marine Fisheries in the Arab World, organized by the Council.

NORTH AMERICAN FREE TRADE AGREEMENT

Canada, Mexico and the United States of America are members of the North American Free Trade Agreement (NAFTA). NAFTA´s main aims are to: contribute to the expansion of world trade; create, expand and secure markets for the goods produced in their territories; reduce distortions to trade; create new employment opportunities and improve working conditions and living standards in their respective territories; and address related environmental and conservation issues

Because of the extent of NAFTA´s market, it is a trading block with a global reach. It is also innovative, as it establishes linkages between economies with different levels of economic development. Current discussions envisage the linking of existing subregional integration schemes, of which NAFTA is one, into a Free Trade Area of the Americas (FTAA).

FISHERIES: PURPOSES AND ACTIVITIES

NAFTA does not carry out any specific activities concerned with fisheries.

TABLE 15
NAFTA: fisheries and aquaculture production and trade

	1984	**1988**	**1992**	**1996**
Aquaculture production				
Inland production *('000 tonnes)*	201	254	304	312

Percentage of world total	4.7	3.5	3.2	2.0
Marine production *('000 tonnes)*	190	198	214	229
Percentage of world total	7.0	4.3	3.5	2.1
Fisheries production				
Inland production *('000 tonnes)*	218	269	239	190
Percentage of world total	3.8	4.3	3.8	2.5
Marine production *('000 tonnes)*	6 793	8 287	7 432	7 134
Percentage of world total	9.5	10.1	9.3	8.2
Fishery and aquaculture production				
Combined total *('000 tonnes)*	7 402	9 008	8 188	7 865
Percentage of world total	8.8	9.0	8.0	6.5
Trade in fishery commodities				
Total imports *(US$ million)*	4 084	6 021	6 785	8 321
Percentage of world total	23.8	17.1	15.0	14.6
Total exports *(US$ million)*	2 712	5 087	5 985	6 178
Percentage of world total	16.7	16.0	14.9	11.8

COOPERATION WITH FAO

To date, there is no cooperation between NAFTA and FAO on fisheries matters. NAFTA member countries deal individually with FAO in this field.

SOUTH ASIAN ASSOCIATION FOR REGIONAL COOPERATION

The South Asian Association for Regional Cooperation (SAARC) was established in 1985 by the heads of state and government of Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. SAARC's main goal is to accelerate economic and social development in member states through joint action in certain agreed areas of cooperation. To achieve this objective, SAARC seeks to:

- promote the welfare of the peoples of South Asia and improve their quality of life;
- accelerate economic growth, social progress and cultural development in the region, and provide all individuals the opportunity to live in dignity and realize their full potential;

- promote and strengthen collective self-reliance among the countries of South Asia;
- promote active collaboration and mutual assistance in the economic, social, cultural technical and scientific fields;
- strengthen cooperation with other developing countries;
- strengthen cooperation among themselves in international fora on matters of common interest, and cooperate with international and regional organizations with similar aims and purposes.

TABLE 16
SAARC: fisheries and aquaculture production and trade

	1984	**1988**	**1992**	**1996**
Aquaculture production				
Inland production *('000 tonnes)*	631	1 045	1 605	2 103
Percentage of world total	14.8	14.6	17.1	13.5
Marine production *('000 tonnes)*	10	21	42	91
Percentage of world total	0.4	0.5	0.7	0.8
Fisheries production				
Inland production *('000 tonnes)*	1 152	1 006	963	1 415
Percentage of world total	19.8	16.1	15.4	18.7
Marine production *('000 tonnes)*	2 440	2 611	3 450	3 831
Percentage of world total	3.4	3.2	4.3	4.4
Fisheries and aquaculture production				
Total *('000 tonnes)*	4 232	4 683	6 060	7 441
Percentage of world total	5.0	4.7	6.0	6.1
Trade in fishery commodities				
Total imports *(US$ million)*	26	38	61	76
Percentage of world total	0.1	0.1	0.1	0.1
Total exports *(US$ million)*	529	765	1 012	1 490
Percentage of world total	3.3	2.4	2.5	2.8

FISHERIES: PURPOSES AND OBJECTIVES

The Integrated Programme of Action is the key component of SAARC´s activities. It now includes 11 areas of cooperation, each covered by a Technical Committee: Agriculture; Communications; Education; Culture and Sports; Environment and Meteorology; Health and Population Activities; Prevention of Drug Trafficking and Drug Abuse; Rural Development, Science and Technology; Tourism; Transport; and Women in Development. SAARC also has a Technical Committee on Aquaculture.

COOPERATION WITH FAO

SAARC does not cooperate formally with FAO in fisheries or aquaculture.

SOUTH PACIFIC FORUM

The South Pacific Forum (SPF), consisting of heads of government, was established in 1971. It provides an opportunity to discuss a wide variety of South Pacific and international concerns and issues common to members, including the promotion of a free trade area in the South Pacific region. In 1998, the members of the SPF and its affiliated agencies were: Australia, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu. The SPF has a secretariat (Forum Secretariat) which promotes regional cooperation among members on important economic issues.

TABLE 17
SPF: fisheries and aquaculture production and trade

	1984	1988	1992	1996
Aquaculture production				
Inland production *('000 tonnes)*	1	2	2	3
Percentage of world total	0.0	0.0	0.0	0.0
Marine production *('000 tonnes)*	19	39	66	95
Percentage of world total	0.7	0.9	1.1	0.9
Fisheries production				
Inland production *('000 tonnes)*	19	22	23	19
Percentage of world total	0.3	0.3	0.4	0.3
Marine production *('000 tonnes)*	475	595	819	748
Percentage of world total	1.0	0.2	1.0	0.9
Fisheries and aquaculture production				
Combined total *('000 tonnes)*	513	658	910	865
Percentage of world total	0.6	0.7	0.9	0.7
Trade in fishery commodities				
Total imports *(US$ million)*	306	415	482	584
Percentage of world total	1.8	1.2	1.1	1.0

Total exports *(US$ million)*	671	1 095	1 372	1 711
Percentage of world total	1.8	1.2	1.1	1.0

FISHERIES: PURPOSE AND ACTIVITIES

The South Pacific Forum Fisheries Agency (FFA), established as a specialized agency by the SPF in 1977, facilitates and coordinates cooperation and mutual assistance among members of the Forum in fisheries policy matters while seeking to secure the maximum benefits from the region's living marine resources for Pacific Islanders. The SPF, the Forum Secretariat and the FFA maintain close working relations with important intergovernmental and non-governmental organizations. The FFA is mandated by its Convention, *inter alia*, to collect, analyse, evaluate and disseminate relevant information to members. Within its mandate, the FFA facilitated the coordination of its members in negotiating the Multilateral Treaty on Fisheries between the Governments of Certain Pacific Island States and the Government of the United States of America.

The FFA has brought important economic and social benefits to its members. The small developing island states have benefited in particular through regional cooperation and the adoption of regional minimum standards. Regionally agreed measures to limit fishing effort (e.g. in the purse seine tuna fishery) have also been of tangible benefit to FFA member countries.

COOPERATION WITH FAO

The FFA has formal relations with FAO and the two agencies cooperate on a range of technical issues, including such matters as joint training exercises and exchanges of technical information. FAO participates in the annual FFC meeting as an observer. In close cooperation with the FFA and its members as well as the DWFNs, FAO also participates as an observer in the Multilateral High Level Conference on the Conservation and Management of Highly Migratory Fish Stocks in the Central and Western Pacific (MHLC).

The FAO Subregional Office for the Pacific is expected to participate in the Marine Sector Working Group of the South Pacific Organizations Coordinating Committee, which is being convened by the Forum Secretariat and its members (comprising relevant Pacific regional organizations). The Working Group was established to facilitate the coordination of activities in the development of a regional strategy for the marine sector.