The State of World Fisheries and Aquaculture - 1996

OVERVIEW

PRODUCTION

In recent years fish supplies have expanded rapidly. As reported in the new edition of *The State of World Fisheries and Aquaculture*, in 1994 they reached 109.6 million tonnes, and preliminary figures for 1995 indicated a new peak of total production at 112.3 million tonnes. The increase is mainly a result of continued rapid growth in aquaculture production, particularly in China, and rapid expansion of highly fluctuating harvestable stocks of pelagic species off the west coast of South America. Both fishmeal production and fish supplies for human consumption have reached record levels.

In 1995, landings by capture fisheries reached about 91 million tonnes. Ten countries accounted for about 70 percent of the volume. Aggregate production in the low-income food-deficit countries (LIFDCs) continued the pattern of high growth that has characterized recent years, showing an average annual rate of increase of 6.9 percent during the period 1988 to 1994. In 1994, LIFDCs accounted for 35 percent of total production, compared with 26 percent in 1988.

Provisional production figures for mariculture and inland aquaculture show an estimated increase from 18.6 million tonnes in 1994 to 21.3 million tonnes in 1995, more than offsetting a very small (i.e. 0.02 million tonne) decline in the harvest from marine and inland capture fisheries during the same period.

The rapid growth in aquaculture production is the result of an increased predominance of Asian aquaculture and of carp species. Five Asian countries (China, India, Japan, the Republic of Korea and the Philippines) accounted for 80 percent of the volume of aquaculture produce. In 1994 carps accounted for almost half of the total volume of cultured aquatic products (aquatic plants excluded). Even though cultured fish and shellfish contribute significantly to total national fishery production, aquaculture in most countries is dominated by a few species.

UTILIZATION

Of the preliminary figure of 112.3 million tonnes of total fishery production in 1995, it is calculated that some 31.5 million tonnes were used for reduction. The amount of fish available for direct human consumption in 1995 was estimated to be 80 million tonnes, 3.4 million tonnes more than in 1994, representing a greater increase than the estimated population growth rate in the same year. Therefore, average annual per caput availability of food fish increased to 14 kg.

TRADE

The value of international fish trade continues to increase. In 1985, the value of international fish exports was US$17 billion. In 1990, it was US$35.8 billion. In 1994 it had reached US$47 billion. The increased volume of international trade in fishery products in 1994 was associated with higher trade in low-value commodities such as fishmeal, with the result that the value of exports increased less than the volume. Preliminary figures for 1995 indicated an increase in the value of trade because of higher prices. However, in recent years the growth in value of international fish trade has slowed down.

INLAND AND MARINE FISHERY PRODUCTION

WORLD FISH UTILIZATION

Developed countries accounted for about 85 percent of total fish imports in 1995 in value terms. Japan continued to be the world's biggest importer of fishery products, with some 30 percent of the global total. In 1995, fish imports by all three major world importers (Japan, the European Union and the United States) increased.

For many developing nations, fish trade represents a significant source of foreign currency earnings. Net receipts of foreign exchange by developing countries - calculated by deducting their imports from the total value of their exports - demonstrated an impressive increase from US$5.1 billion in 1985 to US$16 billion in 1994, and a further increase was likely for 1995.

ISSUES FOR SUSTAINABLE FISHERIES

In the first half of the 1990s the international community addressed several of the management issues connected with sustainable fisheries:

· how to reduce overfishing and control fishing capacity;

· how to reduce by-catches and discarding;

· how to reduce environmental degradation of catchment and coastal areas;

· how to deal with uncertainty and risk.

The discussion resulted in the concept of responsible fisheries and the elaboration and adoption of the Code of Conduct on Responsible Fisheries by the Conference of FAO in Rome in October 1995.

EXPLORATORY ESTIMATES: PER CAPUT AND TOTAL DEMAND IN 2010 AT CONSTANT REAL PRICES

OUTLOOK

The medium-term outlook for global demand for food fish is largely determined by population growth, changes in per caput income and the pace of urbanization. The interplay of these factors was considered in a review prepared by FAO for the 1995 Kyoto Conference on the Sustainable Contribution of Fisheries to Food Security. The review gave a conservative estimate of demand for food fish in the year 2010 (at 1990 constant real prices) in the range of 110 to 120 million tonnes (live weight), compared with 75 to 80 million tonnes in 1994/95. This estimate is based on per caput demand projections by country. It is expected that demand for, and supply of, fish for reduction will remain stable at between 30 and 33 million tonnes over the next few years. (It is realized that the demand for fishmeal is complex, and this projection is made in the absence of detailed studies.) In summary, projected demand for fish for all uses is in the order of 140 to 150 million tonnes for 2010.

Over the past few years, governments have taken action to deal with capture fisheries matters, both separately and in concert. This is a promising trend for future supplies. FAO estimates that the world's potential harvest through capture fisheries is between about 85 to 90 million tonnes with current fishing regimes[1] (i.e. with some fish stocks overfished and some underexploited, and regardless of any increased supplies from a reduction in discarding) and 100 to 105 million tonnes if management systems for capture fisheries are improved in all oceans and with some positive reduction in discarding.

[1] Inland fisheries contribute about 6 million tonnes annually, and during the period from 1986 to 1994 marine capture fisheries fluctuated between 80 and 85 million tonnes. There is considerable potential for further expansion of aquaculture. It has been estimated that under favourable conditions production (not including aquatic plants) could be 39 million tonnes by 2010.

Total supplies for human consumption (calculated by deducting fish to be used for reduction from total fish supplies) under the best of circumstances may reach 114 million tonnes in 2010; if circumstances are less favourable this figure could be significantly lower, at 74 million tonnes. Therefore, only under the optimistic scenario will supply meet demand (at 1990 constant real prices) in the year 2010.

REGIONAL REVIEWS

NORTH AMERICA

With a total production of 7.1 million tonnes in 1994, North America contributed about 6 percent of global fish catch.

Future seafood demand in North America will probably be stimulated by the growing perception of fish as healthy food and inhibited by sanitary and environmental concerns.

In aggregate, it is difficult to quantify the exact impact of the different issues upon consumption patterns. Nevertheless, it is expected that demand for fish and fishery products will increase. A further shift to higher-value seafood could also be expected.

The marine capture fisheries of the region have practically reached a plateau of production where most commercial fish stocks are fully fished or overexploited.

LATIN AMERICA AND THE CARIBBEAN

In 1994 fish production in Latin America and the Caribbean reached a record level of 24 million tonnes, representing 22 percent of the world total. Small pelagic marine fish make up about 75 percent of the total catch.

Fish consumption has been increasing gradually over the past 20 years and will probably continue to increase in the future. With population and economic growth taken into account, it is estimated that demand will increase by about 2 to 3 million tonnes by the year 2010.

Increased supplies could come from the reduction of discards and post-harvest losses. Greater utilization of small pelagic fish for direct human consumption could be another key issue for the region. Fish production in the region will continue to fluctuate according to the variability in abundance of small pelagic stocks.

Export-oriented industrial aquaculture has expanded significantly in the region and still has moderate growth potential. Other types of aquaculture such as pond-based fisheries in reservoirs, freshwater fish culture and culture of molluscs and aquatic plants have all grown less than expected.

Given the strong influence of international demand in terms of volume and unit value, and the orientation of the regional export industry towards foreign markets, the value offish exports is likely to continue to grow.

EUROPE

Fish production is important to many countries in the region (which includes the Russian Federation), in particular as a foreign exchange generator in the countries in transition and as a source of employment in coastal communities. The region is a net importer, both in value and volume.

Demand for fish is likely to increase in the future, given the positive perception of fish as a food item in the western part of the region and the recovery of previous consumption levels in the east. Fish production in the transition countries, in particular the Russian Federation, should stop declining soon and start to recover slowly.

Future fishing prospects for the industrialized countries depend mainly on the effectiveness of fisheries management in the Northeast Atlantic. Elimination of over

capacity and amore direct control of fishing efforts could be among the components of a scheme for improved management.

In order to meet future demand, the region as a whole will continue to be a net importer of fish.

NEAR EAST AND NORTH AFRICA

No country in the region depends substantially on fish and fishery products as a mainstay of the economy.

Fisheries are diversified, ranging from those based on relatively abundant resources off the Atlantic coast of Morocco, to coastal and inland-water fisheries of relatively poor resources.

It would seem reasonable to expect that, at least until 2010, a slight increase in demand could be met from higher regional landings of fish. Morocco will probably show a high increase in fish consumption as the economy and the fisheries sector expand. Fish consumption in Near Eastern countries is expected to remain relatively modest. Fish supply does not play, and is not expected to play, a substantial part in the food security of the subregion, but fish nonetheless constitutes an important alternative food source.

SUB-SAHARAN AFRICA

Fisheries are important in many African countries for their contribution to animal protein supplies, foreign exchange earnings and rural employment. An estimated 8 million people are directly or indirectly employed in the sector. Total production by the countries of the region(excluding production by foreign fleets not landed in the region) amounted to 3.9 million tonnes in 1994. Food fish consumption has declined recently, from an average per caput supply of about 9 kg in 1990 to less than 7 kg in 1994(live weight equivalent). The overall trade balance of the region has been positive (in value terms) for the past decade, even though the region only has a marginal role in international trade.

United Nations projections for population growth predict a regional population of 700 million inhabitants by the year 2000 and 915 million by 2010. At current levels of per caput food fish consumption, an increase of total supplies in the order of 2 million tonnes would be needed to meet demand in 2010.

The main future possibilities for increasing food fish supplies in the region include productivity enhancement programmes in small water bodies, aquaculture development, better utilization of small pelagic fish, relocalization of foreign fleets and increased imports.

Given the forecasts for modest growth in gross domestic product over the next 15 years, future prospects appear rather dim. Likely trends include further constraints on imports, increases in real fish prices, continued demand for mainly low-value species and the

continuing export of most demersal production. At the same time, lower public subsidies will increase production costs and weaken competitiveness in export markets in the process.

The implications for food security and supplies as well as for foreign exchange earnings are difficult to quantify but might be a cause for concern in the future.

EAST ASIA

Fish production is an important economic activity in the East Asian coastal States. The region is one of the world's largest fish-producing areas, with a total production of 36.6 million tonnes in 1994.

Fish consumption in the region should stay high and should even increase in some areas (both in volume and in per caput levels) along with population growth and improved consumer purchasing power. An exception may be Japan, where fish consumption is already high and population growth is close to zero. Japanese fisheries are unlikely to grow significantly over the coming decades.

The Republic of Korea is currently liberalizing its trade regulations on fishery products, and imports could be expected to increase. However, at the same time the country will remain an important exporter.

In China, the expected continuation of both rapid economic growth and expanding fish production will enable per caput consumption to increase further. Significant growth potential exists for freshwater aquaculture, principally through the rehabilitation of existing ponds and the utilization of waterlogged areas and the vast surface areas of paddy fields.

SOUTH AND SOUTHEAST ASIA

The South and Southeast Asia region includes some of the most productive fishing waters in the world. Total regional fish production was 19.5 million tonnes in 1994, representing 27 percent of the global catch.

The regional population is growing rapidly, and fish is a customary source of animal protein for most people. Domestic markets should grow rapidly in response to rising incomes, and higher prices on international markets will help expand exports of high-value wild and farmed fishery products. Higher incomes also mean more intraregional trade for both high-value products and low-price fish. By 2010, fish supplies will need to increase by 6 million tonnes merely to maintain current per caput consumption levels; because of the effect of economic growth on demand, even higher volumes will be needed.

However, most of the pelagic fish, crustaceans and demersal species in coastal fishing grounds in the Gulf of Thailand, the Gulf of Tonkin, the Bay of Bengal and the South

China Sea have been fully exploited or depleted. Although there are some moderately exploited fish stocks (e.g. anchovies, and smaller tunas and cephalopods in the Western Central Pacific), it is clearly unlikely that future demand will be met from significant increases in marine fish production.

Aquaculture, and to a lesser extent inland fisheries, may provide considerable opportunities for further development to increase regional fish production, particularly in Bangladesh, Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Thailand and Viet Nam. Nevertheless, the region will probably rely more and moreon imports of fishery products for its future supplies.

SOUTH PACIFIC

Although South Pacific fisheries (including fishing by foreign fleets) provide only about 2 percent of total world fishery production, the fisheries sector - together with tourism - plays a critical part in the economies of the States and territories of the region.

The region's fisheries resources are probably capable of meeting a somewhat increased future demand for fish, although it is likely that additional amounts of pelagic species will have to be consumed, particularly in urban areas and in other areas of high population concentration. The promotion of sustainable fisheries and the implementation of regional and national arrangements to ensure that fisheries resources are utilized rationally are major social and economic policy issues in the South Pacific, and most States and territories are attempting to deal with overfishing of inshore resources.

In the small island developing States (SIDS), the forecast is for a contraction of fish imports and a small increase in exports, mainly tuna. Fresh sashimi-grade tuna is already air-shipped to the Japanese market, but distance and other logistic problems will continue to hamper access to this lucrative market. Papua New Guinea might become an important exporter of canned tuna to the European market once its cannery is fully operational.

SOFIA IN-DEPTH STUDY: PATTERNS OF MARINE FISHERY LANDINGS AND FUTURE POTENTIAL

WORLD LANDINGS OF THE TOP DEMERSAL MARINE FISH SPECIES AND TOTAL

WORLD LANDINGS OF THE TOP PELAGIC MARINE FISH SPECIES AND TOTAL

The in-depth study, extracted from FAO Fisheries Technical Paper No. 359, Chronicles of marine fishery landings (1950-1994):Trend analysis and fisheries potential(1996),

presents an initial analysis of trends in marine resources as described in the FAO fishery production statistics for 1950 to 1994. During this period marine production of fish, crustaceans and molluscs grew from 18 to 90 million tonnes.

The first estimates of world fishery production were provided by FAO in 1945. They indicated that the total marine harvest was 39 billion pounds (17.7 million tonnes), of which 37 billion pounds were commercial landings and the remainder subsistence and recreational landings. Even then, one-third of the total landings were destined for reduction to fishmeal and oil. At that time only the North Pacific and North Atlantic fisheries were well developed, and these areas accounted for 47 and 46 percent of the total commercial harvest, respectively, while the southern parts of the Pacific and Atlantic Oceans accounted for 1 percent each and the Indian Ocean for 5 percent. The report publishing these estimates stated that there were considerable possibilities for fisheries expansion, mainly off Central America, off Peru and Chile, in the Caribbean, off West Africa and off Australia, New Zealand, the South Pacific Islands and the East Indies. The report recognized, however, that some stocks were already overfished and pleaded that the benefits of stock recovery in European waters during the Second World War should not be lost once normal fishing activity resumed. It stressed the essential need for fisheries conservation based on scientific evidence, particularly at the regional level, and recommended that FAO promote the collection of basic fishery data and analysis of them.

In the 50 years since that report was prepared, fisheries have developed rapidly, with the result that there are now few underexploited resources and an increasing number of overexploited ones. The challenge of implementing effective management has proved much more difficult than the authors of the 1945 FAO report could have expected.

SOME TRENDS IN LANDINGS: RELATIVE CONTRIBUTIONS OF PELAGIC AND DEMERSAL FISH

Production from marine fish species has risen from about 14 million tonnes in 1950 to about 73 million tonnes in 1994. Of this amount 10 percent is unspecified marine fish which is usually landed unsorted and which goes in part for reduction to oil or meal. The proportion in weight of the total marine fish landings that is accounted for by pelagic fish rose from about 50 percent in 1950 to over 60 percent in 1994. The production of pelagic fish increased in general over the period, with large oscillations reflecting natural variations of resource productivity as well as boom and bust fishing strategies. In terms of value, pelagic production is less important than demersal production, but the relative importance of the former has been increasing with time. In 1993 pelagic production accounted for about 40 percent of the total value of the marine fish landings compared with 50 percent for demersal fish and 10 percent for unspecified marine fish. Demersal fish production showed an increasing trend until the mid-1970s and has generally levelled off, with some oscillations, since then. The production of unspecified fish continued to increase throughout the time period considered, however, of their overfishing and the overfishing of those resources that have already reached the highest level of and this represents a major shortcoming of the data set.

FISHERIES POTENTIAL

The overall picture that emerges of the current state of world fisheries is consistent with the scenario presented in FAO's last world review of the state of marine fisheries, but with due consideration to the numerous caveats, it differs somewhat in regard to fisheries potential.

The study analyses the dynamics of the 200 top marine fish resources of the world in light of the rapid increase in fishing pressure. Results indicate that in 1994 about 35 percent of these resources were in the "senescent" phase (with declining landings), 25 percent more were in the "mature" phase at a high exploitation level, and 40 percent were still "developing"; none remained in the "undeveloped" phase. (These figures refer to "conventional" resources, as no time series of data exist for analysis of the state of non-conventional resources such as krill, mesopelagic fish and many oceanic squids which are usually considered underdeveloped.) A corollary is that there has been a gradual increase in the estimated amount of stocks requiring management, from almost none in 1950 to over 60 percent in 1994. The results underline the urgent need for effective measures to control and reduce fishing capacity and effort.

IMPLICATIONS FOR MANAGEMENT AND DEVELOPMENT

Resources that are currently below their historical peak levels of production could possibly be returned to these levels by reduction of fishing effort and, in most cases, simultaneous improvement of yield-per-recruit. This can be achieved by increasing significantly the age at first capture, prohibiting the exploitation of juveniles, increasing mesh sizes and closing temporarily or permanently areas of high concentrations of young fish.

An opportunity for improvement is the reduction of unwanted by-catch, which is an important problem. It has been estimated that 27 million tonnes of fish are discarded every year, comprising species of low commercial value but also a large proportion of juveniles.

Increases in production would come from further fisheries expansion for "developing" resources, i.e. those that make a still growing contribution to world landings.

In conclusion, the information available indicates that an increase in fisheries production of at least 10 million tonnes is possible. In addition, further increases in landings of an unknown magnitude could be obtained from fisheries development and mariculture. FAO indicated in 1995 in *The State of World Fisheries and Aquaculture* that 20 million tonnes more of landings might be obtainable. The results of the present study provide a firmer basis for believing that such an increase can be realized if:

· degraded resources are rehabilitated;

· underdeveloped resources are exploited further, with avoidance, sustainable exploitation they can stand;

· discarding and wastage are reduced.

INTRODUCTION

The increasing globalization of the world economy and the ever-continuing information explosion both affect world fisheries and, as a consequence, those who are responsible for formulating and implementing national policies in the fishery sector find that the nature and scope of their task is changing. Today one essential aspect of this task is the monitoring and analysis of international developments in a more systematic manner.

Globalization is manifested in the fisheries sector through expanding trade, a greater reliance on market forces in policy-making and a very rapid increase in the amount and international mobility of private investment capital. One concrete result is that growth in the demand for fish products, no matter where it occurs, may affect fish production anywhere in the world through the mechanisms of foreign private investment and/or trade.

The makers of national policies for fisheries and aquaculture find increasingly that an understanding of only the national conditions affecting the sector is insufficient. The international context must be understood and taken into account and, while this has already been the case for administrators, managers and policy-makers in the major fishing nations for the last two to three decades, it is now becoming essential to all fishing nations. The task of those concerned is growing rapidly in size and complexity - it is not only a matter of knowing where demand is likely to expand, and for which products, but also of being informed of possible technological developments, the requirements of foreign markets, the likely actions of potential competitors and the likely reactions of consumers.

The information explosion means that there is a continually expanding supply of information concerning fisheries and aquaculture, but a large part of the most easily available data is local in scope and seldom placed in a historical context. As a result, this body of information is frequently too large and heterogeneous to be useful to senior managers and needs to be monitored, evaluated, consolidated and shaped into scenarios of plausible future developments.

The State of World Fisheries and Aquaculture 1996 aims to do this by providing consolidated global information about recent developments in the sector and possible future trends.

The first section reports on trends in world production, utilization and trade of fish and fishery products (recent developments in aquaculture are reviewed separately). The section continues by reporting on the status and recent developments affecting four major

issues in fisheries: fishing capacity; by-catch and discards; environmental degradation; uncertainty and risk. The section ends with a brief outlook for the fisheries sector.

The second section presents a study of marine fishery landings data for the period 1950 to 1994. The study examines time series of landings data for about 200 major resources using a generalized fishery development model and shows that the overall development during the period comprised a reduction of fisheries in the underdeveloped phase and increases in the proportions of those in mature and senescent phases. The potential for further development is examined for each ocean.

The third section contains a review of recent developments in fisheries and aquaculture by geographical region. For this purpose the world has been divided into eight regions: the South Pacific, East Asia, Europe (including the independent European republics of the former USSR), Latin America and the Caribbean, North America, the Near East and North Africa, South and Southeast Asia and sub-Saharan Africa.

In the fourth section the fishery activities, including those carried out in cooperation with FAO, of 14 country groupings are reported in a summarized form.

The report has been prepared by the Fisheries Department of the Food and Agriculture Organization of the United Nations (FAO). Most of the staff of that department, including those posted in regional offices, have contributed in one way or another. Consultants have also contributed: D. Insull to the first section; and J. Swan and L. Westlund to the third. Initial editing was done by R. Flood. The report has been finalized and prepared for publication by FAO's Publishing Management Group where J. Shaw and M. Cappucci edited the text and designed the graphs, respectively, and M. Criscuolo designed the layout.

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WORLD REVIEW OF FISHERIES AND AQUACULTURE

This World Review comprises four parts. The first section briefly describes the most recent changes in fisheries and aquaculture production, utilization and trade. When the document was being prepared, only partial statistical information was available for 1995 and attention is therefore focused on 1994. Recent developments are put in historical perspective by graphs showing major developments since 1950.

The second section describes recent trends in aquaculture production which makes an increasingly important contribution to local food supplies. A number of factors relating to sustainability are examined in the third part of the review. In recent years, the world fishery community has focused increasing attention on the sustainability of fisheries. Concentrating on the period 1995 to 1996, the review reports on the major initiatives taken by the international community and by fishing nations. Relevant initiatives by non-governmental organizations (NGOs), industry and resource users are also mentioned.

The final section considers the outlook for world fisheries and aquaculture. Likely production levels of marine and inland capture fisheries and aquaculture are identified for the end of the century in the context of projected demand for, and supplies of, fish in the year 2010.

Recent trends in world fish production, utilization and trade

In recent years fish supplies have expanded rapidly and in 1994 they reached 109.6 million tonnes, mainly as a result of continued rapid growth in aquaculture production (especially in China) and in harvestable stocks of pelagic species off the west coast of South America. Consequently, both fishmeal production and fish supplies for human consumption have reached record levels.

A brief review follows of where and how this production increase came about and of what it has meant for utilization and trade.

Production and utilization

PRODUCTION

In 1994, the total global production of fish and shellfish from capture fisheries and aquaculture reached a record level of 109.6 million tonnes, just over 7 million tonnes more than it had been in 1993 (or a 7 percent increase). Most of the increase came from marine capture fisheries, which accounted for 4.9 million of the 7.3 million tonne increase, with just under 0.5 million tonnes being produced from mariculture (Figure 1).

Most of the remaining 1.9 million tonnes came from inland aquaculture production, mainly from Asia, while some 0.25 million tonnes were reported from higher inland capture fishery production, again mainly in Asia (Figure 2).

Preliminary figures for 1995 indicate a new peak of total production at 112.3 million tonnes (Table 1). Provisional production figures for mariculture and inland aquaculture show an estimated increase from 18.6 million tonnes to 21.0 million tonnes, more than offsetting the decline in the harvest from marine and inland capture fisheries of about 0.6 million tonnes with respect to 1994, reaching a volume of about 91.0 million tonnes. Asia, especially China, contributed most of the increase in aquaculture production.

These production figures show that the recent pattern of production continues, with regard to capture fisheries and aquaculture. The trend for demersal fisheries, however, is markedly different from that characterizing pelagic species.

Global landings of pelagic fish (which, with the exception of high-priced tunas and other large pelagics, are relatively low-priced fish) have shown an underlying upward trend since 1950. This trend continues and is particularly apparent when five highly variable species - anchoveta, Atlantic herring, Japanese pilchard, South American pilchard and chub mackerel - are excluded.

In contrast, landings of demersal fish, which obtain relatively high prices, have remained constant since the 1970s. This situation, which has occurred in spite of the setting up of new fisheries for established species, is particularly apparent when the relatively variable landings of Alaska pollock are excluded.

The rapid growth in aquaculture production is the result of the increased predominances of Asia and of carp species - in 1994 carps accounted for almost half of the total volume of aquatic products produced through culture (aquatic plants excluded). As a consequence of the relatively slow geographical spread of aquaculture and a relatively small increase in the number of species under culture, the predominance of long-established producers and traditional species increased.

UTILIZATION

The increase in catches from marine fisheries in 1994 was mainly owing to greater catches of anchoveta in the southeast Pacific, a stock that is subject to massive fluctuations depending on El Niño conditions. These catches are generally reduced to fishmeal and fish oil and form the largest single source of fish used for reduction. Consequently, the global use of fish for reduction to fishmeal and fish oil in 1994 was estimated to have been a record almost 33 million tonnes (Figure 3).

The net increment in 1994 of fish available for direct human consumption was almost entirely owing to aquaculture production. Despite record levels, food fish production from capture fisheries was only 0.79 million tonnes higher than in 1993. The quantity of fish available for direct human consumption totalled about 76.6 million tonnes, up from 73.7 million tonnes in 1993, corresponding to the increase in inland aquaculture production. Globally, the increase in the total quantity available for direct human consumption resulted in a very small increase in average per caput availability of fish in 1994 to 13.6 kg (Figure 3).

Figure 1. Inland and marine fishery production

Source: FAO
Figure 2. Production for principal major fishing areas
Source: FAO
Of the preliminary figure of 112.3 million tonnes of total fishery production in 1995, it is calculated that some 31.5 million tonnes were used for reduction. Anchoveta catches in the southeast Pacific were somewhat lower than they had been in 1994 and catches of small pelagic species for reduction in the other main fishmeal exporting countries were, on aggregate, also slightly lower than those of the previous year.

Fish available for direct human consumption in 1995 was estimated to be 80 million tonnes, 3.4 million tonnes more than in 1994, representing a greater increase than the estimated population growth rate in the same year. The average annual per caput availability of food fish increased to 14 kg. As in the previous year, most of the production increase occurred in Asia, particularly China.

TABLE 1

World fishery production (million tonnes)

	1990	**1991**	**1992**	**1993**	**1994**	**1995**
Inland:						
Aquaculture	8.26	8.74	9.55	10.86	12.46	14.60
Capture	6.54	6.21	6.21	6.46	6.71	7.00
Total inland	**14.80**	**14.95**	**15.76**	**17.32**	**19.17**	**21.60**
Marine:						
Aquaculture	4.13	4.43	4.87	5.62	6.10	6.70
Capture	78.92	78.38	78.72	79.24	84.31	84.00
Total marine	**83.05**	**82.81**	**83.59**	**84.86**	**90.41**	**90.70**
Total aquaculture	12.39	13.17	14.42	16.48	18.56	21.30
Total capture	85.46	84.59	84.93	85.70	91.02	91.00
Total world production	**97.85**	**97.76**	**99.35**	**102.18**	**109.58**	**112.30**
Human consumption	70.31	69.49	71.40	73.73	76.60	79.92
Reduction	27.54	28.27	27.95	28.45	32.98	31.48

Source: FAO.
FISH PRODUCTION BY TYPE OF ECONOMY

Recent production trends continued in developed industrial economies, economies in transition and developing economies (Figure 4).

Production in the European Union (EU) countries and the United States remained relatively stable or increased and Japanese production continued the downward trend started in 1988. Fish production in the economies in transition continued to decline, with aggregate production declining from 7.6 million tonnes in 1992 to 5.2 million tonnes in 1994. However, in 1995, for the first time in several years, the Russian Federation's production increased, although its total of 4.23 million tonnes was still lower than the 4.46 million tonnes it produced in 1993.

Aggregate production in the low-income food-deficit countries (LIFDCs) continued the pattern of high growth that has characterized recent years, showing an average annual rate of increase of 6.9 percent during the period 1988 to 1994. In 1994, LIFDCs accounted for 35 percent of total production, compared with 26 percent in 1988 (Figure 5).

This increase has generally taken place in LIFDCs that are large fish-producing countries, such as China (14 percent average annual increase between 1990 and 1994), India (5 percent), Bangladesh (6 percent), Morocco (7 percent), Indonesia (7 percent) and the Philippines (14 percent). These countries also account for 73 percent of the global population of LIFDCs. However, in most LIFDCs, production has changed little over recent years, and in some of them it has dropped considerably.

PRODUCTION BY PRINCIPAL PRODUCERS AND REGION

Twenty countries account for about 80 percent of total world production, while ten countries account for almost 70 percent (Figure 6).

China has been the largest producer since 1988, when it overtook Japan, having started to increase production dramatically in the early 1980s. The consecutive increases in production in 1994 and 1995, driven by aquaculture production, have been referred to above.

In examining the changes in fish production by the comparative performance of each major region, the region showing a marked decline in production in recent years is Europe, which here includes the European republics of the former USSR (Figure 7).

The decline in European production is confined to the former centrally controlled economies in Eastern Europe and the former USSR. The expansion of production in China accounts for most of the growth achieved by the East Asia group, while the increase in anchoveta catches in the southeast Pacific has driven the expanded production of Latin America and the Caribbean. Production in South Asia and Southeast Asia has contracted slightly, while a greater decrease in production in North America is owing to the contraction of Canadian east coast fishing activities. Other regions have shown little change in production.

Figure 3. World fish utilization

Source: FAO

Figure 4. World fishery production by economic group

Source: FAO

Recent trends in trade of fish and fish products

The value of international fish trade continues to increase. In 1985, the value of international fish exports was US$17 billion; five years later (in 1990) it was $35.8 billion and in 1994 exports were valued at $47 billion. The increased volume of international trade in fishery products in 1994 was associated with higher trade in low-value commodities such as fishmeal, with the result that the value of exports increased less than the volume. Preliminary figures for 1995 indicate an increase in the value of trade caused by higher prices. In recent years, however, the growth in value of the international fish trade has slowed down (Figure 8).

Figure 5. Fishery production for low-income food-deficit countries (LIFDCs) in relation to other economic classes

Source: FAO

In 1995, developed countries accounted for about 85 percent of total fish imports in value terms. Japan continued as the world's largest importer of fishery products, with some 30 percent of the global total. The United States, which is the world's second major exporter of fish and fishery products, was also its second biggest importer and the EU further increased its dependence on imports for its fish supply. In 1995, fish imports by all three major importers increased (Figure 9).

For many developing nations, fish trade represents a significant source of foreign currency earnings. The increase in net receipts of foreign exchange in developing countries - deducting their imports from the total value of their exports - is impressive, rising from US$5.1 billion in 1985 to $16 billion in 1994, with a further increase likely for 1995.

SHRIMP

In 1994, shrimp supplies on international markets were low relative to the high demand, especially in the United States, but also for most of the year in Japan. An important constraint on supply was the relatively low exports from China, with exports to Japan being one-third lower than the previous year and only half the quantity of 1990.

In 1994, shrimp imports to both Japan and the United States reached record levels of 303 000 tonnes to Japan and 284 800 tonnes to the United States. In spite of this, prices rose and, for certain species on national markets, for example Indian white prawn on the Tokyo market, reached record levels. The high prices for shrimp on the two major markets led to a mixed market situation in Europe, where markets with strong currencies reported higher imports (although France was an important exception to this phenomenon), while traditional markets with relatively weak currencies, notably Italy and Spain, were not able to increase their shrimp imports.

In 1995, in both the main markets shrimp imports declined from their previous high levels. A reported shortage of supplies leading to higher prices may well have been a reason for this decline. Japanese imports slumped from 303 000 tonnes to 293 000 tonnes, while United States imports were 5 percent lower than in 1994, at 270 900 tonnes. The European market, however, was stronger than in the previous year, and imports to France, Italy and Spain all increased. However, lower imports to the two major markets appeared to result in a fall in prices.

Figure 6. Production by principal producers in 1994 and cumulative production as percentage of world total

Countries listed are those with a production above 1.1 million tonnes

Source: FAO/FIDI

TUNA

Japan is the world's major market for tuna products. Apparent tuna consumption exceeds 1 million tonnes per annum, or almost 30 percent of world catches. About 70 percent of consumption is contributed by Japanese production, with the remainder being met by imports. In 1994, Japanese imports were 320 000 tonnes, increasing slightly in 1995 to 324 000 tonnes.

The United States is the second largest market for tuna, almost all canned, but the market is currently contracting and consumption of tuna has fallen from about 30 percent of world catches in the late 1980s to about 20 percent in 1995. In 1995, some 96 500 tonnes of canned tuna were imported by the United States, down from 113 000 tonnes in 1994. Possible reasons for this decline include competition with other fast foods, less advertising, smaller cans and changes in quality.

On the other hand, European countries have reported a large increase in tuna consumption in the 1990s, with Spanish, French and United Kingdom markets expanding strongly.

COD

In 1994 and 1995, the world market for cod was characterized by large exports of dressed cod from the Russian Federation to Canada, Iceland and Norway for further processing. The Russian Federation, together with Norway, has been able to take advantage of the relatively high quotas for cod in the Barents Sea. Norway, which is the largest importer of Russian caught cod, imported some 100 000 tonnes in 1995. As a result, Norway's exports have expanded despite lower domestic landings. The influx of cod of Russian origin together with only moderate demand, have meant that prices were low on both sides of the Atlantic in 1994, recovering a little in the first part of 1995, to fall back again in the second part of the year.

Prices were further depressed by the availability of low-priced hake from Chile and Alaska pollock.

SQUID

Squid catches were generally low in 1994, with only a few countries reporting greater catches and all the major squid-catching countries reporting lower catches than in 1993. In response, prices increased. In 1995, large catches of *Loligo* sp. squid were reported, but *Illex*, which is the prime product in the important Spanish market, continued to be in short supply. Consequently, prices of *Illex* remained high in 1995.

Figure 7. Total fishery production by region

Source: FAO

High squid prices in Spain in 1995 enabled Mexico and Peru to export Pacific squid, which was previously considered unacceptable to Spanish consumers until its low price and some innovative processing methods created a niche in the market.

CANNED SARDINES AND MACKEREL

World imports of canned sardines have shown a gradual decline over the past ten years, totalling 127 800 tonnes in 1994 compared with 143 300 tonnes in 1985. Moreover, in the expanding market for fish products and preparations, the market share of canned sardines fell from 10.7 percent in 1985 to 6.1 percent in 1994.

While canned sardines have taken part in a general downward trend in the consumption of canned small pelagic species over recent years, world imports of canned mackerel increased from 53 543 tonnes in 1993 to 88 211 tonnes in 1994. Nevertheless, as with canned sardines, the market share of canned mackerel has fallen, from 4.1 percent in 1984 to 3.6 percent in 1994.

SALMON

In 1994 and 1995, salmon production increased significantly. An important factor was the increased production of farmed salmon. In addition, there were particularly good harvests of wild salmon in both years in Alaska and Japan. Total world production of salmon now exceeds 1.4 million tonnes per annum, of which farmed salmon contributes about 440 000 tonnes.

Despite increased supplies, prices stayed relatively buoyant in 1994, but in 1995 European market prices declined significantly, especially for Atlantic salmon from Norway. World production will probably continue to expand, presenting market challenges to the producers.

Figure 8. Growth of world fish production and international trade

Figure 9. Share of major markets in total international trade in 1994

FISHMEAL

The high anchoveta catches in the southeast Pacific in 1994 resulted in record levels of fishmeal production in Chile and Peru. At the same time, the demand for fishmeal was high and world exports achieved record levels. Southeast Asian and East Asian countries accounted for more than half the total imports of over 4 million tonnes, China being the main fishmeal-importing country with imports of 690 000 tonnes.

Increased demand in 1994 resulted in significantly higher prices. This situation continued in 1995; fishmeal production was high again, although not as high as in 1994, and exports were only marginally lower.

Figure 10. Global trends in aquaculture production

Source: FAO
Similarly, demand was still high, mainly from China. As in 1994, prices continued to increase to record levels, falling back only in early 1996 in response to the competition from soymeal.

Trends in aquaculture production

The continued expansion of aquaculture since the 1980s was sustained in 1994 (Figure 10). Aquaculture increased its contribution to world fishery production and maintained its position as one of the fastest-growing food production activities in the world.

In 1994, total production of finfish, shellfish and aquatic plants reached a record 25.5 million tonnes with a value of US$39.83 billion (ex-farm), representing overall increases of 11.8 and 10.3 percent over 1993 production in weight and value respectively (Figure 11).

Asia increased its dominance as an aquaculture producer of finfish, shellfish and aquatic plants in 1994. China and India supplied 60 percent of total world production, while five countries, all Asian, accounted for about 80 percent of world aquaculture production (Figure 12).

Aquaculture production continued to expand in developing countries (Figure 13).

Between 1990 and 1994, aquaculture production within LIFDCs rose sharply at an average annual rate of 17 percent and, in 1994, accounted for 75 percent (or 19.1 million tonnes) of world production of finfish, shellfish and aquatic plants.

The number of species under culture continues to grow, as does the number of countries reporting aquaculture production. Aquaculture species reported for the first time in 1994 included European abalone and largemouth bass. An increasing number of countries

cultured crustaceans and oysters; in 1994, Portugal reported production of giant river prawn for the first time, Mexico produced crayfish and cupped oysters, Cyprus produced Indian white prawn and the Channel Islands, cupped oyster.

The relative importance of aquaculture to total fishery production varied markedly among countries in 1994 (Figure 14).

Although cultured fish and shellfish contribute significantly to total national fishery production, farming activities in most countries are dominated by a few species such as carps in China and India and oysters and mussels in Japan, the Republic of Korea and France. Most of the world's production of milkfish is reported from the Philippines and Indonesia. Cultured milkfish account for 42 percent of total production in the Philippines and for 27 percent in Indonesia.

The culture of cyprinids, in particular freshwater herbivorous Chinese carps produced largely under semi-intensive and extensive aquaculture systems, dominated finfish production and 9.2 million tonnes were farmed, mainly in China. The four Chinese carps - the silver, grass, common and bighead carps - represented the top four cultured species by weight and made up half of total finfish production (Figure 15).

Figure 11. Aquaculture production by categories of species in 1994

Source: FAO

Figure 12. Contribution of principal countries to global aquaculture production of finfish and shellfish

Source: FAO

Figure 13. Aquaculture production of finfish and shellfish by economic class

Source: FAO

Total prawn and shrimp production recovered well in 1994 after disease outbreaks caused production to fall in 1992 and 1993. Reported production rose from 0.84 million tonnes in 1993 to over 0.92 million tonnes in 1994. The culture of the giant tiger prawn expanded from 0.33 million tonnes in 1991 to 0.51 million tonnes in 1994, while the culture of the fleshy prawn in China collapsed from a peak of 0.22 million tonnes in 1991 to 0.06 million tonnes in 1994.

The giant tiger prawn, which ranked eighth by weight, was the most valuable cultured species in 1994 (US$3.43 billion), with the silver carp ($2.20 billion), common carp ($2.02 billion) and grass carp ($1.69 billion) being the third, fourth and fifth most valuable species. Global aquaculture thus continued to be dominated in both weight and value by freshwater finfish production. Although crustaceans contributed only 4 percent of production by weight, their higher unit value meant they contributed 18 percent of total value.

Review of initiatives in major management issues

In the first half of the 1990s, the international community addressed several of the management issues connected with sustainable fisheries; how to reduce overfishing and control fishing capacity; how to reduce by-catches and discarding; how to reduce environmental degradation of catchment and coastal areas; and how to deal with uncertainty and risk.[1]

[1] The 1990s have witnessed many international agreements and accords relating to the intentions of the international community to achieve sustainable fisheries. These agreements represent milestones in international efforts over many years and include the United Nations Convention of the Law of the Sea in 1982 (which entered into force in November 1994); the preparatory work, mainly undertaken in 1990-92, which resulted in Chapter 17 of Agenda 21 of the United Nations programme of action which includes seven programme areas relating to coastal areas and the oceans; the 1992 International Conference on Responsible Fishing, held in Cancun, Mexico; and the 1993 Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas.
Each of these issues is briefly reviewed in terms of the roles played by the international community, by governments and by NGOs, mostly, but not exclusively, during the period 1995 to 1996.

Overfishing and fishing capacity

THE ISSUE

Overfishing is not a recent issue. It was formally recognized internationally in the early 1900s and was the subject of the London Conference on Overfishing in 1947. Subsequently, it has become prevalent in most fishing areas and affects capture fisheries in developing and developed countries, often becoming articularly severe in densely populated coastal areas and in very productive offshore areas.

Figure 14. Contribution of finfish and shellfish culture to national fishery production in 1994

Source: FAO
Figure 15. Farmed production of major finfish and shellfish species

Unless effective action is taken, overfishing will get worse. In many developing countries, population pressure and the shortage of alternative employment opportunities, together with the lack of effective conservation and management policies, will increase the attraction of fisheries as a last resort of employment.

While the problems and their severity differ from one situation to another, important factors contributing to excessive fishing effort include:

· a reluctance by many governments to restrict access and to take the necessary conservation and management decisions, frequently giving priority to economic and social objectives with short- to medium-term benefits in preference to other complementary biological and social objectives with long-term sustainable economic benefits;

· a lack of financial and technical resources to formulate and implement the necessary management actions in many developing countries;

· slow growth in employment and production in many developing countries, which effectively limits fishermen's possibilities to leave fisheries for other occupations;

· management authority that is not being devolved to the lowest practical level;

· insufficient control of fishing fleets by both flag states and port states, leading to considerable unauthorized fishing;

· a lack of commitment to international cooperation towards joint management, often coupled with a limited effective authority of regional fisheries bodies.

ACTION AT INTERNATIONAL LEVEL

The problem of excess fishing capacity and the need to control fishing effort were addressed in the Rome Consensus on World Fisheries (Box 1), in Article 7 of the Code of Conduct on Responsible Fisheries (Box 2), in the Kyoto Declaration (Box 3), in the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, adopted in New York in August 1995 (Box 4) and in the resolution on fishery matters adopted by the 95th Inter-Parliamentary Conference, held in Istanbul in April 1996. In addition, the 1996 draft *Report of the ad hoc Intersessional Working Group on Sectoral Issues of the Commission on Sustainable Development* urged states "... to take steps to reduce overcapacity and prevent any net increase in over-fished or depleted stocks...". These international initiatives have also reiterated the need to strengthen regional and subregional bodies and arrangements to facilitate conservation and management.

For high seas fisheries, the conclusion of the UN Agreement should serve to enhance the conservation and management of the two types of stocks it embraces if states implement it as intended. However, its effectiveness will depend on the level of international cooperation developed, on the capacity and willingness of flag states to exercise control over their flag vessels and on the extent to which subregional and regional organizations and arrangements are adapted or established to carry out the required conservation and management functions. Ultimately, the success of the Agreement will depend on the willingness of flag states to contribute equitably to the required reduction in excessive fishing effort which characterizes many high seas fisheries.

Subregional and regional fisheries organizations and arrangements are required to facilitate the conservation and management of shared fisheries resources. The UN Convention on the Law of the Sea provides for cooperation in fisheries management through competent subregional, regional or global organizations. Agenda 21 called for the strengthening of international cooperation to supplement and support national efforts in implementing strategies and activities for marine and coastal areas and seas.

GOVERNMENT INITIATIVES

Despite the difficulties, efforts are being made to reduce excess fleet capacity and to improve management. Box 5 summarizes the action taken by some states to make management more efficient by creating fishing rights (such as effort quotas, individual transferable quotas [ITQs] and limited entry into fisheries) or adopting new approaches (such as community-based management) to management. Countries that have taken, or are taking, steps to restructure their fisheries sector and implement comprehensive and effective fisheries conservation and management measures in areas under their national jurisdiction include Argentina, Australia, Canada, Chile, the members of the EU, Iceland, Japan, Malaysia, Namibia, New Zealand, Norway and the United States.

BOX 1
THE ROME CONSENSUS ON WORLD FISHERIES

adopted by the FAO Ministerial Meeting on Fisheries, Rome, 14 to 15 March 1995

The Consensus was adopted at a Ministerial Meeting attended by ministers of 63 countries and senior officials from a further 71 countries. In addition the meeting was attended by the Holy See, other UN agencies, the Organisation for Economic Cooperation and Development (OECD), the World Bank, the African Development Bank, intergovernmental organizations (IGOs) with a responsibility for fisheries and NGOs. The meeting urged governments and international organizations, *inter alia*, to:

- reduce fishing to sustainable levels in areas and on stocks currently heavily exploited or overfished;
- adopt policies, apply measures and develop techniques to reduce by-catches, fish discards and post-harvest losses;
- review the capacity of fishing fleets in relation to sustainable yields of fishery resources and where necessary reduce these fleets;
- strengthen and support regional, subregional and national fisheries organizations and arrangements for implementing

conservation and management arrangements;
- increase consultation on fisheries with the private sector and NGOs;
- implement effectively the relevant rules of international law on fisheries and related matters which are reflected in the provisions of the UN Convention on the Law of the Sea.

BOX 2

THE CODE OF CONDUCT ON RESPONSIBLE FISHERIES

adopted by the Conference of FAO, Rome, October 1995

The development of the concept of responsible fisheries and the elaboration of a Code of Conduct to this end was requested by the 19th Session of the FAO Committee on Fisheries (COFI), held in March 1991. The Code was adopted at the 28th Session of the Conference of FAO in October 1995. It contains the following Articles:

- 1. Nature and scope of the Code;
- 2. Objectives of the Code;
- 3. Relationship with other international instruments;
- 4. Implementation, monitoring and updating;
- 5. Special requirements of developing countries;
- 6. General principles;
- 7. Fisheries management;
- 8. Fishing operations;
- 9. Aquaculture development;
- 10. Integration of fisheries into coastal area management;
- 11. Post-harvest practices and trade;
- 12. Fisheries research.

FAO is preparing guidelines in respect of Articles 7 to 11 in support of the implementation of the Code by governments and resource users.

BOX 3
THE KYOTO DECLARATION

In 1995, the Government of Japan, with technical assistance from FAO, convened the International Conference on the Sustainable Contribution of Fisheries to Food Security. The Conference adopted the Kyoto Declaration and Plan of Action on the Sustainable Contribution of Fisheries to Food Security. The Declaration is a comprehensive document which takes into account UNCED and post-UNCED fisheries initiatives and other fisheries considerations that undermine sustainable resource use and that, in turn, constrain the fisheries sector's contribution to food security. The Declaration and Plan of Action were a major sectoral contribution to the 1996 FAO World Food Summit.

In the Plan of Action it was agreed, *inter alia*, that states and FAO, in cooperation with IGOs and/or regional fisheries management organizations and arrangements, should:

- assess and monitor trends in the demand and supply of fish and their effects on food security, employment, consumption, income, trade and sustainable production;
- enhance subregional and regional cooperation and establish, or strengthen, subregional and regional organizations and arrangements for the purposes of conserving and managing fisheries resources;
- conduct, through cooperative mechanisms, integrated assessments of fisheries to evaluate opportunities and strengthen the scientific basis for multispecies and ecosystem management;
- identify and exchange information on mechanisms to reduce excess fishing capacity and on action to reduce excess capacity as soon as possible;
- increase efforts to estimate the quantity of fish, marine mammals, sea birds, sea turtles and other sea life that is incidentally caught and discarded in fishing operations and minimize waste and discards through the development and use of selective, environmentally safe and cost-effective fishing gear and techniques;
- promote information exchange among research institutes to increase opportunities for the sustainable use of unexploited or underexploited species for human food and promote and support research activities to improve scientific knowledge of existing fishery resources;
- strengthen national and international coordination to stimulate

environmentally sound aquaculture and stocking programmes;
- provide and coordinate technical and financial assistance for developing countries, in LIFDCs and small island developing states, and encourage cooperation among these countries in order to allow fisheries to contribute to food security through such means as the rapid transfer of technology and expertise in enhancement in inland fisheries and marine waters, upgrade and increase the capabilities needed to minimize post-harvest losses, and ensure improved control of fishing activities within areas under national jurisdiction.

BOX 4

AGREEMENT FOR THE IMPLEMENTATION OF THE PROVISIONS OF THE UNITED NATIONS CONVENTION ON THE LAW OF THE SEA OF 10 DECEMBER 1982

Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, August 1995

The Agreement, consistent with the 1982 United Nations Convention on the Law of the Sea, was reached by consensus following negotiations over two years between two principal groups - the distant-water fishing nations and the coastal states - at the Conference on the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.

The importance of the Conference and its Agreement lies partly in that it affects an estimated 10 percent, or more, of the total world fish stocks taken on the high seas. More significantly, however, the Agreement affects the interrelationship between, on the one hand, fishing in zones of national jurisdiction and, on the other, high seas fishing, when straddling fish stocks and highly migratory fish stocks are targeted in both jurisdictional areas. International cooperation regarding these two types of stocks is essential in order that the conservation and management regimes adopted in both types of area are complementary.

The Agreement adopted by the Conference was seen by some states, IGOs and NGOs as not entirely satisfactory and was regarded by many as yielding too little too late, while other states and industry groups felt

that it went further than they considered necessary. Nevertheless, if the Agreement is implemented effectively and fully, the conservation and management arrangements and mechanisms it contains represent a significant step forward to achieving more rational exploitation of straddling fish stocks and highly migratory fish stocks, and to ensuring that these stocks are harvested sustainably, as stated in Chapter 17 of Agenda 21.

It was stated above that the successful implementation of the UN Agreement depends on the willingness and capacity of the governments concerned to make the Agreement work, acting through regional and subregional organizations and arrangements. Many existing subregional and regional bodies are not as effective as intended. The difficulties they encounter in implementing conservation and management measures is often reflected in the poor state of the resources they are set to manage.

The requirements of many developing countries for technical and financial assistance in improving their own management, conservation, monitoring, control and surveillance (MCS) capacities, has been mentioned in a number of international statements and documents in recent years. According to the Fishery Investment Project Information System (FIPIS) database maintained by FAO on behalf of donor organizations, in the period 1992 to 1995, official external assistance for management and conservation, extended through 136 projects, amounted to a total financial commitment of over US$105 million in 45 countries.

ACTION BY NGOS, RESOURCE USERS AND INDUSTRY

NGOs have produced important documents on conservation and management and exercise considerable influence on public opinion and government policies regarding conservation and management. A specific initiative by NGOs in cooperation with the fishing industry is in operation to establish a worldwide system of ecocertification and labelling of fishery management systems and fishery products. In 1995, Greenpeace[2] suggested that groups representing all those concerned should be established to support marine conservation and management through various activities such as certification of products, training and education. In a similar initiative, a major European (national) association for the fishing industry and fish trade has suggested that its members adhere to a number of principles embodying the proper conservation and management of fish resources. A major multinational company has set up a joint working party with the World Wide Fund for Nature (WWF) to ensure ways of improving fishing practices and guaranteeing a healthy and sustainable marine ecosystem. Similarly, a major European multiple food retailer has announced that it will phase out the sale of products using oil from fisheries that specialize in supplying fish to be converted into fishmeal and oil.

[2] Greenpeace International. 1996. *Greenpeace principles for ecologically responsible fisheries*. Amsterdam, the Nether-lands. 6 pp.

BOX 5
Adapting the capacity of fishing fleets to available resources

The existing overcapacity in the world's fishing fleet contributes to falling stocks and causes major economic losses to society. These consequences constitute serious problems that are difficult to overcome. Those who benefit - albeit often in the short term - from the inability of many administrations to limit access effectively generally oppose any interference with access rights, often on the grounds that such interference would amount to the redistribution of income and wealth.

Progress is being made, however. In recent years a number of countries (including Argentina, Chile, Malaysia, Namibia, Australia, Canada, Iceland, Japan, New Zealand, Norway and the United States) have introduced conservation and management measures that limit fisheries inputs and outputs. The policy instruments used include: ITQs; buy-back schemes; and other modifications to rights of access (such as "closed areas"). In general, the situation has improved and in some of these countries the fishing industry itself has started to benefit - usually by becoming more cost-competitive.

By restricting areas to a selected number of licence-holders, a defined and limited user group is created. A scheme under which a limited number of licences are made available will generally halt the constant increase in capacity that results from open access and, in fact, such a scheme may well lead to a decrease in capacity. This provides a condition that may, given appropriate support, lead to increased cooperation within the group and the group's acceptance of some of the responsibilities of management. In the northern Australian prawn fishery, for example, the fishermen found it to their advantage to cooperate in restraining their catch of smaller and lower-priced prawns and invested in the research needed to tell them when they should move from one stock to another in order to focus on the larger prawns. Although beset with imperfections, a scheme providing a limited number of licences may set the stage for the eventual resolutions of the problems of overcapacity.

In order to limit capacity and reduce effort in particular fisheries, a number of governments now implement buy-back schemes for vessels. Combined with a moratorium on the entry of any new vessels into the fishery, this helps to prevent the build-up of capacity, which is particularly likely to occur when it is anticipated that a closed access scheme will be established.

Some states (e.g. Australia, Iceland and New Zealand) have introduced

conservation and management systems based on ITQs. Such systems affect the nature of resource ownership by converting a publicly owned and used resource into a publicly owned but privately used resource. Developing states face many difficulties with respect to the conservation and management of subsistence and small-scale, commercial fisheries. Among the problems to resolve in some of these fisheries are the relocation and redeployment of fishermen who would be displaced as a consequence of limited entry policies. It must be recognized, however, that the failure to limit entry in overexploited artisanal and small-scale fisheries will only destruct these fisheries further and contribute to the long-term impoverishment of communities dependent on them for their livelihoods.
Fisheries conservation and management are generally high-cost activities when undertaken by a centralized, public administration. Buy-back schemes and the implementation of limited licence schemes and/or of ITQs require the constant and continuing involvement of administrations in the management process. Given the broad consensus regarding the need for better management, however, industry is assuming greater financial responsibility for, and increased participation in, essential conservation and management decisions. In some countries (e.g. Australia and Japan) the industry is closely involved in setting research priorities in support of fisheries conservation and management and in cost-sharing for the research undertaken. In developing countries the high cost of management is a serious problem; funds are frequently not available to pay for the operational and cost-effective implementation and enforcement of conservation and management measures. This is in spite of the fact that the long-term social costs of non-management are high and, therefore, the real costs of management are far lower to society than the direct expenditures incurred for the management scheme.

By-catch and discards
THE ISSUE

Most fishermen at most times catch more types of fish, and sometimes fish of smaller size, than they aim to. The unintended catch is usually referred to as the “by-catch”. Some of the by-catch is useful and is kept; the rest is discarded which usually means returned to the sea.

[3] The proportion that is discarded may be imposed or required by management regulations or may be the result of the fisherman’s assessment of the costs and benefits of bringing the by-catch ashore versus discarding it. The outcomes of these assessments vary; what is discarded one day may be kept the next.

[3] By-catch is taken to mean all species captured other than the target species. Discards may include a small to significant fraction of the captured target species (normally undersized fish) together with non-target species.

When the by-catch consists of a small proportion of mature specimens from healthy stocks the incurred fishing mortality does relatively little damage, but when the by-catch consists of juveniles of commercial species it may be quite damaging. If large numbers are caught, it is likely to reduce the future numbers of mature fish. For this reason fishery managers increasingly resort to the closure of fishing in those areas where juveniles are numerous, for as long as they remain in large concentrations.

The consequences of discarding and the valuation of these consequences are complex issues. The valuation ought to take account of a possible commercial value, a possible aesthetic value and the extent to which discarded species enhance or detract from system productivity. In general, however, at the moment that discarding occurs, the consequence is usually a waste of human food.

The need to minimize discards in industrial fisheries has become a major issue.[4] In 1994, FAO showed that the proportion of the world fish catch made up of by-catch might be much larger than previously considered and estimated that discarding amounted to an average of 27 million tonnes per year (or about 32 percent of the total reported annual production of marine capture fisheries).[5]

[4] In most small-scale fisheries most of the catch is retained and landed.

[5] FAO. 1994. *A global assessment of fisheries by-catch and discards*. FAO Fisheries Technical Paper No. 339, by D.L. Alverson, M.H. Freeberg and J.G. Pope. Rome.

The occurrence of by-catch and its subsequent discarding are sometimes seen by the public as the results of careless fishing. It should be clear from what has already been said that this is a misconception. Discarding is a consequence of the very nature of fishing and it can be reduced but not completely eliminated. The direct reasons for discarding are: biological (i.e. there is a mixture of species available on the fishing grounds); technological (i.e. it is difficult to target specific fish for capture); economic (i.e. the accidental capture of fish of no value to the catcher); or legal.[6] However, the tendency to discard may be significantly strengthened by management regulations (such as quota and minimum landing size regulations).

[6] In some fisheries fishermen are limited as to the total quantities of fish of certain species that they can bring ashore. Fishermen then have an incentive to discard specimens of inferior size or quality if they believe that they will be able to fill their quota with better specimens obtained during later fishing trips.

The approaches adopted to deal with discarding may be technological (e.g. reducing by-catches through the use of selective gear) or commanding and controlling (e.g. making it mandatory not to throw by-catches back into the sea) or they may offer an economic

incentive. In general, approaches are likely to be complementary and will be the result of comparing the perceived benefits to be derived from improving the state of the fish stock (including the conservation of biological diversity) to the short-term costs on the industry.

ACTION AT INTERNATIONAL LEVEL

This issue has been addressed in most major fisheries initiatives since the United Nations Conference on Environment and Development (UNCED), which was held in Rio de Janeiro, Brazil, in June 1992. In general, since UNCED, fisheries conservation and management practice have emphasized an ecosystem approach which takes full account of the need to exploit fisheries in a precautionary manner. The ecosystem approach differs significantly from past approaches to conservation and management, in which the primary concern was the impact of fishing gear on the target species with less concern for impacts on non-target species and the aquatic environment. Documents to which states have subscribed and which contain specific statements on the need to reduce by-catch and discards include Chapter 17 of Agenda 21, the Rome Consensus, the Code of Conduct for Responsible Fisheries, the Kyoto Declaration, the UN Agreement, the United Nations General Assembly Resolutions 49/118 of 1994 and 50/25 of 1995[7] and the Resolution of the 95th Inter-Parliamentary Conference.

[7] United Nations General Assembly Resolutions 49/118 of the 49th Session of the United Nations General Assembly in 1994 and 50/25 of the 50th Session in 1995 were concerned with fisheries by-catch and discards and their impact on the sustainable use of the world's oceans and seas.

GOVERNMENT INITIATIVES

States that have already adopted policies prohibiting or limiting the discarding of part of the catch at sea include Iceland, Namibia, New Zealand and Norway. Others, such as the United Republic of Tanzania and the United States, are establishing policy frameworks to deal with the issue.

Environmental degradation of coastal zones and catchment areas

THE ISSUE

Coastal fish habitats are rapidly being degraded in many parts of the world by industrial, urban and agricultural pollution, landfill, the damming and diversion of rivers, the clearance of mangrove, sedimentation, mining and oil exploration and extraction, marine-based pollution, etc. In addition, the displacement of fishing communities through competitive resource use is not uncommon in coastal areas.

Similar factors threaten the fish supply from inland waters and - relatively speaking - their impact may be even more severe. Flood plain areas are often seen as "wastelands" and are therefore drained for agricultural and other uses. Fishery administrations have

difficulties in assuring the preservation of flood plains in spite of the fact that they are among the most productive fishing areas in any catchment.

Coral reef ecosystems are important not only for fish production but also for tourism, aesthetic reasons and shoreline protection. Coral reefs are seriously threatened worldwide.

While the fisheries sector suffers harm globally, it is also, itself, responsible for environmental damage. Local pollution from fishing vessels and fish processing plants can be significant and irresponsible fishing practices also cause harm. A critical problem is the environmental degradation often associated with intensive aquaculture practices, notably of tropical shrimp and salmonids in temperate zones. Intensive shrimp culture has also been associated in some countries with severe social impacts, primarily through the displacement of local people and communities.

For inland fisheries, integrated management policies need to cover the complete extent of the basin concerned in order to be effective. Often, this is not the case. Where the basin transcends national boundaries, a regional mechanism for management is required.

ACTION AT INTERNATIONAL LEVEL

To meet the threat of environmental degradation of coastal and marine areas, many international initiatives have been taken. Concerns about marine environmental pollution were addressed in the 1995 Washington Declaration and Global Plan of Action for the Protection of the Marine Environment from Land-based Activities and the 1995 Report of the Second meeting of the Conference of the Parties to the Convention on Biological Diversity (Conservation and Sustainable Use of Marine and Coastal Biodiversity).

In tackling this issue, there has been particularly good cooperation within the UN system and between UN agencies and other multilateral organizations. The Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) was established by the International Maritime Organization (IMO), FAO, the United Nations Educational, Scientific and Cultural Organization's Intergovernmental Oceanographic Commission (UNESCO-IOC), the World Meteorological Organization (WMO), the World Health Organization (WHO), the International Atomic Energy Agency (IAEA) and the United Nations Environment Programme (UNEP). The original purpose of GESAMP was to advise solely on marine pollution issues, but it has had its terms of reference broadened to be able to respond fully to the needs of its sponsoring agencies for advice (based on the natural and social sciences) on all aspects of marine environmental protection and management. A training initiative has been set up by the United Nation's Division of Ocean Affairs and the Law of the Sea (UN-DOALOS) and guidelines dealing with integrated coastal management (ICM) have been produced by a number of UN agencies, including UNEP and UNESCO-IOC, by the World Bank and by the World Conservation Union (IUCN).

The Asian Development Bank was one of the first international bodies to adopt an integrated management approach to resolving the problems that affect fisheries and the World Bank has been active in formulating programmes in Africa. In many countries, multilateral agencies and IUCN, with donor country support, have been active in developing an integrated approach to resolving coastal and marine area degradation. In this regard, reference should also be made to the activity made possible through the Global Environment Facility (GEF), for example in the Black Sea Environmental Programme. FAO initiatives specifically concerned with fisheries in ICM featured the development of the concept of integrated coastal fisheries management (ICFM) in three pilot projects.

GOVERNMENT INITIATIVES

Regarding environmental damage from fisheries, many, if not most, states are well aware of the problems and several have attempted to solve them. Where harmful fishing practices persist, they often reflect difficulties in enforcement and fishermen's reluctance to change. In order to limit pollution from the fisheries sector, states have either instituted zoning or intend to do so. These measures should lessen the harmful effects of the fishing industry on other resource users.

However, there is still widespread concern that the adverse environmental and social impacts of intensive and/or large-scale aquaculture are not being properly addressed. Yet, there is progress. A number of countries that produce salmonids have instituted rigorous controls on production to ensure that pollution is kept within acceptable limits. A major producer of tropical shrimp in South Asia has instituted a temporary ban on new developments until an acceptable social and environmental policy is adopted and a number of countries have set up the required legislative frameworks or are doing so. As in other areas of management, however, enforcement is often difficult.

There have been many government initiatives in recent years to institute some form of coastal management. Such initiatives in developing countries have usually, but not invariably, been assisted by some form of external assistance. Integrated coastal management activities are relatively few and most initiatives focus on either one or two issues.

The Call to Action of the International Coral Reef Initiative (June 1995), in which the United States together with the International Centre for Living Aquatic Resources Management (ICLARM) played an important role, has resulted in a number of governments establishing programmes for community-based management or co-management of reef resources. Such initiatives include capacity building, research and monitoring and periodic reviews.

In general, coastal management initiatives in countries tend to be institutionally isolated, with relatively few countries (more often, developed countries) having a nationwide and effective strategy for dealing with coastal and marine environmental degradation and resource competition.

The integrated management of catchment areas has received less attention than that of coastal areas. In catchment areas the management of large inland water bodies together with their riparian areas has generally been more actively pursued than riverine management; for example in Latin America, Bolivia and Peru have cooperated for a number of years in managing Lake Titicaca and, in Africa, the agreement of the riparian countries to establish the Lake Victoria Commission points to the introduction in the not too distant future of cross-sectoral management of the lake and its surroundings.

With few exceptions (such as the Danube), river management, particularly where rivers cross national boundaries, has very often been restricted to such topics as establishing water use and navigation rights, rather than basin environmental management. Nevertheless, cases of such catchment area environmental management are emerging, for example in Australia where an earlier emphasis on land-and water-use management in catchment areas is being widened to take account of such sectors as fisheries.

There are relatively few examples of integrated management being applied holistically to areas that incorporate coastal catchment hinterlands. One such approach is incorporated in estuarine programmes in the United States.

ACTION BY NGOs

NGOs have contributed significantly to promoting the integrated management of coastal areas, being actively involved in many of the programmes undertaken. In many cases where coastal and marine protected areas (MPAs) have been established, NGOs manage or support them by helping local communities to understand the importance of protected areas as a management tool for ensuring marine and coastal biological diversity. This is the case, for example, in the Bahamas, Saint Lucia and Montserrat. Internationally, NGOs have stressed the need for a special study on a global representative system of MPAs and have made recommendations on establishing and managing them effectively.

Uncertainty and risk

THE ISSUE

A number of major problems confronting policy-makers and fisheries managers have emerged in recent years as the complexity of management has become increasingly understood. These problems include: the lack, or inadequacy, of information relating to key biological parameters, such as the assimilative capacity of the resource, and to economic parameters, such as the identification of the appropriate values and/or discount rates to apply in converting long-term future income streams to present values; and the attribution of values to some aspects of biological diversity. Another major source of uncertainty for fisheries managers is the extent to which natural fluctuations (compounded by global climate change) and human impacts are responsible for observed changes in a resource base.

Considerable progress is being made in understanding these problems but one of the manifestations of this progress is that more is known about the number of parameters management has to consider to achieve sustainability than about the values these parameters assume.

The concept of the precautionary approach has evolved from this recognition of the limits of knowledge and uncertainty and its potential consequences. The implications of uncertainty in fisheries management and operations (and related activities) are fundamental. The recognition of uncertainty and the need to manage risk has led, *inter alia*, to understanding in the 1990s of: the risk of using maximum sustainable yield (MSY) as a target; the need for a broader and more precautionary range of management targets set at levels of fishing effort below the MSY; the need to set explicit limit reference points within which the fishing effort should be constrained; the need for better quantification of the reliability of scientific advice and the robustness of management systems in response to uncertainty; and the need for impact assessment and/or pilot projects as a basis for any authorization of the introduction of new fishing gear and methods.

ACTION AT INTERNATIONAL LEVEL

The precautionary approach in fisheries was introduced in Chapter 17 of Agenda 21, which referred to approaches which are "precautionary and anticipatory in ambit...", on the basis of a preparatory paper prepared by FAO. The approach has been included in a number of other documents produced by the international community in recent years, notably in the Code of Conduct for Responsible Fisheries (Article 7.5) and the UN Agreement. Guidelines on the implementation of the approach in fisheries were produced by FAO in 1995 and these will form part of the fisheries management guidelines being prepared in support of the Code.[8] A meeting was held in Oslo, Norway, in September 1996 to examine the application of the approach to North Atlantic fisheries and a consultation will be held in 1997 (under the aegis of the FAO/Bay of Bengal Programme) to review the application of the precautionary approach to artisanal fisheries.

[8] FAO. 1995. *Precautionary approach to fisheries. Part 1. Guidlines on the precautionary approach to capture fisheries and species introductions*. Fisheries Technical Paper No. 350. Rome. 52 pp.

GOVERNMENT INITIATIVES

The precautionary approach is being progressively implemented in a few countries (e.g. Australia and the United States) but several years will need to pass before any progress can be measured. Uncertainty should also be reduced through the development of better information systems.

Many developed countries have research and monitoring programmes related to the marine environment, including research oriented towards climatic variations. Some developed countries are also carrying out specialized research on the effects of ultraviolet

(UV) radiation on the marine environment and many are developing vulnerability assessments for coastal zones, including vulnerability to marine pollution. The results of this research demonstrate very clearly the benefits of cooperation and the need for regional initiatives, as illustrated by the regional conventions dealing with the Baltic and North seas. Many developed countries are participating in the development of the Global Ocean Observing System (GOOS).

As much of the necessary research is relatively costly, it is not surprising that developing countries are not as active in this area as are the more developed states. Nevertheless, many developing countries have established national science policies oriented towards the marine environment and are actively involved in coastal zone research, observations and assessments. Many developing countries strongly support the development of GOOS, although their participation is limited.

Outlook

This section reviews the medium-term outlook for fisheries. It has two parts: scenarios for demand and supply; and a forecast of what seems most likely to happen to the consumption and production of fish and fish products by the year 2000.

Demand and supply: possible scenarios in 2010

DEMAND

The medium-term outlook for global demand of food fish is largely determined by population growth, changes in per caput income and the pace of urbanization. The interplay of these factors was considered in a review prepared by FAO for the Kyoto Conference.[9] At 1990 constant real prices, the review gave a conservative estimate of the demand for food fish that was in the range of 110 million to 120 million tonnes (live weight) for the year 2010, compared with 75 million to 80 million tonnes in 1994/95. This estimate is based on per caput demand projections, which are displayed and aggregated by region in Figure 16 along with the resulting demand per region in million tonnes. Projections indicate that North America, Oceania and Europe will have the highest per caput demand, at more than 20 kg per year (live weight equivalent), but that the large population in Asia means that region could account for about two-thirds of total demand.

[9] FAO. 1995. *Apparent historical consumption and future demand for fish and fishery products - exploratory calculations*. Written by L. Westlund for the Conference on the Sustainable Contribution of Fisheries to Food Security, Kyoto, Japan.

Fishmeal is the main product derived from the fish used for non-food purposes. As fishmeal is one of the more expensive ingredients in animal feeds, livestock, poultry and fish/shrimp producers have a clear incentive to reduce the amounts used. In response to possible price increases in the future (and even in their absence), fishmeal usage in poultry finisher and layer diets may disappear completely and less fishmeal may go into

pig grower and turkey grower diets.[10] This may make it possible for more fishmeal to be used in aquaculture without causing its price to increase. Thus, it is expected that the demand for, and the supply of, fish for reduction will remain stable at between 30 million and 33 million tonnes over the next few years.[11]

[10] Ian H. Pike. Personal communication.

[11] It is realized, however, that the demand for fishmeal is complex and the above projection is made in the absence of detailed studies.

In summary, the projected demand for fish for all uses is in the order of 140 million to 150 million tonnes for 2010.

SUPPLY

Per caput supplies of food fish increased in both 1994 and 1995. However, it is still not clear that growth in aquaculture production can compensate for the possible stagnation in aggregate food fish production from capture fisheries.

Aquaculture is becoming established outside its traditional confines of Asia and Europe, although absolute growth is still faster in Asia than elsewhere. Aquaculture has become popular for two reasons: it provides a source of income rather than simple subsistence; and it can be incorporated into local agricultural systems to diversify the production base. As a result, more flexible integrated culture systems that include fish are being adopted in many regions. There is considerable potential for further expansion and, under favourable conditions, production could be 39 million tonnes by 2010 (Figure 17).[12]

[12] Muir, J.F. and Nugent, C.G. 1995. *Aquaculture production trends: perspectives for food security*, Conference on the Sustainable Contribution of Fisheries to Food Security, Kyoto, Japan. This estimate does not include production of aquatic plants, of which China, Japan, the Republic of Korea and the Philippines produced an estimated 6.4 million tonnes in 1994.

Aquaculture in industrialized economies has normally targeted high-priced species but, although this trend continues (e.g. turbot, char and abalone), the cost reductions achieved, particularly in the culture of Atlantic salmon, now make feasible the “industrial” or technically sophisticated culture of large volumes of comparatively low-value species (e.g. tilapia and white salmon) as a substitute for “white fish”. However, these types of culture are not likely to have an impact on supplies before the end of the century.

In low-income countries outside Asia, the growth of commercial aquaculture will be stimulated by easier access to wealthy consumers in high-income countries and by the adoption of macroeconomic policies aimed at providing a conducive environment to small-scale entrepreneurs. However, the past rapid rate of growth in output of cultured carps may slow down as producers switch to higher-priced species.

The two main constraints on aquaculture are environmental degradation and the availability of land and water. The first constraint sometimes results from the mismanagement of aquaculture facilities, but more often arises from external sources. The second constraint stems from competition with other land and water uses, particularly in agriculture, and from urban encroachment into coastal zones. These factors will limit growth.

Over the last few years, governments have taken action (both separately and in concert) to deal with capture fisheries matters and this is a promising trend for future supplies. FAO estimates that the potential worldwide harvest through *capture fisheries* ranges from about 85 million to 90 million tonnes under current fishing regimes (i.e. with some fish stocks being overfished and some underexploited and regardless of any increased supplies from a reduction in discarding)[13] rising to 100 million to 105 million tonnes if management systems for capture fisheries are improved in all oceans and if there is some reduction in discarding.

[13] Inland fisheries contribute about 6 million tonnes annually. During the period 1986 to 1994, marine capture fisheries fluctuated between 80 million and 85 million tonnes.

However, there is significant doubt as to the aggregate results of improved management systems, reduced discards and a reduction in capacity. The main factor is the uncertain outcome of the predator-prey relationships which will come into play if stocks of currently overfished or depleted large predators are replenished.

The possible increase in sustained production could be in the order of 15 million tonnes - 10 million tonnes through the rebuilding of stocks and the remainder through reductions in post-harvest losses and discarding.[14] No significant additional supplies are expected from inland capture fisheries.

[14] FAO. 1996, *Chronicles of marine fishery landings (1950-1994); trend analysis and fisheries potential*. FAO Fisheries Technical Paper No. 359 by R.J.R. Grainger and S.M. Garcia. Rome. 51 pp.

Figure 16. Exploratory estimates: per caput and total demand in 2010 at constant real prices

Source: Table 1A, KC/FI/96/TECH/8

Figure 17. Possible aquaculture production in 2010 (not including aquatic plants)

FAO calculates the fish supplies for human consumption as being the sum of capture fisheries production and aquaculture production, less the fish used for reduction and other purposes.

As stated above, supplies for reduction will probably continue at the level of 30 million to 33 million tonnes for the immediate future and it is assumed that aquaculture production

will be used entirely for food.[15] Table 2 shows the resulting range of supplies. The table indicates a range of supplies and the actual supply is expected to fall somewhere within this range.

[15] The relatively small quantities used as bait and in "put-and-take" fisheries are not considered.

Therefore, only under the optimistic scenario will supply meet demand at constant real prices (of 1990) in the year 2010.

Production and consumption for the year 2000

Given the likely evolution of demand and the possible ranges of supply, a number of factors will influence the ways in which production and consumption develop in the immediate future? Fisheries will affect the volumes produced as well as their quality and value, while the world trade regime will help influence consumption patterns. Trade rules will also help to provide incentives for increased production and/or the better management of production.

Governments have a role to play in assuring that capture fisheries achieve a sustainable yield of 100 million tonnes. Sustainable production levels will be influenced by how governments, NGOs and industry deal with:

· protection of the aquatic ecosystem in coastal zones and inland catchment areas;

· management of fishing on those stocks that have been overfished and/or are under heavy pressure;

· support to developing fisheries on currently unexploited or underexploited stocks;

· by-catch and discarding.

These issues are not new, but governments still have to tackle them for two reasons: first, benefits are slow to appear and do so only after considerable costs have been incurred for some time; and second, the individuals who incur the costs are seldom convinced that they will reap the benefits and so they resist what they perceive as a likely redistribution of their income.

PROTECTION OF AQUATIC ECOSYSTEMS IN COASTAL ZONES AND INLAND CATCHMENT AREAS

This is an issue of overriding importance for the long-term sustainability of capture fisheries, but one that the fishery sector can do little about on its own. The richer industrial economies are taking steps to protect aquatic ecosystems and the benefits are beginning to show. Densely inhabited LIFDCs have fewer resources for such action and less political pressure to carry it out. By the end of the decade, these countries will

probably be characterized by further damage to aquatic ecosystems, a decline in capture fisheries production and increasing conflicts in fisheries management. Despite its obvious potential in the long term, it does not seem likely that the framework for action adopted by the United Nations Environment Programme's (UNEP) Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, in Washington, DC (November 1995) will have reversed these trends by the end of the century.

TABLE 2

Projected supplies of fish for human consumption, 2010

Source of production	Pessimistic scenario	Optimistic scenario
Aquaculture production	27	39
Capture fisheries[1]	80	105
Subtotal	107	144
Less (for reduction)	33	30
Available for human consumption	74	114

[1] If capture fisheries management is not improved, it is likely that production will drop below current levels.

Source: Muir and Nugent, 1995.

OVERFISHING

Better management of existing fisheries produces considerable benefits, such as higher incomes and greater catch volumes. The in-depth review on page 31 indicates a possible sustained increase of 10 million tonnes through the effective management of resources that are at present overexploited. This increase will be achieved over a number of years and could then, given suitable management, become sustainable. It will take time for stocks to recover, however, particularly those stocks that require both a reduction of fishing effort and better environmental conditions to recover. Even if effective management were introduced straight away in those fisheries that are depleted, production would grow only gradually. In the meantime, higher real prices will probably continue to create financial incentives for further investment in the fishing effort on already depleted stocks, making management of the fisheries in question even more difficult to implement.

Without effective action, there is a considerable danger that overfishing will continue to get worse. In many developing countries, population pressure and the shortage of alternative employment opportunities, together with the lack of effective conservation and management policies, will make fisheries more attractive to poor people as an employment of last resort. If no management action is taken, annual production from

capture fisheries of marine fish for direct human consumption could fall from about 50 million tonnes at present to about 40 million tonnes.[16]

[16] FAO. 1995. *Safeguarding future fish supplies: key policy issues and measures*. Conference on the Sustainable Contribution of Fisheries to Food Security, Kyoto, Japan.

Thus, even assuming that governments increasingly institute effective management regimes, it is unlikely that such initiatives will bring about a noticeable increase in capture fisheries production before the turn of the century. More important though, such measures would prevent long-term drops in production.

UNDEREXPLOITED STOCKS

Apart from small pelagics, conventional resources are generally fully or overexploited. It seems unlikely that currently underexploited oceanic resources (squid, mesopelagics and krill) will make any significant contribution to food fish supplies before the end of the century. In the Indian Ocean, the present annual rates of increase in production seem to indicate that further increases are possible.[17] However, given the element of considerable doubt involved and the need for a precautionary approach, production increases will tend to be modest up to the end of the century. In addition, there does not seem to be any immediate prospect of new technological developments leading to lower production costs for products from small pelagic species.

[17] FAO, op. cit., footnote 14, p. 26.

BY-CATCH AND DISCARDS

In several major industrial fisheries, and in some tropical shrimp fisheries, there is an ongoing technical and political effort to reduce unwanted by-catches (particularly of juveniles and endangered species), thereby reducing discarding. The results are gradual and positive. As gear selectivity improves and closed seasons are enforced, an increase in commercial catches can be expected as more juveniles are left to grow to adult size. Higher real prices should open markets for some of the remaining by-catch, partly through the development of ready-to-eat products.

TRADE

International interest in the trade of fish and fishery products will be stimulated by the various agreements concluded at the establishment of the World Trade Organization (WTO), the expanded membership of this organization and the ongoing discussions aimed at further liberalizing international trade. The effects will be felt at the end of the transition periods (five years for developed countries and ten years for developing countries), by which time the new mechanisms in place at the WTO Ministerial Meeting in December 1996 will have been in operation for some time. Further liberalization of trade will facilitate the flow of fish and fish products to markets with strong purchasing power. Likewise, any official links between environmental protection, particularly

resource conservation, and international trade will affect future trade volumes and destinations.

As reported earlier, some environmental organizations and a few major industrial groups are moving to enlist the support of consumers, mainly in the industrial economies, to use their purchasing power to force producers to ecolabel fishery products and certify fishery management systems so as to guarantee that their fish and fish products are the result of ecologically correct production methods. Consideration is being given as to what standards should be adopted and how they should be applied. The extent to which ecolabelling will affect the fish trade and fisheries management over the next few years is not yet clear. The impact of ecolabelling will be conditioned by consumer reactions and by the degree of support from fishing industries. However, in the longer term, this initiative may have a major impact on the conduct of fisheries and aquaculture.

IMPACT ON FISH CONSUMPTION AND PRODUCTION

In conclusion, it seems plausible that average *world per caput fish consumption* by about the year 2000 will be approximately 13.5 to 14 kg, that is unchanged from 1993-95. In the process, however, the real price of fish will have increased somewhat and regional consumption and production patterns will have been shifted. Total production (capture fisheries and aquaculture) of fish for human consumption should have increased to about 85 million to 87 million tonnes (live weight equivalent).

Consumption is likely to remain at current levels, but at somewhat higher real prices in traditional industrial economies. By the year 2010, per caput consumption may have grown in Southeast Asia and the Near East and North Africa and declined in sub-Saharan Africa and South Asia. The shift in *production patterns* will come from the increased share of food fish supplies from aquaculture. Substantial progress will have been made on matching fishing capacity to available stocks and discarding will have been substantially reduced, although catches will not yet have markedly increased as a result.

In *sub-Saharan Africa*, per caput consumption will probably continue to decline until the end of the century owing to continued low imports and the inability of local production to keep up with population growth. In the past, per caput supplies were maintained in part by the relatively large amounts of fish imported by countries around the Gulf of Guinea. The economic outlook for the concerned countries is such that they are unlikely to resume fish imports on a large scale. In addition, many of the vessels that supplied small pelagic fish in bulk in the past cannot meet current fishing costs from revenues.

Supplies from capture fisheries for local consumption are unlikely to expand significantly. Any expansion of high-value demersal fisheries is likely to be channelled to non-African markets. Small marine pelagics off northwestern and southwestern Africa constitute potential resources for West African and central African markets, and production of these resources will expand, initially in southwestern Africa. Significant growth in production of small pelagics from the Indian Ocean is unlikely, while inland capture fisheries are already at a stage of advanced exploitation. Aquaculture starts from

too small a group of producers to be able to achieve production increases that will make a significant contribution to total supplies. In addition, it seems likely that in the future African aquaculture entrepreneurs will follow the pattern already observed elsewhere, i.e. the culture of high-value species for overseas markets.

It seem quite plausible, therefore, that fish prices will increase as supplies will not be sufficient - at present prices - to satisfy demand. As a result it will be economically possible for fishermen to continue fishing, in spite of declining catches per fishing trip. The conservation and management of stocks, particularly of the demersal ones, will become increasingly urgent and difficult.

No major changes are foreseen in the production and consumption patterns of North America by the end of the century. Per caput consumption may increase somewhat in volume as fish is frequently seen as a healthier food than red meat. Higher per caput income is gradually going to be reflected in an increasing proportion of higher-priced products in the fish consumption basket of the average consumer. The economy will be able to import fish and fish products to make up any shortfalls in local production. Capture fishery production will remain stable as the cod stocks off the northeast coast of North America are unlikely to recover before the end of the century. The management of capture fisheries should improve, mainly by reductions in effort and by better spatial and temporal allocation of fisheries. The initial effects of such initiatives are likely to be higher incomes for those remaining in the industry; catches will increase later. Aquaculture will expand at least as fast as fish consumption in response to local market opportunities and, on the whole, both fisheries and aquaculture should become more sustainable.

By the end of the century, per caput fish consumption will probably have grown slowly in *Latin America*. Only small volumes are required in absolute terms and these will come from local production while average real prices will remain at about present levels. Interregional trade is set to increase rapidly, particularly within the Southern Common Market (MERCOSUR) economic grouping in southern South America. Industrial marine capture fisheries will continue to be oriented mainly to consumers outside the region - on the west coast as a prime supplier of fishmeal and on the southeast coast as a supplier of groundfish to North America and the EU. Freshwater capture fisheries will continue to be a marginal activity essentially for local markets and increasingly for recreation and tourism. The recreational and tourism aspects of fisheries will also increase in the *Caribbean*. Aquaculture will essentially continue to focus on high-priced products for export markets.

In the most optimistic scenario, the low per caput fish consumption in *South Asia* will not have declined by the end of the century, while per caput consumption will probably have increased somewhat in *Southeast Asia*. The increase in marine capture fisheries production has kept pace with consumption over the last decade in both South Asia and Southeast Asia but, given the present state of marine resources, this is unlikely to be the case in the future. Supplies of freshwater fish will expand. Freshwater fish consumption is significant in South Asia and a rapidly increasing share is provided through the culture

of various species of relatively cheap carps. As massive fish imports are not an economically viable solution for South Asia, the capability of fish culturists to expand production will have a major influence on both overall per caput supplies and the food security of marginal populations.

In Southeast Asia, economic growth will probably guarantee constant or slightly increasing per caput food fish supplies at least until the end of the century. Real prices will probably increase to some degree. Interregional and extraregional trade patterns will cause per caput supplies to increase in some countries and decrease in others. High-value items will increasingly reach markets further afield and aquaculture will supply more fish for local markets. However, fishermen and public fishery administrators have little influence over the state of aquatic ecosystems and the state of health of these will be essential in determining the future role of inland fisheries and freshwater aquaculture.

In Japan, consumers will continue to rely on imports for a large, and possibly slowly growing, share of their consumption. Capture fisheries may continue to contract as long-distance fisheries are reduced but ranching and culture may expand in compensation.

The economic and social environment in China is changing rapidly and has so far contributed to very rapid growth in aquaculture and capture fisheries production. However, in the process, aquatic ecosystems have been damaged in both coastal areas and freshwaters. It seems plausible that the recently observed rate of increase in fish production cannot be sustained over the next few years. While the drive for exports continues, China is unlikely to become a substantial importer of fish and, hence, per caput consumption will stabilize.

Fish will continue to be the principal source of animal protein for inhabitants of the small island countries of the *Pacific*. Per caput supplies will probably be maintained through imports, although these may contract somewhat by the year 2000. Local inshore demersal resources are generally heavily exploited and are unlikely to support larger production, which would have to come from the exploitation of small pelagics. At present the small island countries of the Pacific take only a small share of the tuna fished in the region but this share is set to increase, albeit slowly. Aquaculture as a source of food is insignificant in small island countries and likely to remain so at least until the end of the century. Speciality products and tuna will continue to be exported in somewhat increased volumes.

In *Western Europe*, per caput consumption will remain basically at current levels for the remainder of this decade. The increase in demand will be low owing to very slow population growth and only a modest increase in income levels. Demand will be met mostly through increased imports and slightly higher price levels from the growing share of ready-to-eat products. In many cases, marine capture fisheries do not appear particularly well managed, despite an exceptional research and management capacity, and will not expand significantly. Aquaculture might expand if production costs can be reduced to levels similar to those of groundfish production. If this occurs, aquaculture would gain access to the white fish market segment (fish sticks, etc.). By the end of the

century, it is not impossible that a “white” salmon could be produced at an acceptable cost.

Fish consumption in the *former USSR and Eastern Europe* will stabilize over the next four to five years as the adaptation to market economies continues. In the past, fish consumption in these economies was subsidized and consumption was high. However, drastic increases in prices and low incomes have turned fish into a food item that is replaced by other more moderately priced products. As large quantities of fish will not be imported into the region, consumption will have to depend on local supplies and, in this context, the culture of freshwater fish (carps) will grow in Eastern Europe at least to the levels recorded in the mid-1980s.

In the *Near East and North Africa*, per caput consumption will increase slightly but remain low. In the oil-based economies, the increase may be made possible through greater imports mainly from outside the region. Apart from shrimp, most production will continue to be consumed locally, with only two major exceptions - fish production in Morocco and in Oman. As local fisheries (excluding small pelagics) are fully, or close to fully, exploited it seems likely that the exploitation of small pelagic stocks will have increased by the end of the century.

IN-DEPTH STUDY: PATTERNS OF MARINE FISHERY LANDINGS AND FUTURE PROSPECTS[1]

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[1] This in-depth study has been extracted from FAO. 1996. *Chronicles of marine fishery landings (1950-1994): trend analysis and fisheries potential*. FAO Fisheries Technical Paper No. 359, by R.J.R. Grainger and S.M. Garcia. Rome.

The first estimates of world fishery production were provided by FAO in 1945[2] and these indicated that the total marine harvest was 39 billion pounds (or 17.7 million tonnes), of which 37 billion pounds was from commercial landings and the remainder from subsistence and recreational landings. Even then, one-third of the total landings were destined for reduction to fishmeal and oil. At that time only the north Pacific and north Atlantic fisheries were well developed, and these areas accounted for 47 and 46 percent of the total commercial harvest, respectively, with the southern parts of the Pacific and Atlantic oceans accounting for 1 percent each and the Indian Ocean accounting for 5 percent. The same report stated that there were considerable possibilities for fisheries expansion, mainly off Central America,

Peru and Chile, in the Caribbean, off West Africa and off Australia, New Zealand, the South Pacific Islands and the East Indies. The report recognized, however, that some stocks were already overfished and pleaded that the benefits of stock recovery in European waters during the Second World War should not be lost once normal fishing activity resumed. It stressed the essential need for fisheries conservation based on scientific evidence, particularly at a regional level, and recommended that FAO promote the collection and analysis of basic fishery data.

[2] FAO. 1945. *Five technical reports on food and agriculture: fisheries*, p. 175-216. Report of the Technical Committee on Fisheries, submitted to the United Nations Interim Commission on Food and Agriculture, Washington, DC.

In the 50 years since that report was prepared, fisheries have developed rapidly with the result that there are now few underexploited resources and an increasing number of overexploited ones. The challenge of implementing effective management has proved much more difficult than the authors of the 1945 FAO report could have expected.

The first estimate of world potential production based on analysis of historical landings was made in FAO by J. Gulland in 1971.[3] No other analysis of this kind has been undertaken since and, given that this analysis was based on statistics for 1953 to 1968 (less than half the time period currently available), it is appropriate to review estimates of potential in light of the major developments that have taken place since. During the period considered by Gulland, landings were increasing at about 6 percent per year (Figure 18), and Gulland estimated that the potential for traditionally exploited marine species was about 100 million tonnes per year. This estimate of fishery potential was consistent with estimates made earlier by several other authors,[4] based on different analyses. In fact, the growth rate for marine production observed by Gulland soon fell, although some growth was maintained, and despite fisheries' developments in non-traditional species, marine fishery production has so far reached only about 90 million tonnes, with capture fisheries accounting for 84 million tonnes.

[3] Gulland, J.A., ed. 1971. *The fish resources of the ocean*. Fishing News (Books) Ltd. 255 pp. see also ICES. 1995. Reports of the ICES Advisory Committee on Fisheries Management, 1994. *ICES Coop. Res. Rep*. No. 210. International Council for the Exploration of the Sea (ICES).

[4] Moiseev, P.A. 1971. *The living resources of the world ocean*, p. 203. Jerusalem, Israel Program for Scientific Translations. 334 pp.

This study presents an initial analysis of trends in marine resources as described in the FAO fishery production statistics for 1950 to 1994,[5] during which period marine production of fish, crustaceans and molluscs grew from 18 to 90 million tonnes.

[5] FAO. 1995. *World fishery production 1950 to 1993*. Supplement to the FAO *Yearbook of Fishery Statistics 1993*. Vol. 76. *Catches and landings*. Rome. 44 pp.

Some trends in landings

Relative contributions of pelagic and demersal fish

Production from marine fish species has risen from about 14 million tonnes in 1950 to about 73 million tonnes in 1994, 10 percent of which is unspecified marine fish which is usually landed unsorted and some of which goes for reduction to oil or meal. The proportion in weight of the total marine fish landings accounted for by pelagic fish has risen from about 50 percent in 1950 to over 60 percent in 1994. The production of pelagics has increased continuously, with large oscillations reflecting natural variations of resources productivity as well as boom and bust fishing strategies. In terms of value, pelagic production is less important than demersal production, but its relative importance has been increasing and in 1993 pelagic production accounted for about 40 percent of the total value of the marine fish landings compared with 50 percent for demersal fish and 10 percent for unspecified marine fish. Demersal fish production showed an increasing trend until the mid-1970s and has generally levelled off, with some oscillations, since then. The production of unspecified fish has continued to increase throughout the period considered and this represents a major shortcoming of the data set.

While 186 species items are exploited by pelagic fisheries, 50 percent of the average total pelagic landings for 1950 to 1994 are represented by only seven top species (anchoveta, Atlantic herring, Japanese pilchard, South American pilchard, chub mackerel, capelin and Chilean jack mackerel) which account for a major part of the overall variation in landings (Figure 19). A further feature shown in Figure 19 is that, once a few major and highly fluctuating species are excluded, there is a smooth and continuous increase in total landings of about 180 remaining pelagic species.

The global trend in marine demersal landings is shown in Figure 20. Once the two major species, Alaska pollock and Atlantic cod, are excluded, landings of the remaining 403 resource items show a clear pattern of increase up to the early 1970s, followed by stability since then.

An examination of the ratio of pelagic fish (small and large) to demersal fish landings from 1950 to 1994 for each ocean and the Mediterranean Sea (Figure 21) shows the following:

· In the Atlantic Ocean, pelagic fish represent on average about one-half of marine fish landings and this proportion has been extremely stable since 1954, despite the large variations in the landings of herring in the Norwegian and North seas, of sardine off Namibia and of small pelagic resources off West Africa.

· In the Pacific Ocean, pelagic fish comprise on average about 59 percent of the total landings but the proportion has fluctuated greatly, reflecting large oscillations of pelagic

resources such as Peruvian anchoveta and Chilean sardine, as well as “demersal” resources such as the Alaska pollock.

· In the Mediterranean Sea, pelagic fish dominate the landings and their proportion increased steadily from the 1960s before collapsing in the late 1980s. The progression was remarkably sustained, possibly reflecting a shift in the ecosystem owing to eutrophication and the progressive depletion of predators.[6] While nutrient enrichment might potentially benefit all fishery production by increasing productivity, it may have selectively and locally hampered the development of demersal fish stocks that were already stressed by fishing. The drop in the ratio in the 1990s reflects the collapse of the Black Sea pelagic fish resources and fisheries under environmental stress and overfishing.

[6] Caddy, J.F., Refk, R. and Do-Chi, T. 1995. Productivity estimates for the Mediterranean: evidence of accelerating ecological change. *Ocean and Coastal Management*, 26(1): 1-18.

· In the Indian Ocean, pelagic fish account for less than half of all fish landings, indicating a relative deficiency of pelagic production compared with other oceans. In a recent paper,[7] the lack of development of small pelagic fisheries development in the western Indian Ocean was noted and related to the extreme strength and turbulence of the Indian Ocean system of upwellings combined with extremely dynamic offshore advection, all factors very unfavourable to the survival of small pelagic resources.

[7] Bakun, A, Roy, C. and Lluch-Cota, S. Coastal upwelling and other ecosystem processes controlling ecosystem productivity and fish production in the western Indian Ocean. In K. Sherman and N. Cyr, eds. *Status and future of the large marine ecosystems of the Indian Ocean*. Oxford, UK, Blackwell Scientific. (in press)

Figure 18. Marine fishery production since 1950, showing data available for the FAO 1971 assessment and data available since

Figure 19. World landings of the top pelagic marine fish species and total

Demersal fisheries

It has already been noted that the underlying trend in global demersal fish production, unlike that of pelagic fish, has not shown any increase since the early 1970s. However, this masks the fact that there are regional differences in the development of fisheries and the proportions of stocks that are fully fished or overfished. Table 3 shows the sequence of dates at which peak demersal fish landings were observed in smoothed time series for each FAO region. The sequence of peaks is generally as would be expected from a knowledge of world fisheries development. Landings peaked first in the Atlantic (between the late 1960s and the early 1970s), then in the Pacific (between the mid-1970s and the late 1980s) and, finally, in the Indian Ocean (in the early 1990s). The case of the Mediterranean, one of the oldest and most intensively exploited marine systems, is a paradox as many of its resources have been declared overfished for decades although production continues to rise slowly, probably in response to eutrophication, except for in

the Black Sea where pollution, species introduction and overfishing have led to a general resource and fisheries collapse.[8]

[8] Caddy, Refk and Do-Chi, op. cit., footnote 6, p. 33.

Figure 20. World landings of the top demersal marine fish species and total

Figure 21. Ratio between landings of pelagic and demersal fish by ocean

TABLE 3

Comparison of peak landings and recent landings (1991) for demersal fish species (five-year running means)

Fishing area	Recent landings	Maximum landings	Year of maximum landing	Recent/maximum landings
Atlantic, northwest	**1 007**	**2 588**	**1967**	**0.39**
Antarctic	**28**	**189**	**1971**	**0.15**
Atlantic, southeast	**312**	**962**	**1972**	**0.32**
Atlantic, western central	**162**	**181**	**1974**	**0.89**
Atlantic, eastern central	**320**	**481**	**1974**	**0.67**
Pacific, eastern central	**76**	**93**	**1975**	**0.81**
Atlantic, northeast	**4 575**	**5 745**	**1976**	**0.80**
Pacific, northwest	**5 661**	**6 940**	**1987**	**0.82**
Pacific, northeast	**2 337**	**2 556**	**1988**	**0.91**
Atlantic, southwest	**967**	**1 000**	**1989**	**0.97**
Pacific, southwest	**498**	**498**	**1990**	**1.00**
Pacific, southeast	**459**	**508**	**1990**	**0.90**
Mediterranean	**284**	**284**	**1991**	**1.00**
Indian, western	**822**	**822**	**1991**	**1.00**

Indian, eastern	**379**	**379**	**1991**	**1.00**
Pacific, western central	**833**	**833**	**1991**	**1.00**
Total		***18 720***	***24 059***	***0.78***

The final column of Table 3 shows that in two-thirds of the areas the present landings are less than the historical peak landings. In 30 percent of the areas, the landings are still increasing. Apart from the Antarctic, where resources have been explored, developed and overfished and catches have now been limited by management, the major decreases have been seen in the southeast and northwest Atlantic where landings have fallen by over 60 percent in the last two decades. Declines in other areas have been far less marked - the Pacific areas showed declines of less than 20 percent - and landings in some areas, such as the Indian Ocean and the Mediterranean, are still increasing. Although environmental changes have almost certainly played a part in some declines (e.g. in the northwest Atlantic), overfishing has been a major factor in most cases.

The difference between peak and current landings should be interpreted with caution. Peaks in smoothed production probably give an indication of the average long-term yield (ALTY) that the species assemblage in a given area may be able to produce sustainably in the future, with proper management. However, in the case of demersal stocks, which are sensitive to natural fluctuations of climatic conditions (regime shifts) on a decadal scale, peak harvests resulting from transient favourable environmental situations may bear little relation to the ALTY, although the smoothing procedure applied to the raw data should have reduced the potential impact of these problems. As a consequence, the difference between the total of peak landings and current landings (bottom line of Table 3), which amounts to about 5 million tonnes, may represent a rough estimate of the potential benefit from improved management of demersal stocks, assuming, as usual, that the stock declines are indeed reversible. In this regard, however, it is acknowledged that historical trends are also the result of environmental changes and biological interactions, and declines may sometimes reflect potentially irreversible situations created by fishing and climatic changes in the exploited ecosystem.

Overexploited marine resources

FAO prepares regular reviews of the state of world fishery resources and the one for marine fisheries[9] classifies each of the main species fished in the major fishing areas according to its state of exploitation (unknown, underexploited, moderately exploited, fully exploited, overexploited, depleted or recovering), where this has been formally assessed. In this study all the marine resources that were classified in the FAO publication as overexploited or depleted in 1992 are considered. The aggregate landings by fishing area for all such resources (except tuna) are shown in Figure 22, and it can be seen that these stocks together showed a decline in production from over 14 million tonnes in 1985 to about 10 million tonnes in 1992 and 8 million tonnes in 1994. However, the southeast Pacific area (shown in Figure 22 as the uppermost plot component) contains only one species, the South American pilchard, which was virtually

unexploited prior to 1973. Exclusion of this element shows that the decline actually started 20 years ago, with most of the decrease attributable to the northeast, northwest and southeast Atlantic areas. The pattern of long-term decline is also evident for landings of some tunas which are classified as overexploited including albacore in the Atlantic, which has shown a downward trend since the mid-1960s, and southern bluefin tuna, which has shown a more recent but steeper decline as catches have been limited by management in response to declining stock size.

[9] FAO. 1995. *Review of the state of the world fishery resources: marine fisheries*. FAO Fisheries Circular, No. 884. Rome. 105 pp.

Many of the resources classified as overexploited in 1992 have thus been showing decreasing yields for the last 20 years and are now producing 6 million tonnes less than they did in 1985 and about the same as they produced in the mid-1960s, when the fishing effort was far less than it is now. The aggregate decline of 6 million tonnes in Figure 22, however, masks the successive declines in some individual resources and the compensation by increased exploitation of others. The sum of the differences between the observed historical peak landings in the (smoothed) time series of each area component and recent landings amounts to about 9 million tonnes. This observation implies that, if these individual areas could all be restored to their historical maximum levels, a gain of 9 million tonnes of landings could be expected.

Highly migratory and straddling resources

Highly migratory and straddling resources have received intense international attention at the UN Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks (held in New York from 1993 to 1995) which led to the adoption of a legally binding international instrument for their improved management. Landings of highly migratory species as listed in Annex 1 of the 1982 Convention on the Law of the Sea are given in Figure 23, which shows an increase in landings from about 700 000 tonnes in 1950 to about 4.5 million tonnes in 1994. Increases have been most rapid since about 1970. In recent years, over half the total landings of highly migratory species has been accounted for by just two species - skipjack and yellowfin tunas. Skipjack is classified as underexploited or moderately exploited in the Atlantic, Indian and Pacific oceans and so it is likely that catches will increase further in the near future. In contrast, yellowfin is fully exploited in the present fishing areas of the Atlantic and Indian Oceans and in the eastern Pacific, and moderately exploited in the central and western Pacific and, unless new areas or substocks are discovered, it is unlikely that much increased catches can be sustained in the long term.

Figure 22. Landings by fishing area from all resources classified as overexploited or depleted in 1992

Figure 23. Landings from highly migratory fish resources by species

A first attempt at listing fish resources which straddle the boundary between exclusive economic zones and high seas areas was provided by FAO.[10] Given constraints due to lack of geographical resolution in the landings data and to a lack of information on stock identity in many cases, it was necessary to specify these straddling "stocks" in terms of species and FAO major fishing areas. Figure 24 shows the landings of straddling resources by major fishing area since 1950.11 Overall landings of straddling stocks increased from less than 2 million tonnes in 1950 to nearly 14 million tonnes in 1989, and subsequently declined to about 12 million tonnes. The landings composition by area has changed markedly during the whole period. The northwest Atlantic provided the major part of the straddling stock landings up to the mid-1960s but the importance of the region decreased markedly as Atlantic cod stocks declined, while the northwest and northeast Pacific greatly increased their contributions, owing almost entirely to landings of Alaska pollock. Likewise, the decrease in the overall landings since 1989 is caused mainly by the reduced contribution of this latter species.

[10] FAO. 1994. *World review of highly migratory species and straddling stocks*. FAO Fisheries Technical Paper No. 337. Rome. 70 pp.

[11] These resources are considered "straddling" for the whole time period concerned (1950 to 1994) for the sake of convenience and historic perspective even though many of them were high sea resources, legally speaking, before the extension of national jurisdictions, mainly after 1970.

Figure 24. Landings from straddling stocks by major fishing area

State of world marine resources

This section of the study provides an assessment of the state of world resources, by ocean and by major resource type, based on two sample models which will be briefly described. In the end of the section the results will be given.

Generalized fishery development model

The process of development of a fishery as described by changes in landings with time, often with a "boom and bust" character, has been described by many authors.[12] This process is schematically represented in Figure 25 and is composed of four phases: 1, undeveloped, 2, developing, 3, mature and 4, senescent.

[12] For example: Caddy, J.F. and Gulland, J.A. 1983. Historical patterns of fish stocks. *Marine Policy*, 7: 267-278; Caddy, J.F. 1984. An alternative to equilibrium theory for management of fisheries. *In* FAO Fisheries Report No. 289 Supplement 2. Rome. 214 pp; Welcomme, R.L. 1995. Status and trends of global inland fisheries. *In* N.B. Armantrout and R.J. Wolotra. *Conditions of the world's aquatic habitats*. Proceedings of the World Fisheries Congress, Theme 1, p. 122-138. Oxford & IBH Publishing Co.

When a time series that is sufficiently long is available and marked changes in landings have occurred, segments of the time series may be matched to phases in the development model and so provide an indication of the historical as well as the present state of fishery development. It is important to note, however, that aggregate landings from various stocks that are the subject of a fishery complex may continue to increase despite local overfishing situations as long as the process of increase through expansion to new areas and resource elements overshadows the process of decrease through overfishing. An important implication is that the highest landings observed in a mature fishery represent a sort of multispecies composite ALTY which is different from the sum of the theoretical maximum sustainable yields (MSYs) for the various resource elements, whether these elements represent different species in a given area or even in different areas with their multispecies resource components in a given region or ocean. It must be recalled that it is not advisable to attempt to extract the MSY of any aquatic resource and that it is impossible to extract simultaneously the MSYs of all the components of a species assemblage in a given area. However, when a "meta-fishery" covers many areas, it might be possible to improve the overall ALTY by optimizing the fisheries in each area.

Figure 25 shows the theoretical change in yield and the relative rate of increase of yield during the development process. The relative rate of increase, which varies significantly as the maximum long-term yield is approached, reached and surpassed, is of particular interest and has been used here to provide a rough assessment of the state of marine resources, globally and by ocean. This rate is nil for a stable non-developing fishery (i.e. in phase 1) but increases rapidly as the fishery starts to develop (from phase 1 to phase 2). It then decreases during the phase of steady growth of the fishery (phase 2) and drops to zero again when the fishery reaches its maximum production (in phase 3). Following phase 3, fishing capacity may also develop, further aggravating depletion, and the relative rate of increase may become negative as overfishing progresses. In reality, this representation is of course obscured by natural fluctuations as well as by confusion in the data. However, the trend in decline of the relative rate of increase during phases 2 and 3 (Figure 25) is used here to estimate when full potential is reached and what the corresponding potential yield is.

State of the main resource groups

The top 200 species-area combinations used for the analysis, referred to here as "resources", were selected for analysis on the basis of average landings over the whole time period. These 200 major resources account for 77 percent of world marine fish production; they were grouped by cluster analysis, according to the shape of the landing trends and irrespective of the scale of the landings. Table 4 summarizes the characteristics and landings trend profiles (average standardized landings with fitted curves) for four examples of the groups of resources identified by the cluster analysis (these are only four of the 12 groups used in the analysis). The profiles identified can be considered as parts of the overall fishery development model described above and reflecting some of the various phases identified (from 1 to 4, undeveloped to senescent).

The total aggregated landings (non-standardized) by cluster of resources are shown in Figure 26 together with those of the other 23 percent of marine fish landings not included in the top 200 and so excluded from the analysis (and labelled “others”). Figure 26 shows that the apparently ever-growing total marine production results from sequential development and decay of fisheries on various resource groups, for example:

· in the 1950s and 1960s, group 1n including Atlantic cod (northeast Atlantic) and Pacific jack mackerel (eastern central Pacific);

· in the 1960s, group 4p including anchoveta (southeast Pacific), Cape hakes (southeast Atlantic), haddock (northeast Atlantic), Atlantic herring, silver hake, Atlantic mackerel and American plaice (northwest Atlantic), whiting and European plaice (northeast Atlantic) and Cunene horse mackerel (southeast Atlantic);

· in the 1970s, group 2p including capelin, Atlantic mackerel, saithe, European sprat, Norway pout (northeast Atlantic), chub mackerel (northwest Pacific), southern African anchovy (southeast Atlantic), jack and horse mackerels and sardinellas (eastern central Atlantic) and Indian oil sardine (western Indian Ocean);

· in the 1980s, group 6p including Japanese pilchard, filefishes, threadsail filefish (northwest Pacific), South American pilchard (southeast Pacific), blue whiting and Atlantic redfishes (northeast Atlantic), California pilchard (eastern central Pacific), saithe (northwest Atlantic), horse mackerel and European sprat (Mediterranean);

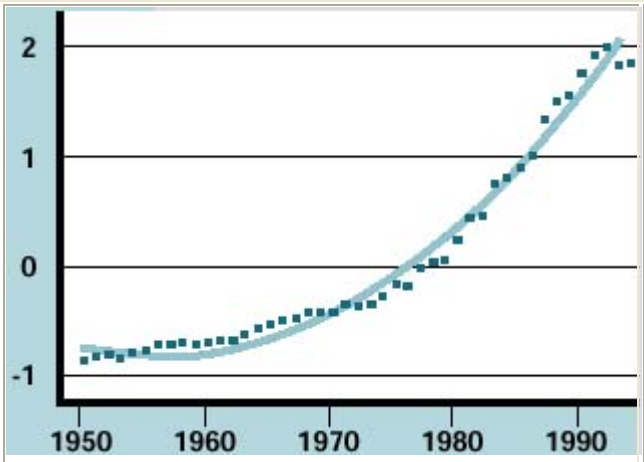
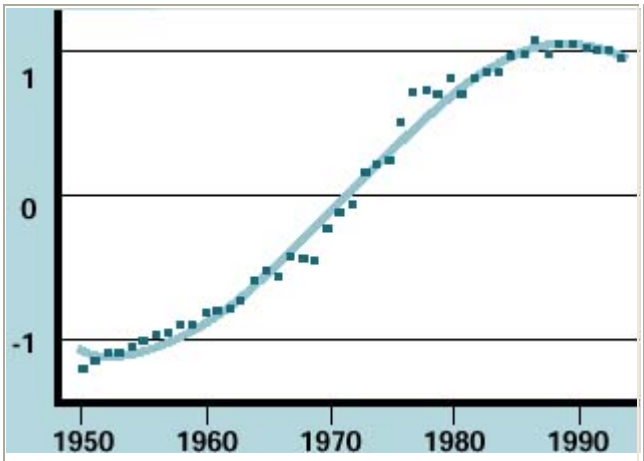
· in the 1990s, group 1p including Chilean jack mackerel (southeast Pacific), skipjack tuna, Indian mackerels, yellowfin tuna (western central Pacific), Pacific cod, scads (northwest Pacific), Pacific cod (northeast Pacific), croakers, drums (western Indian Ocean), round sardinella (eastern central Atlantic) and skipjack tuna (western Indian Ocean).

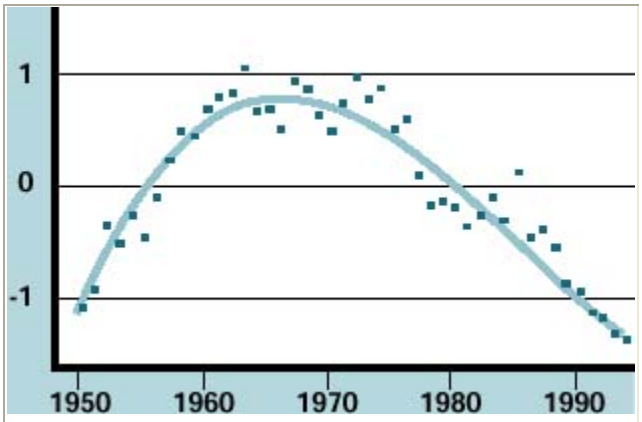
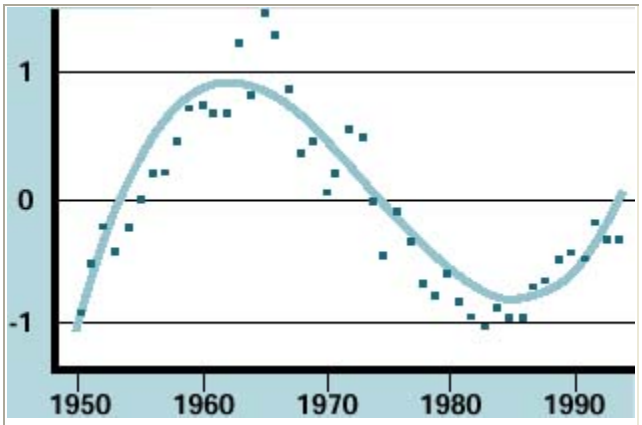
Figure 25. Generalized fishery development model

TABLE 4

Landings trend profiles for four clustered groups of “resources” and corresponding phases of fishery development

Phases in evidence	Landings trend: average standardized landings and fitted curve	Major species in “resource” cluster*

Undeveloped (1) **Developing (2)**		Chilean jack mackerel Skipjack tuna Indian mackerels Yellowfin tuna Pacific cod Scads Pacific cod Croakers, drums Round sardinella Skipjack tuna	**Pacific, southeast** Pacific, western central. Pacific, western central Pacific, western central Pacific, northwest Pacific, northwest Pacific, northeast Indian, western Atlantic, eastern central Indian, western
Developing (2) **Mature (3)**		**Alaska pollock** Gulf menhaden Sand eels European pilchard Cape horse mackerel Argentine hake European pilchard Chub mackerel Yellowfin tuna	Pacific, northwest Pacific, northeast Atlantic, western central Atlantic, northeast Atlantic, eastern central Atlantic, southeast Atlantic, southwest Mediterranean Pacific, southeast Pacific, eastern

			central
Developing (2) Mature (3) Senescent (4)		Atlantic cod Pacific herring Large yellow croaker Picked dogfish Greater lizardfish Albacore Jack and horse mackerels Atlantic wolffish Southern bluefin tuna	Atlantic, northwest Pacific, northwest Pacific, northwest Atlantic, northeast Pacific, northwest Atlantic, northeast Mediterranean Atlantic, northeast Indian, eastern
Developing (2) Mature (3) Senescent (4) Developing (2)		Southern African pilchard Atlantic redfishes Yellow croaker Pacific Ocean perch Albacore East Pacific bonito European anchovy Frigate and bullet tunas Red hake	Atlantic, southeast Atlantic, northwest Pacific, northwest Pacific, northeast Pacific, northwest Pacific, southeast Atlantic, northeast Pacific, northwest Atlantic, northwest

*** Only some of the major resources of each group are listed.**

Figure 26. Total marine fish landing composition according to clustered groups of resources

A curve was fitted to the average standardized landings series for each group of resources. Each curve was then divided into segments corresponding to different phases of the generalized model (Figure 25) and the number of resources in each phase of fishery development calculated for each year. The overall pattern of change in the phase composition is shown in Figure 27.

Figure 27 shows strikingly the process of intensification of fisheries since 1945 and its consequences in terms of the stock of resources. It shows the large proportion of world resources that are subject to declines in productivity (phase 4, senescent) and their increase with time. It also underlines the fact that the ever-growing total tonnage of world fishery production gives a misleading vision of the state of world fishery resources and a false sense of security (a comment already made by FAO).[13] Unfortunately, a similar comment should probably be made for changes in total aggregated landings at national level, which are often used as a justification for further development.

[13] FAO. 1994. *Current situation, trends and prospects in world capture fisheries*. A paper presented by S.M. Garcia and C. Newton at the Conference on Fisheries Management: Global Trends. Seattle, Wash., USA, 14 to 16 June 1994.

The results shown for 1994 (i.e. the last data point available on Figure 27), indicate that about 35 percent of the 200 major fishery resources are senescent (i.e. showing declining yields), about 25 percent are mature (i.e. plateauing at high-exploitation levels), 40 percent are still developing and none remain at low-exploitation level (undeveloped). This indicates that around 60 percent of the major world fish resources are either mature or senescent and, given that few countries have established effective control of fishing capacity, these resources are in urgent need of management action to halt the increase in fishing capacity or to rehabilitate damaged resources. A strikingly similar conclusion was reached by FAO, which concluded that 44 percent of the stocks for which formal assessments were available were intensively to fully exploited, 16 percent were overfished, 6 percent were depleted and 3 percent were slowly recovering, concluding therefore that 69 percent of the known stocks were in need of urgent management.[14] That same study, using a global production model with estimates of the world capacity, concluded that the demersal high-value species were overfished and that a reduction of at least 30 percent of fishing effort was required to rebuild the resources.

[14] Ibid.

Figure 27. Percentage of major marine fish resources in various phases of fishery development

State of resources by oceans

In a review of the state of world fisheries, FAO showed that the annual relative rate of increase of world reported landings had significantly decreased since 1950, and was approaching zero, indicating that the maximum production from the world's conventional marine resources under current exploitation regimes was being approached and that the mean catches of the last few years were probably very close to that maximum.[15] The same analysis has been repeated below globally and by oceans.

[15] Ibid.

Based on the analysis of total marine landings (Figure 28), the predicted maximum production for world marine fisheries with the present overall fishing regime (generally characterized by small sizes at first capture and significant discards) corresponds to about 82 million tonnes, a value close to the average landings of 1990-94 of about 83 million tonnes. It is obvious that this crude global estimate of the world potential of conventional resources under the present regime of exploitation, which indicates that the world would be at full potential about now, is a composite, aggregate result which hides the increasing occurrence of overfishing on a multitude of stocks in many different areas as evidenced during the last 50 years. In order to reduce this effect and to illustrate differences in development rates and timing, as well as potential, the analysis has been undertaken separately for each ocean.

The time series of landings for the Atlantic, Pacific and Indian oceans, as well as for the Mediterranean Sea (including the Black Sea) have been processed in the same way as the world marine total landings, and the corresponding lines showing the declines in relative rate of increase are shown in Figure 28. Only the main conclusions are reported here and details can be found elsewhere.[16]

[16] Ibid.

Figure 28. Trends in the relative rate of increase in landings by ocean

Estimates of world marine production potential obtained from both analyses were as follows:

· estimate based on world marine total landings (potential = 82 million tonnes);

· summing estimates made for each ocean (potential = 100 million tonnes).

The aggregated estimate of 82 million tonnes refers to the present fishing regime. The difference between the aggregate potential and the sum of the different oceans' potentials, which amounts to 18 million tonnes, is indicated to come mainly from the development of fisheries in the Indian Ocean.

In order to gain some insight in to how fishery potential might be distributed within the oceans, the same analysis was undertaken at a lower level of aggregation by considering total landings for each of 16 FAO major fishing areas. The statistical fits, which are

generally much poorer than for the ocean totals, indicate an overall potential of 125 million tonnes, assuming that each area can be optimized separately. Comparing, area by area, the average landings of the last five years and the estimated potential production from this last analysis and taking into account the subjective degree of reliability of each estimate, it would appear that, compared with the present situation (i.e. landings of about 83 million tonnes):

· an increase of 10 million tonnes could well be possible (i.e. total potential of 93 million tonnes), 4 million tonnes coming from management of overfished stocks in each of the Atlantic and Pacific oceans and 2 million tonnes from fisheries development in the Indian Ocean;

· an additional increase of 17 million tonnes is less certain (i.e. total potential of 110 million tonnes), comprising 2 million and 1 million tonnes from management of overfished stocks in the Atlantic and Pacific oceans, respectively, and 14 million tonnes from development in the Pacific Ocean;

· an additional increase of 15 million tonnes is highly uncertain (i.e. total potential of 125 million tonnes), from fisheries development in the Indian Ocean.

These hypothetical potential increases, particularly the last two of 110 million and 125 million tonnes, have to be considered with prudence because some critical regional assessments (i.e. those for the Indian Ocean, the Mediterranean and the southeast Pacific) are not reliable and require further analysis to confirm or reject the preliminary results given above.

Comparison of ocean potentials

In order to investigate the coherence of the estimated potentials by ocean, a comparison of estimated potential production per unit of shelf was made for the Atlantic, Pacific and Indian oceans and for the Mediterranean and Black seas. Shelf area (between 0 and 200 m depth) and total surface area were estimated using the Geographic Information System (GIS). The relationships between ocean potential and shelf area for the two sets of data, which have been plotted on Figure 29 corresponding to estimates by ocean (potential), are surprisingly consistent although there are only four data points in each relation (the world total in each plot is not independent). This would tend to indicate that, while the results for each region have to be considered with caution, the overall picture is generally coherent.

Conclusions

Fisheries potential

The overall picture which emerges of the current state of world fisheries is consistent with what FAO has already stated in its last world review of the state of marine fisheries

but, with due consideration to the numerous caveats, it differs somewhat in regard to fisheries potential.

This analysis has described the dynamics of fisheries on the 200 top marine fish resources of the world which demonstrated the rapid increase in fishing pressure. Results indicate that in 1994 about 35 percent of these resources were in the senescent phase (with declining landings), 25 percent were in the mature phase at a high level of exploitation and 40 percent were still developing, while there were none remaining in the undeveloped phase.[17] A corollary of this is that there has been a gradual increase in the estimated number of stocks requiring management, from almost none in 1950 to over 60 percent in 1994. This underlines the urgent need for effective measures to control and reduce fishing capacity and effort.

[17] These figures refer to "conventional" resources as no time series of data exists for the analysis of the state of non-conventional resources such as krill, mesopelagic fish and many oceanic squids which are usually considered underdeveloped.

A strikingly similar conclusion was reached by FAO in 1994[18] based on traditional stock-assessment information. Using a global production model, with estimates of the world capacity as a measure of fishing pressure, it was concluded that the demersal high-value species were overfished and that a reduction of at least 30 percent of fishing effort was required to rebuild the resources.

[18] FAO, op. cit., footnote 13, p. 42.

Generally speaking, the Indian Ocean has the least-developed fisheries, but the coastal resources in this ocean are under severe stress in many areas and require effective management, even though the potential for expansion may exist further offshore. It must also be pointed out that, although the possibility of expanding Indian Ocean fisheries offshore has been repeatedly considered by the coastal countries in that area (particularly India, Indonesia, Malaysia and Thailand), no convincing evidence of the existence of such resources has ever been provided.

It is interesting to note that the estimates of the possible gains to be obtained through management or development depend on the level of aggregation in the analysis. The more aggregated the data used for the analyses, the less is the estimated potential for further increase. This is an expected result as only a disaggregation of the time series by region and stock can reveal the various situations of underdevelopment or overfishing that exist contemporaneously in all areas. This analysis of regional resources takes the disaggregation only some way towards the stock level of detail.

The statements made in the various sections of this study that have implications in terms of resource assessment or fisheries outlook are summarized in Table 5. Taking all the results together, it seems reasonable to reject the assessment of world marine fishery potential based on the time series of world total landings which leads to an estimate of 82

million tonnes. The reason is that a number of more detailed analyses have shown the opposite:

· The analysis of the overexploited marine resources has shown that there may have been historical "losses" (of about 9 million tonnes) owing to overfishing which might be recouped through management. The existence of such losses is supported by the analysis of the demersal fish resources (5 million tonnes loss) and of the straddling stocks (2 million tonnes loss), although there is much overlap in the composition of these classifications. The global figure of 9 million tonnes from improvement of management of overexploited resources may be considered a minimum, assuming that the degradation of the resources is reversible.

· In addition, the resources evaluation based on the groups of resources has estimated that fisheries on 40 percent of the major marine fish resources are still developing. The analyses of the relative rate of increase in landings indicate that in 56 percent of the areas the point where the rate of increase is equal to zero has been passed, while 37 percent are still increasing. These results clearly indicate that, in some areas and on some resources, an increase in landings is still possible, even though the magnitude of this increase is not known.

Figure 29. Relationship between ocean fishery potentialand shelf area for two estimates of potential

Mariculture production is included in the data used in both the global and regional assessments. It will have a negligible influence on marine fish projections (diadromous fish such as salmon are not included in the analysis) but it is important for crustaceans and molluscs. The great variations in the importance of aquaculture among regions (which are masked in the global analysis) may explain some of the differences between the global and regional projections.

The overall conclusion from this study is, therefore, that the increase of 10 million tonnes (i.e. marine potential of 93 million tonnes) based on the more reliable estimates of potential by major fishing area seems a realistic possbility. It is entirely consistent with the possible increase in landings of 9 million tonnes from the present level through fisheries management (based on reduced landings of overexploited resources, demersal fish species and straddling stocks) plus some unknown quantities from further development (including in the Indian Ocean) from fisheries that are still developing. Given that many of the developing and declining fisheries are based on stocks that are increasing or decreasing in reponse to environmental or ecosystem changes, rather than on fishing, it is safer to reject at this stage the higher estimates of marine fishery potential.

Implications for management and development

For the resources that are at present below their historical peak levels of production it might be possible to return to those levels by reducing the fishing effort and, in most

cases, simultaneously improving yield-per-recruit. This can be achieved by increasing significantly the age at first capture, prohibiting the exploitation of juveniles, increasing mesh sizes and closing temporarily or permanently areas of concentrations of young fish. Examples in Cyprus and the Philippines[19] have shown that 100 percent increases of sustainable production can be obtained in the tropics within 18 months. More recent experiences with the protection of juveniles in Morocco (on cephalopods, through a closed-season area) and Norway (on cod, through ad hoc area closures) have also produced improvements in catch rates which tend to show that short-term benefits can also be expected in more temperate areas. Effective management can undoubtedly also lead to long-term increases in yield. This has been demonstrated for the northeast Arctic cod stock in the Norwegian and Barents seas which, in contrast to most other Atlantic cod stocks, has shown a recovery in spawning stock biomass from a depleted condition to a level not seen since the 1950s following a major reduction in fishing mortality in the late 1980s.[20]

[19] Garcia, S.M. 1986. Seasonal trawl bans can be very successful in heavily fished areas: the Cyprus effect. *Fishbyte*, April 1986: 7-12.

[20] ICES, op. cit., footnote 3, p. 32.

TABLE 5

Summary of analyses, conclusions and diagnostics

Type of analysis	Conclusions	Diagnostics
TRENDS IN DEMERSAL FISH		
Overall decrease	**Production stable since the 1970s**	**Hiding overfishing**
Sum of peaks minus present landings	**In 31% of the FAO areas: increases In 67% of the FAO areas: decreases Minus 5 million tonnes**	**Largely owing to overfishing Possible increase unknown Obtainable through management?**
TRENDS IN OVEREXPLOITED MARINE RESOURCES		
Overall decrease	**Minus 6 million tonnes since 1985**	**Overfishing**
Sum of peaks minus present landings	**Minus 9 million tonnes overall**	**Overfishing**
TRENDS IN HIGHLY MIGRATORY AND STRADDLING RESOURCES		

Highly migratory	**Still increasing**	**Some overfished**
Straddling	**Minus 2 million tonnes since 1989**	**Mainly overfishing of Alaska pollock**
TRENDS IN 200 MAJOR FISH RESOURCES		
(accounting for 77% of world marine fish landings)	**35% resources overfished 25% resources fully fished 40% still developing**	**60% need urgent management**
TRENDS BY OCEAN		**POSSIBLE ADDITIONAL PRODUCTION**
Atlantic	**Fully fished in 1980 (21.1 million tonnes)**	**No further increase**
Pacific	**Fully fished in 1999 (54.1 million tonnes)**	**Insignificant increase (+ 1.1 million tonnes) through development**
Indian	**Developing (5.4%/year, about 23.1 million tonnes)**	**Substantial increase (+ 16.1 million tonnes) through development to be verified**
Mediterranean and Black seas	**Developing (2.6%/year, 2.1 million tonnes)**	**Increase through eutrophication (likelihood unknown)**
Three estimates of global marine potential:		
World ocean	**Fully fished in 1996 (82.1 million tonnes)**	**Further increase unlikely**
Sum of oceans	**Developing (100.1 million tonnes)**	**Substantial increase (+ 17.1 million tonnes) depends on reliability of Indian Ocean estimate. Mainly development**
Sum of areas	**Developing (125.1 million tonnes)**	**Very substantial increase (+ 42.1 million tonnes) mainly from management and development. Highly**

			unreliable

An important problem and opportunity are in the potential improvement from the reduction of unwanted by-catch. It has been estimated that 27 million tonnes of fish are discarded every year,[21] comprising species of low commercial value but also a large proportion of juveniles. These 27 million tonnes are part of the catches, if not part of the landings, and are not included in the data used in this study, but nevertheless need to be taken into account for management. If added to the present landings, they result in a world marine catch of more than 110 million tonnes. The benefits resulting from a reduction of unwanted by-catch through the increased survival of juvenile fish can be very significant.

[21] FAO. 1994. *A global assessment of fisheries by-catch and discards*. FAO Fisheries Technical Paper No. 339. Rome. 233 pp.

Increases in production would come from further fisheries expansion on those resources that are apparently still increasing their contribution to world landings (about 40 percent of major fish resources are classified as still developing in this study and FAO in 1994[22] estimated 32 percent). It must be recognized that, although for these resources landings are still growing at a steady rate, it is not possible to have a reliable estimate of the potential. It would be a mistake, however, not to recognize that some potential exists.

[22] FAO, op. cit., footnote 13, p. 42.

An important question is whether, at the global level at which the analysis has been conducted, improvements in yield from both demersal predators and pelagic prey can be expected. The pelagic group contains a number of significant predators, among which are the large pelagic tunas and tuna-like species. The demersal group contains a number of small species which are prey, and demersal fish eggs and larvae, during their early pelagic phases, are prey for the small pelagic species. The implications of these interactions are not easy to foresee and it is therefore impossible to establish how much of the present balance in the abundance (and potential) of pelagics and demersals results from the relative overfishing of the demersals and the resultant reduced pressure on pelagics. Neither is it possible to determine to what extent the rehabilitation of the overfished demersals will affect the survival and potential of the pelagics. The issue of resource rehabilitation at the large, regional scale has never been tackled and remains, with the issue of the medium-term variations of the small pelagics, one of the key issues of the management of fisheries for the twenty-first century.

In conclusion, while it must be recognized that the statistical significance of the most detailed analysis in this study is insufficient, the elements of information available indicate that an increase in fisheries production of at least 10 million tonnes is possible plus further increases in landings of an unknown magnitude obtained from fisheries development, as well as from mariculture. FAO in 1995[23] indicated that 20 million tonnes more landings might be obtainable. The results of the present study provide a firmer basis for believing that such an increase can be realized if: degraded resources are

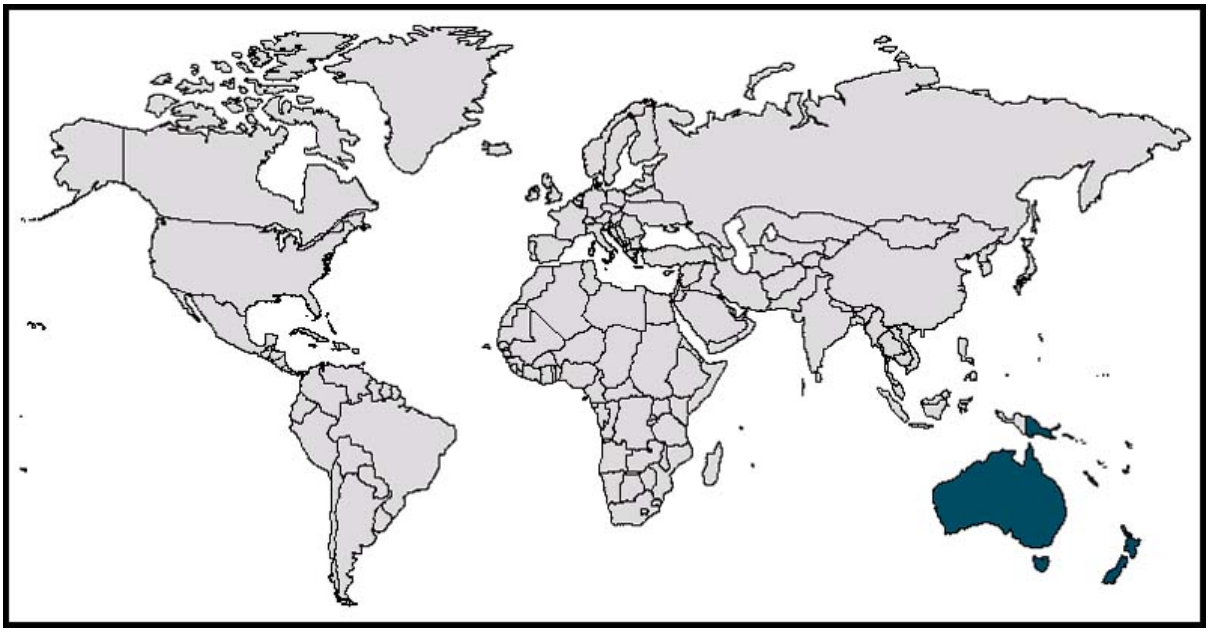
rehabilitated; underdeveloped resources are exploited further, avoiding, however, their overfishing and the overfishing of those resources that have already reached the highest level of sustainable exploitation they can stand; and discarding and wastage are reduced.

[23] FAO. 1995. *The State of World Fisheries and Aquaculture*. Rome. 57 pp.

REGIONAL REVIEW

1. South Pacific[1]

[1] This review is based on the regional study prepared by the FAO interdepartmental task force, headed by D. Doulman, Fishery Policy and Planning Division/International Institutions and Liaison Service (FIPL). The information is based on written contributions by Dr Tim Adams of the Resource Assessment Management Section, Coastal Fisheries Programme of the South Pacific Commission, Noumea, New Caledonia.



The region covers the western and central Pacific Ocean, stretching from Australia in the west to Pitcairn Island in the east. There are 16 independent states as well as dependent territories of France, the United Kingdom and the United States. Two of the states, Australia and New Zealand, are developed while the remaining states and territories are small island developing states (SIDS). The main fishing areas are the southwest and central Pacific Ocean and the eastern Indian Ocean.

Although the South Pacific region provides only about 2 percent[2] of total world fishery production, the fisheries sector - together with tourism - plays a critical role in the economies of the South Pacific states and territories. The region's inshore and offshore fisheries resources are harvested for food, for sale on national markets and, above all, for export. The South Pacific has one of the world's richest tuna fishing grounds, and fisheries exports from the region consist almost wholly of tuna. Food fish consumption is relatively high in the region at an average of 20 kg per caput annually (live weight equivalent). Excluding Australia and New Zealand, the average for some small island developing states alone would probably be twice as high.[3]

[2] Including fishing by foreign fleets.

[3] Precise statistics on fish supplies in the Pacific islands are not available.

RESOURCES AND PRODUCTION

Marine fisheries

The total domestic marine fishery production of the region was 769 000 tonnes in 1994, making up almost 90 percent of total fish production. Almost another 1 million tonnes of tuna is harvested annually by foreign fleets. In the 1980s and early 1990s, regional production rose much more quickly than the global average, but has declined in recent years mainly as a result of restructuring in Australian commercial fisheries and changing management regimes in New Zealand (see below). The bulk of aggregate landings originate from the fishing area of the southwestern Pacific Ocean, mainly caught by New Zealand. Australia also fishes in the eastern Indian Ocean and the catch of the small island developing states (SIDS) is mainly harvested in the western central Pacific Ocean.

In the SIDS, the main types of fisheries are distinguished by their pattern of operation and the way they are administrated. For industrial fisheries, tuna is the main target and distant-water fishing fleets from several countries outside the region participate through access agreements; in fact, Pacific island national fleets take only about 6.5 percent of the total catch of around 1 million tonnes. Small-scale coastal fisheries are divided between those targeting export products and those fishing for domestic consumption. Export production includes high-value products for specific niche markets, for example sea cucumbers, snapper and mother-of-pearl shells. There is very little interaction between the export fisheries and domestic fish production, and the species exported are usually not part of the traditional local diets. However, the species exported are also retained for the

local tourist industry. The species consumed locally include crustaceans, reef fish and pelagics such as tuna and swordfish.

Figure 30. Regional fish production and share of world production in percentage

Throughout the Pacific islands, little is generally known about the volumes of coastal fish catches and the status of stocks: export categorization is often confused; coastal fishery stock assessment is virtually non-existent; and most of the information used in policy-making is anecdotal in origin. SIDS are concerned about the impact of high-seas fishing by foreign fleets in the region; about 20 percent of the South Pacific region is covered by high seas that fall between the exclusive economic zones (EEZs) of island states and territories.

In the Pacific island states and territories, industrial fisheries technology has tended to be of an intermediate level. A lack of trained work force and of the infrastructure necessary to support sophisticated industrial fishing operations is characteristic in most states and territories in the region. Foreign fishing fleets operating in the South Pacific are monitored by the Forum Fisheries Agency and a number of activities relating to conservation and management have been put in place for these fleets, including a regional cap on the number of purse-seine vessels permitted to operate. In coastal fisheries there are localized excess capacity problems particularly around atolls and reefs. The main challenge for states and territories in the region is to achieve sustainable resource use while ensuring the greatest socioeconomic benefit.

As would be expected of developed states, fishery technology and infrastructure in Australia and New Zealand are advanced and appropriate to a modern fisheries industry. In the trawl fisheries, these two states lead the world in deep-water trawling technology. In nearshore fisheries, harvesting methods and small vessel design also use extremely high technology - in many cases this is assisted by the extensive small boat leisure industry, which requires similar technologies and services. Australian catches include a large variety of species - scallops, lobster and orange roughy being among the more important. New Zealand catches have recently been dominated by blue grenadier, as well as squid, jack and horse mackerels and orange roughy. Several stocks have shown signs of overfishing recently. In both countries, the management of excess capacity is not a particularly contentious issue. Fleets have been reduced, particularly the prawn fleet in Australia’s Gulf of Carpentaria which, through rigorous industrial management, has decreased from 292 vessels in 1977 to 125 vessels in 1993.

Inland water fisheries

Owing to the good supplies of freshwater, significant inland fisheries are restricted to the larger land masses of the region (i.e. Australia, New Zealand and Papua New Guinea). In Australia and New Zealand, inland fisheries are valued as a recreational resource and not as a source of food security. On the other hand, in the highland areas of Papua New Guinea inland fisheries are very important owing to restricted access to marine coastal areas and limited production of other sources of animal protein. Some SIDS also support

a certain level of inland water fishing as well as specialized fisheries. The total inland capture fishery harvest in the South Pacific region in 1994 was 25 102 tonnes. River eels, barramundi, freshwater molluscs and crustaceans, tilapia, gudgeons and sleepers are found in the region. Salmonids, such as rainbow and brown trout, are common inland sport fish in Australia and New Zealand.

Data for inland fisheries do not include sport and recreational fisheries, which are important in developed areas such as Australia and New Zealand. Although data on recreational fishing throughout Australia are limited, anglers now appear to be the dominant harvesters of several estuarine fish species. The growing number of recreational anglers in Australia, and probably elsewhere, could lead to both heightened conflict among user groups and greater exploitation of the limited resources.

Figure 31. Fish utilization and food supply

Figure 32. Fishery imports and exports (including intraregional trade)

N.B. FAO trade statistics available only from 1976.

Aquaculture

Aquaculture production has risen from some 20 000 tonnes in 1984 to almost 75 000 tonnes in 1994, mainly owing to increases in New Zealand and Australia. Excluding the two major producers, the remaining Pacific states and territories contributed a mere 2 500 tonnes in 1994. The major increase from a single species was from mussel cultivation in New Zealand, which grew from 9 800 tonnes in 1984 to 47 000 tonnes in 1994. Other significant, rapid increases have been observed in the culture of salmon in New Zealand and of *Salmo salar* in Australia. Oysters and pearl oysters are other important species. Most aquaculture production is derived from coastal aquaculture, even though the physical potential for freshwater aquaculture development could be considerable in larger countries.

PRODUCTS AND MARKETS

Apart from in Australia and New Zealand, fish is a culturally and nutritionally important source of food throughout the region. The diet of the Pacific islanders depends heavily on fish and most states and territories derive a high proportion of their animal protein supplies from fish, ranging up to a high of 69 percent for Kiribati and with almost all states deriving over 25 percent from this source. Actual fish consumption is difficult to estimate, however, because of the limited statistics available and the unknown contribution from unrecorded household catches. The figures for per caput food fish supply provided by FAO probably underestimate overall consumption. These figures have shown a steady upward trend over the years and range up to 100 kg per head per year (live weight equivalent) for Tokelau. The regional average as a whole was 20 kg per person in 1994, but the average for the island countries alone - excluding Australia and New Zealand - is at least twice as high.

Fisheries exports from the region consist almost wholly of tuna, which is the South Pacific's most important development resource. Canneries in American Samoa, Fiji and the Solomon Islands export tuna at slightly higher prices than their Southeast Asian counterparts, but the latter two states benefit from African, Caribbean and Pacific (ACP) status in the European Union (EU) market.[4] Exports of fishery products from Australia and New Zealand are encouraged by sophisticated fish-processing industries geared to exporting high-value products to discriminating markets.

[4] The EU has a trade agreement with 69 countries in Africa, the Caribbean and the Pacific. However, with the new General Agreement on Tariffs and Trade/World Trade Organization (GATT/WTO) agreement, these privileges will be withdrawn gradually. See Box 22 on p. 103.

Figure 33. Fishery production by species categories

Figure 34. Fishery imports and exports for major trading countries in 1994

FISHERIES POLICY AND MANAGEMENT

Most national fisheries administrations in the Pacific islands are small and fragile with only a limited range of technical expertise. High priorities are assigned by governments to policies aimed at institutional strengthening and capacity building because of the importance of fisheries among these countries. In the early 1990s, action was taken to restructure the national fisheries administrations in Australia, New Zealand and Papua New Guinea. In each case, national fisheries authorities with semi-commercial status were established and these have facilitated a more prominent participatory role for the private sector in fisheries administration, including private-sector financial contributions to the costs of administration and research.

The socio-economic development of many South Pacific island states and territories is closely tied to the fortunes of regional fisheries. Hence, national development strategies and planning invariably involve plans for developing and/or strengthening participation in the fisheries sector. In addition, for economic security reasons the South Pacific states and territories place a high priority on the development of national industries (fleet and processing) as they consider that domestic industry affords them a greater degree of control over the sector. The high level of participation of foreign vessels in the tuna fisheries is seen as an intermediate solution, and the states and territories generally aspire to develop their fishery resources themselves. In the meantime, the Pacific islands have the objective of increasing the revenues from licensing fees in order to raise what they consider a more reasonable financial return from the exploitation of their resources. Most of the South Pacific states and territories also seek to diversify activities in the fisheries sector by encouraging the establishment of new industries, trying to integrate the fisheries sector more closely into the expanding tourist industry and, where possible, promoting inland fisheries and aquaculture.

Regional fisheries cooperation in the South Pacific is well-established, successful and, in many cases, a cornerstone of national foreign policy. States recognize that individually

they are weak because they are small and can easily be manipulated in fisheries matters. It was primarily this recognition that led to the establishment, in 1989, of the Forum Fisheries Agency (FFA), which is mandated to assist its member countries to coordinate their fisheries policies and activities.[5] The South Pacific Regional Environmental Programme (SPREP) assists member countries in respect of the adverse impact of human activities on fishes in coastal fisheries and, for reef and lagoon fishes, the South Pacific Commission (SPC) Coastal Fisheries Programme is developing a mechanism for greater harmonization of national policies. SPC also compiles fisheries data and provides scientific assessments in support of FFA's conservation and management work. In addition, after the United Nations Conference on the Law of the Sea, the independent island states pooled their effective capacity for managing tuna fisheries probably to a greater extent than any other region. The Pacific island states, which generally lack any capacity for distant-water fishing, have taken a conservationist rather than an exploitative approach to the management of highly migratory species.

[5] The members of the FFA are Australia, the Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Is-lands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Samoa, the Solomon Islands, Tonga, Tuvalu and Vanuatu.
In Australia and New Zealand, most fisheries are managed by licences and/or quotas and the import of vessels from abroad is monitored; hence the fleet is at, or around, the optimum size for harvesting the available resources. This is greatly aided by industry's involvement in fisheries management. The reduction in the fleet has mainly been brought about by the buy-back of existing licences. In New Zealand, the introduction of individual transferable quota (ITQ) systems has greatly slowed down the pace of fishery expansion and led to greater fisheries rationalization. Finally, in both Australia and New Zealand, ITQs have enhanced economic efficiency within the fisheries sector.

The issue of by-catch discards is of most concern in trawl fisheries, but these are found only in Papua New Guinea's Gulf of Papua shrimp fisheries, which has a by-catch of around 80 or 90 percent of the total, and very recently in the experimental scallop fishery in the Lagon Nord off New Caledonia (Box 6).

Many inshore and inland aquatic resources have declined as a result of overfishing and habitat degradation. Efforts to reverse this situation include the construction of artificial reefs, stocking, habitat improvement and the introduction of exotic species. Aquatic environments have been stressed and degraded by increased population growth (Box 7).

BOX 6
Discards in the South Pacific

In their artisanal and subsistence fisheries, Pacific islanders discard, or return, very little of their catch, except tabu fish (such as remora or shark in certain islands) and fish that are known to have a high

probability of conferring ciguatera or some other toxin. Of the fish that are eaten, there is also a very high recovery rate of edible material; only the bones, scales, gills and some of the viscera are discarded. Mollusc shells (apart from mother-of-pearl) and crustacean carapaces are normally considered waste, and middens of such fishery waste are the prime source of archaeological information about pre-contact Pacific island populations.

The discard of by-catches is a consideration for the distant-water albacore long-line fisheries and, to a lesser extent, the skip-jack and yellow-fin purse-seine fisheries. Small-scale long-liners running short trips out of Pacific island ports generally discard only sharks, and this to a lessening extent as a demand is being created. Any unsaleable fish from Pacific island pole and line tuna fisheries are taken home by the crew or, in previous years in Fiji, given to coastal villages to compensate for bait-fishing access. In Honiara, there are now important skipjack sales to the local fish market, contributing to more moderate fish prices and enhancing the urban diet of nearby villages.

Trawl fisheries, which often generate large unwanted by-catches, are found in the Pacific islands only in Papua New Guinea's Gulf of Papua (shrimp) and, very recently, in the Lagon Nord off New Caledonia (scallop). By-catches from the Gulf of Papua shrimp-trawl fishery are around 80 to 90 percent of the total catch, while the New Caledonia scallop-trawl fishery is still experimental (and most of the by-catch is likely to be marketable). As a general rule, Pacific island shallow-water substrates are too coral-strewn for trawling, and no fisheries (apart from very localized beds of precious coral) have been identified in abyssal substrates.

Source: South Pacific Commission. 1996.

BOX 7
Enhancement and rehabilitation of inshore fisheries

Many of the inshore and inland aquatic resources of the South Pacific region have declined as a result of overfishing and habitat degradation around urban or industrial areas. Overfishing of inshore and lagoon areas was identified as a significant issue in nearly every state and territory in the South Pacific and efforts to increase production or

profit from inland and inshore have included the construction of artificial reefs, the stocking of water bodies and coastal reef areas, habitat improvement and the introduction of exotic species. Nearly 30 exotic aquatic species have been introduced to Australia and nearly 20 to New Zealand. In Papua New Guinea, over 30 species have been introduced and there is still an active programme to stock the Sepik River with exotic fishes. Smaller island states have transferred or introduced tilapia (*Oreochromis* spp.) and the molluscs trochus (*Trochus niloticus*) and green snail (*Turbo* spp.). States and territories realize the potential dangers of inappropriate introductions and are adopting or have adopted legislation or guidelines to regulate the use of exotic species.

Many species of commercially important molluscs are prone to overexploitation because of slow recruitment and the ease of harvest. The giant clam and its relatives (*Tridacna* spp. and *Hippopus hippopus*) have been classified as threatened species by the World Conservation Union for many of the islands and stocking and transplantation projects have been attempted for species of giant clam (Tridacnidea) and for trochus on Australia's Great Barrier Reef and in the Cook Islands, French Polynesia, the Federated States of Micronesia and other Pacific islands. The largest hatcheries for *Tridacna* enhancement are at the Coastal Aquaculture Centre in the Solomon Islands, the Micronesian Mariculture Development Centre in Palau and James Cook University in Australia. Green snail, which has been introduced to French Polynesia from Vanuatu, is being considered for translocation to other areas within the region and as a candidate for stocking coral reefs with hatchery-raised juveniles.

Artificial reefs have been used to increase habitat diversity, thereby increasing or congregating species of commercially important fish and shellfish in areas such as South Australia and Queensland. Using materials of convenience, such as old tyres and derelict vessels, the artificial reefs have increased the catch for recreational fishermen and sport divers.

Source: South Pacific Commission, 1996.

OUTLOOK

Fish and fishery products will continue to play a fundamental social and economic role in the South Pacific. Fish for human consumption will remain the most important source of animal protein for many Pacific island communities, in particular for the most disadvantaged ones. The fisheries sector will be one of the primary vehicles for

promoting economic development in the South Pacific and, for some states and territories, the sector will be the main engine of economic development. Few areas or regions of the world will depend more on the fisheries sector for development than the South Pacific.

The region's fisheries resources are probably capable of meeting a somewhat increased future demand for fish, although it is likely that additional amounts of pelagic species will have to be consumed, particularly in urban areas and in other areas of high population concentration. Marketing and distribution systems will need to be improved in order to move fish more quickly and efficiently both among states and territories in the region and within states and territories themselves. The promotion of sustainable fisheries and the implementation of regional and national arrangements to ensure that fisheries resources are utilized rationally are major social and economic policy issues in the South Pacific and most states and territories are attempting to deal with overfishing of inshore resources.

States and territories in the South Pacific recognize that effective and sustainable regulation of both inshore and offshore fisheries resources is essential for long-term food and socio-economic security.

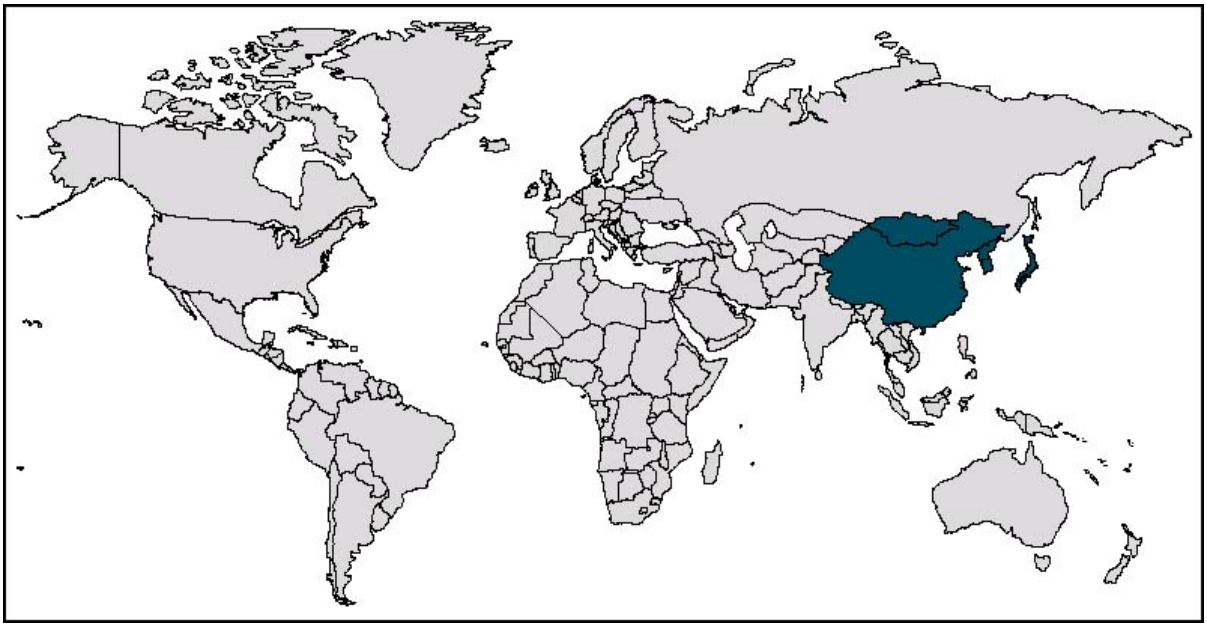
The potential for aquaculture development varies significantly among subregions. Physical, biotechnical, economic, institutional and other issues generally disturb the development of aquaculture in the South Pacific, although the potential does exist for the selective and careful development of production for food and economic purposes.

With regard to trade, Australia and New Zealand are speciality product exporters to Japan, the United States and Europe. Exports have expanded in recent years, especially for New Zealand fishery products (e.g. mussels) and this is expected to continue. The forecast for New Zealand's and - to a lesser extent - Australia's seafood exports is positive, provided that sound management practices are enforced for deep-water species, such as orange roughy, which grow slowly.

In the SIDS, the forecast is for a contraction of fish imports and a small increase in exports, mainly tuna. Fresh sashimi-grade tuna is already transported by air to the Japanese market, but the distances involved and other problems will continue to hamper access to this lucrative market. Papua New Guinea might become an important exporter of canned tuna to the European market, once its cannery is fully operational - the advantages of the Papua New Guinea industry is that it is close to the resource and that the quality of the tuna is excellent.

2. East Asia[1]

[1] This review is based on the regional study prepared by the FAO interdepartmental task force, headed by J. Cortez, Fishery Policy and Planning Division/International Institutions and Liaison Service (FIPL).



The region encompasses the marine and inland water jurisdictions of the following states: the Democratic People's Republic of Korea Hong Kong, Japan, Macao, Mongolia, China, the Republic of Korea, the east coast area of the Russian Federation (the fisheries of the Russian Federation are summarized in the regional study on Europe on p. 64) and Taiwan (Province of China). The review will concentrate on the three most important fishing nations - Japan, China and the Republic of Korea - although the figures given for the region cover all countries, unless otherwise specified.

The seas within this region consist of the northwest Pacific Ocean including the Sea of Japan, the East China Sea and the Yellow Sea.

Fish production is an important economic activity in the East Asian coastal states. The region is one of the world's largest fish-producing areas with a total production of 36.6 million tonnes in 1994.[2] The East China Sea, the Yellow Sea, the Sea of Japan and the eastern offshore waters of Japan are among the most intensively fished waters in the world, and aquaculture production in the region contributed more than 70 percent of the total global volume. Fish consumption is generally high, exceeding meat consumption in some of the countries; annual food fish supply amounts to 21 kg per caput on average (live weight equivalent). The region is an active trading partner on the international market and a net importer (in both volume and value).

[2] Including distant-water fishing by the fleets of the region and Poland's distant-water fishing in this area.

RESOURCES AND PRODUCTION

Marine fisheries

Marine fisheries landings by local fleets in the northwest Pacific reached a total of 22.6 million tonnes in 1994. Another 1.9 million tonnes were fished in other marine waters. The main fishing nations are China, followed by Japan and the Republic of Korea.

Figure 35. Regional fish production and share of world production in percentage

Fisheries in the East China Sea are usually small-scale, although larger trawlers are sometimes used. Tuna, mackerel, shrimp, milkfish, sea breams, croakers and shellfish of various kinds are the main species harvested. The demersal fish resources of the Yellow Sea have been exploited by trawlers from China, the Republic of Korea, the Democratic People's Republic of Korea and Japan for years. The main resources are sea bream, croakers, lizard fish, prawns, cutlass fish, horse mackerel, squids and flounders. All species are overfished, and the catch of particularly valuable species has declined recently. The Sea of Japan has a range of pelagic and demersal species, including herring, pilchard, Alaska pollock, mackerels and bluefin tuna, but these resources have gradually been overexploited. Squid fishing is carried out in the central part of the sea, salmon fishing in the shoal areas and crustacean trapping in the deeper parts. The sea is heavily fished by fleets from Japan, the Russian Federation, the Republic of Korea and the Democratic People's Republic of Korea.

Total marine production in the region has decreased over recent years, although 1994 landings represented a slight increase compared with the year before. The decrease is mainly associated with the decline of pelagic fish landings, in particular the Japanese pilchard; although it does not seem to be related to fishing but rather caused by decadal-scale changes in the marine environment (Box 8). However, other resources, particularly Alaska pollock, show low levels caused by heavy exploitation.

The two largest fleets in the region are the Japanese and the Republic of Korea's, which, in 1994, had 2 423 and 1 012 vessels, respectively, of a gross registered tonnage (GRT) over 100 GRT/vessel. The Chinese fleet consisted of 253 vessels of over 100 GRT in the same year. In the Republic of Korea, the fishing industry faces difficulties from rising labour costs and the depletion of marine resources, and in some fisheries, such as the anchovy dragnet fishery and the Alaskan pollock fishery, high degrees of automation have been introduced. In addition, the government plans to adjust fishing capacity in national waters by reducing the overall tonnage by 137 000 GRT by the year 2004 although, over recent years, the total tonnage has increased somewhat despite the reduction in the number of vessels.[3] In Japan, the number of vessels has also decreased during the 1990s, together with the number of fishermen and fishing enterprises. In China, fishing capacity in domestic waters has expanded far more than production. For example, the total power of Chinese fishing vessels operating in the East China Sea increased by a factor of about 7.6 times between the 1960s and the early 1990s, while catches only increased 2.6 times.

[3] National Fisheries University of Pusan. 1996. *Fisheries country profile*. Pusan, Republic of Korea.

The heavy exploitation of most marine domestic fishery resources in Chinese waters and an emerging consumer market provided the impetus for China to develop a distant-water fishing fleet, first introduced in 1985. The Republic of Korea and Taiwan, Province of China, take most of their catches from local waters but have also extended their activities into distant water lately. In 1995, landings of the Republic of Korea's distant-water fishing fleet were 0.9 million tonnes.

Japanese high sea catches decreased from 2.1 million tonnes in 1970 to 0.9 million tonnes in 1993 and are expected to decline further as Japanese fishing companies find it difficult to compete with imported fish and fish products.

BOX 8
The Japanese pilchard fishery

The most dramatic resource variation in the region has concerned the pilchard (Sardinops melanostictus) in the northwestern Pacific off Japan. This fishery grew rapidly in the 1930s' to become the largest single-species fishery in the world at that time. In the early 1940s, however, the pilchard population collapsed abruptly and remained extremely depressed for nearly three decades. Then, in the mid-1970s, the stock suddenly exploded into a rapid rebuilding phase that led to the 1980s' peak of catches that were over three times as large (5.4 million tonnes in 1988) as the peak catches before the earlier collapse in the 1940s had been. Today, the fish population is going through a fast decline for the second time, having sustained intensive fishing for a considerable period. In 1994, less than 1.3 million tonnes were landed (mainly by Japan but also by China and the Republic of Korea). In 1996, there were no signs of recovery; the population continued to decline and is now at a very low stock level. Although spawning levels of Japanese anchovy were very high over the last few years, the new entry of juvenile stock was very low. Japanese researchers are therefore convinced that the fluctuations in pilchard abundance are not the result of overfishing but rather of climatic change, which seems to have adversely affected reproductive success in recent years.

The exact nature of the linkage of climatic variation to reproductive success is not currently understood. However, there appears to be a degree of synchrony in the timing of multi-year runs of good or poor reproductive success among many of the largest fish populations in widely separated parts of the Pacific, as well as in several other ocean areas of the world. Other extremely important fishery stocks showing a tendency to co-vary, either in the same phase or in opposite phase, with the Japanese pilchard on these multi-year timescales include

sardines off western South America and southwestern Africa, Peruvian anchoveta, Alaska pollock and several salmon species in the northern Pacific. These periods of population growth or decline are in turn correlated with several climatic indices including global mean temperature and *El Niño* southern oscillation index, leading to the conclusion that the population expansions and contractions may be driven by climate variability. (See also Box 13 on p. 74.)

Inland water fisheries

Production from freshwater capture fisheries in the region continues to be dominated by China, which generated over 1 million tonnes out of a regional total of 1.4 million tonnes in 1994. However, environmental degradation combined with overfishing have affected capture fisheries in all major Chinese rivers, particularly in stretches downstream of significant pollution sources. This has resulted in significantly reduced yields and the loss of many commercially valuable species. In contrast to the declining contribution of river fisheries, increased yields are being achieved through intensified exploitation of natural lakes and reservoirs, mainly from enhancement measures such as improved stocking, fertilization, the control of unwanted species, habitat modification and environmental engineering of the water bodies.

Aquaculture

Total regional aquaculture production amounted to 18.4 million tonnes and valued US$22.8 billion in 1994, representing 73 and 57 percent of the total world production, respectively. During the period 1984 to 1994, the subsector demonstrated a compounded yearly growth rate of 10 percent in volume and 11 percent in value.

China is by far the most important producer, representing over 60 percent of world aquaculture production - 15.4 million tonnes in 1994. Finfish production is concentrated in China, where it is cultivated at low stocking densities within semi-intensive, polyculture, pond-based farming systems. The main species cultured are cyprinids such as silver carp, grass carp, common carp, bighead carp and, more recently, tilapia.

Chinese production patterns contrast sharply with finfish production in Japan, which is restricted almost entirely to high-value carnivorous marine and diadromous species grown in intensive farming systems. The two major species are yellowtail and red sea bream. Aquatic plants constitute the second most important species group by weight and value. Molluscs and crustaceans are also produced.

Sea ranching is also practised in Japan, where about 80 species are targeted by sea farming (including some that are under technical development). The main species ranched are silver sea bream, bastard halibut, kuruma prawn, swimming crab, abalone and sea urchin.

Growing environmental concern is an increasingly important isssue for future aquaculture development in the region (Box 9).

Figure 36. Fish utilization and food supply

Figure 37. Fishery imports and exports (including intraregional trade)

N.B. FAO trade statistics available only from 1976

PRODUCTS AND MARKETS

Fish consumption in the region is very high by international standards; average annual food fish supply is 21 kg per person (live weight eqivalent) and fish provides about one-quarter of the total animal protein intake. Particularly in Japan, the tradition of eating fish is very strong and fish is generally more important than meat in the diet, even though younger generations today tend to eat more meat than before. The per caput food fish supply in Japan is over 70 kg per year. Although fresh fish is preferred, demand is diversified and includes an increasing share of both traditional and new processed products. At present, about two-thirds of the fishery production is used as raw material for the processing industry but both the fishing and the processing industries are being rationalized and operations are increasingly relocated to foreign countries through joint ventures and other arrangements because of lower labour costs and preferential access to raw material.

During the last decade, imports have expanded considerably and international trade in the region focuses on Japan, the world's major importer of fish and fishery products. About one-third of the world fish trade goes to Japan (in value terms) and Japanese imports of fishery products increased fourfold over the decade to 1994. The main imports were shrimp and prawn, fresh and frozen tuna, crab and salmon (in value) and shrimp, prawn and tuna (in quantity).

Statistics for the Republic of Korea and Hong Kong show per caput food fish supplies of about 50 to 55 kg per year. In the Republic of Korea, captured fish is generally preferred to cultured fish and fresh fish is generally preferred to processed products. Nevertheless, the number of processing plants in the country seems to be increasing.[4] The Republic of Korea is both a major importer and an exporter. In the past, high duties have protected the fishing industry from imports of cephalopods and other fishery products and, as a result, the price of squid was among the highest in the world. However, as of 1995, the Republic of Korea has liberalized over 300 product items and will open its markets fully for fish products by 1997.

[4] National Fisheries University of Pusan, op. cit., footnote 3, p. 58.

BOX 9

Environmental issues in aquaculture

Environmental factors continue to play a key role in aquaculture development throughout the region. For example, shrimp farmers in China recently suffered dramatic losses in production owing to disease outbreaks from poor water and soil conditions in their ponds which caused stress to farmed stock, the introduction of pathogens and very high densities of farming units in certain locations. Intensification trends in resource use and production are increasingly apparent in Chinese freshwater aquaculture, raising concerns over the impending release of wastes.

Environmental problems with coastal aquaculture practices in Hong Kong, Japan and the Republic of Korea concern mainly high densities of cages and rafts in water bodies with limited water exchange. However, many aquafarmers in the region are being affected by increasing aquatic pollution from other activities. Shellfish farmers in the Republic of Korea, for example, have to face recurrent harmful algal blooms, sometimes resulting in anoxic bottom waters and toxin contamination of their products. The increasing pollution of rivers, lakes and reservoirs in China is causing considerable economic losses to aquafarmers and fishermen. Environmental issues in aquaculture development are receiving considerable attention in the countries concerned, and numerous efforts are under way to ensure more sustainable development of the sector.

Sources: ADB/NACA. 1996. *Aquaculture sustainability action plan. Regional study and workshop on aquaculture sustainability and the environment (RETA 5534).* Asian Development Bank (ADB) and Network of Aquaculture Centres in Asia-Pacific (NACA). Bangkok, Thailand, NACA. 21 pp.; Bagarinao, T.U. and Flores, E.E.C., eds. 1995. *Towards sustainable aquaculture in Southeast Asia and Japan*. Proceedings of the Seminar-Workshop on Aquaculture Development in Southeast Asia, Iloilo City, the Philippines, 26 to 28 July 1994. Iloilo, the Philippines, SEAFDEC Aquaculture Department. 254 pp.; FAO/NACA. 1995. *Regional Study and Workshop on the Environmental Assessment and Management of Aquaculture Development in Asia-Pacific*. NACA Environment and Aquaculture Development Series No. 1. FAO and Network of Aquaculture Centres in Asia-Pacific. Bangkok, Thailand, NACA. 492 pp.

In China, the mean per caput supply was reported as 10 kg in 1990, but consumption has probably increased significantly since then. However, important variations exist within the country; in the southern parts, particularly in Guangdong province, the average is 43 kg, whereas fish consumption in the isolated areas of the northeast is negligible. Domestic demand is largely met by freshwater pond products, in particular various carp species; in 1993, over half of Chinese fish production originated from culture fisheries.

The current increases in disposable income in China are creating market opportunities for fish imports. One of the main fish imports at present is Alaska pollock from the Russian Federation, which is processed and re-exported to the United States and Germany. Shrimp is also imported for processing and re-export to the United States.

FISHERIES POLICY AND MANAGEMENT

The restricted circulation of ocean waters into and out of the East Asian seas apparently makes them particularly sensitive to environmental changes from human or natural causes. In the Republic of Korea, industrial complexes near coastal areas and an increase in the influx of sewage from the urban zones are harming coastal fishing grounds. Moreover, land reclamation projects are reducing the fishing ground areas and oil pollution as well as red tides have occurred, particularly in the south.[5] Similar developments are taking place also in other parts of the region.

[5] Ibid.

Providing more than a third of the world's fish landings also means that the region produces a similar amount of by-catch. However, the proportion of the by-catch that is discarded is likely to be lower than this, particularly in China; although there is very little detailed information available on this issue.

Figure 38. Fishery production by species categories

Figure 39. Fishery imports and exports for major trading countries in 1994

International fisheries issues in the region have been dealt with through bilateral fisheries agreements, such as those between Japan and the Republic of Korea and between Japan China. The Russian Federation has established an exclusive economic zone (EEZ); so has Japan for its east coast, but this EEZ is not applied to China and the Republic of Korea. In the region, efforts to avoid unnecessary controversies over potential maritime jurisdictional overlaps are evident. Regional cooperation (except for Taiwan, Province of China) is also carried out through the newly reconstituted Asia-Pacific Fishery Commission (APFIC), a regional fisheries body established under FAO. Likewise, coastal states (except the Democratic People's Republic of Korea) have become members of the Fisheries Working Group of Asia Pacific Economic Cooperation (APEC).

In the Republic of Korea, the Fisheries Act was amended in 1995 to accommodate new international management schemes and reflect the relevant provisions of the UN Convention on the Law of the Sea and other international rules and provisions related to fisheries. In response to the increasing regulation of the high seas and the deterioration of resources in the waters around the Republic of Korea, the government initiated a fisheries restructuring project in 1994 to reduce the number of fishing vessels. In addition, to tackle environmental degradation, the government has designated a number of "fisheries resource conservation areas" and increased research efforts on pollution-related matters.[6]

[6] Ibid.

Japan has a unique and comprehensive system of fisheries management. Coastal and inland fisheries are regulated by fisheries cooperatives through a system of fishing rights; offshore and long-distance fisheries are managed through licensing. The Fisheries Law and the Fisheries Resource Protection Law form the legal basis for fisheries management with broad authority given to the Ministry of Agriculture, Forestry and Fisheries, as well as to the prefectural governors. In the future, improved fishery management is expected to focus on increasing the production of high-value species, using traditional management techniques (regulation of effort or catch, closed seasons and areas), community-based management and innovative approaches to remedying damaged environments to favour habitat, growth and the recruitment of preferred high-value species. Co-management and regional cooperation will also be stressed, and the introduction of EEZs could be expected. Japan will also probably have a more integrated view of the whole fishing and processing industry as links among markets, trade and resources become stronger and more apparent.

China has adopted a pragmatic approach towards developing its fisheries institutions and administration, and is developing managerial capabilities. This is being further strengthened by appropriate legal provisions such as the Fisheries Laws and Regulations for the Conservation and Propagation of Fishery Resources. China appears to face the same fishery and coastal zone management issues as other countries in the region, including the need to create alternative employment opportunities for inshore fishers, intersectoral competition, environmental pollution and habitat destruction. In addition, as provincial governments become more autonomous, interprovincial coordination will be urgently required to resolve conflicts over shared resources and environmental degradation.

OUTLOOK

Fish consumption in the region should stay high and even increase further in some areas (in both volume and per caput levels) along with population growth and improved consumer purchasing power.

An exception to this may be Japan, where fish consumption is already high and population growth close to zero. Nevertheless, the composition of the Japanese fish consumption basket is expected to continue to change from lower-value to higher-value products, which could include more “ready-to-eat” products as well as products sold through fast food outlets. The sophisticated nature of fish consumption attitudes has important bearings on domestic production strategies which need to focus on those types of products where Japanese producers have a clear competitive advantage over foreign suppliers, for example, ranched products which can be marketed as “fish from the wild” rather than cultured products. Sea ranching is expected to become the preferred form of culturing finfish species. Future fisheries development in Japan will be guided largely by market factors, especially the ability of the domestic industry to compete with foreign suppliers. Japanese fisheries are unlikely to grow significantly over the coming decades.

Modest production gains from culture and ranching are likely to be offset by a further decline in the long-distance fleets, but the country will continue to rely on imports to satisfy its high demand for fishery products.

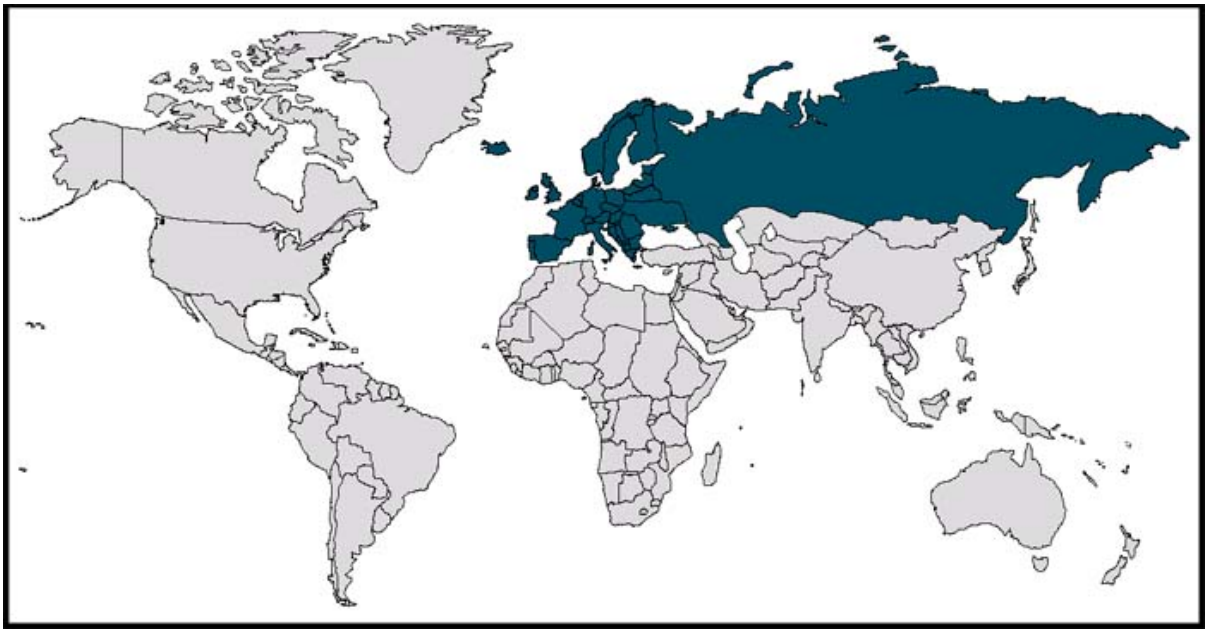
Similar consumption patterns can be seen to some extent in the Republic of Korea, which is currently liberalizing its trade regulations on fishery products and is one of the places where imports could be expected to increase in the future. However, at the same time, the Republic of Korea remains an important exporter. For domestic production, priority is given to enhancing the utilization of national fishing grounds through the construction of artificial reefs and fingerling releases. Aquaculture is also becoming a more important source of fishery products.[7]

[7] Ibid.

In China, the expected continuation of both rapid economic growth and expanding fish production will enable per caput consumption to increase further. Significant growth potential exists for freshwater aquaculture, principally through the rehabilitation of existing ponds, the utilization of water-logged areas and the vast surface areas of paddy fields. The growing number of hatcheries will enable this potential to be realized. Traditional marine capture fisheries do not appear to offer any significant growth potential. Coastal fish resources need to be carefully managed and future increases in landings will probably depend on distant-water fishing. However, strong economic growth is expected to generate enough purchasing power to satisfy any domestic demand-supply gap with imports.

3. Europe[1]

[1] This review is based on the regional study prepared by the FAO interdepartmental task force, headed by R. Grainger, Fishery Information, Data and Statistics Unit (FIDI).



The region covers two main groups of countries: 1. The European industrialized countries comprising the European Union (EU) and the European Free Trade Association (EFTA), i.e. the European Economic Area (EEA), as well as Malta, Andorra and Monaco; and 2. the former centrally planned economies - or transition countries - of Eastern and Central Europe including the Russian Federation and the other European republics of the former USSR. The main seas neighbouring the countries of the region are the northeast Atlantic (including the North Sea, the Baltic Sea, the Norwegian Sea and the Barents Sea), the Black Sea, the Mediterranean Sea and the northwest Pacific (the Bering Sea and the Okhotsk Sea).

Fish production is important to many countries of the European region, in particular as a foreign exchange generator in the transition states and as a source of employment in coastal communities. Regional fleets produce 16 percent of world fishery production volume, i.e. 17.2 million tonnes. Per caput fish consumption varies from high average levels in some of the Mediterranean and Nordic countries, where there are food fish supplies of over 30 kg per year (live weight equivalent), to 10 to 15 kg per year in some of the transition and inland countries. The region is a net importer, by both value and volume.

RESOURCES AND PRODUCTION

Marine fisheries

Total regional marine catches amounted to 15.3 million tonnes in 1994.[2] The fleets of the industrialized countries caught about 70 percent of this total. The production of the western subregion is dominated by catches from the northeast Atlantic, where herring, sand eels, capelin, cod, mackerel, pilchard, sprat, horse mackerel, blue whiting and saithe are among the main commercial species. Further north, in the northeast Arctic and Barents seas as well as in Icelandic and Faeroe Island fishing waters, cod and capelin are the most common species fished, together with herring, haddock and saithe. In the Baltic Sea, cod, herring, sprat and salmon are fished.

[2] Including distant-water fishing production.

Figure 40. Regional fish production and share of world production in percentage

Nevertheless, many demersal groundfish stocks have been intensively exploited during the last decades and some of the stocks are now considered to be outside the safe biological limits. Small pelagic resources are generally less affected. In addition, pollution has caused environmental deterioration in some coastal areas of the north Atlantic. With regard to salmon in the Baltic Sea, wild stocks are threatened by disease and competition from reared stocks (Box 10). In the Mediterranean, most demersal stocks are also fully to overexploited. Consequently, in addition to fishing in nearby waters, the European Union (EU) fleets increasingly seek access to other countries' exclusive economic zones (EEZs) for their distant-water vessels and budget funds for access

agreements have been increased recently.[3] Iceland and Norway also carry out fishing under a number of bilateral agreements.

[3] Fishing News International. 1996. *Review of Europe's* fishing deal.

The main fishing areas of the eastern subregion are the Okhotsk and Bering seas in the northern Pacific Ocean. The most important species in the northern Pacific is the Alaska pollock, although landings in 1994 of 2 million tonnes were only half of those in 1986. Fishing by the fleets of the transition countries is also carried out in the Barents Sea, mainly by Russian vessels fishing cod, and in the Baltic Sea by Estonia, Lithuania, Latvia and the Russian Federation.

Total catches in the Black Sea dropped drastically from 913 000 tonnes in 1988 to 277 000 tonnes in 1992,[4] but recovered to 511 000 tonnes in 1994. The reason for the decline seems to be a change in the ecosystem caused by a combination of uncontrolled and heavy fishing, nutrient input from rivers and littoral zones, as well as the introduction of exotic species.

[4] The total catch of the Black Sea includes catches by countries outside the region.

Fleet technology in the industrialized countries is very high and there has been a shift from labour-intensive to more capital-intensive vessels. Nevertheless, investment in demersal fishing vessels has generally decreased recently. Instead, investments have been directed towards pelagic fisheries and the processing industry. There is a critical overcapacity in the European fisheries; a recent EU review indicates that a reduction of 40 percent in overall fleet capacity is needed in order to downscale the size to match the available fish resources.[5]

[5] Report of the Group of Independent Experts to Advise the European Commission on the Fourth Generation of the Multi-annual Guidance Programmes. 1996.

The marine production of the former centrally planned economies and the former USSR (the eastern subregion of Europe) decreased from about 10 million tonnes yearly at the beginning of the 1980s, to only 4.5 million tonnes in 1994. The main fishing nation, the Russian Federation, represented 3.5 million tonnes of the total in 1994. An important reason for this drastic decline is the reduction in distant-water fishing activities; the former USSR, Poland, Romania and Bulgaria used to have large distant-water fleets and, in 1983, about 40 percent of the production of these countries originated from distant-water fishing but, in 1993, this share had decreased to 20 percent. The fleets of the transition countries are generally old and in great need of modernization. The Russian Federation started an ambitious programme of fleet renovation in 1994 and there have been some signs of recovery, with the Russian Federation and Poland increasing their catches by about 20 percent in 1995.

BOX 10
Baltic Sea wild salmon stocks

A higher incidence of fish disease is often observed in areas of oxygen depletion of bottom water and proximity to river outlets but this is usually on too small a scale to affect the economically most important fish stocks. One exception that has come to light, however, might be salmon in the Baltic Sea. A syndrome called M74 is creating mass mortality in the hatching salmon fry populations, only a small percentage of which survive, which means many more spawners have to reach the rivers for spawning than previously in order to keep the year-class sizes at the average level. The International Council for the Exploration of the Sea (ICES) therefore recommends a total closure of Baltic salmon fisheries that take wild salmon. The causes of M74 syndrome are not known, but it seems to be associated with organochlorine in the female salmon and nutritional factors are also implicated. A complication in the attempt to protect wild salmon is that, if reared salmon are not caught, they might swamp the wild salmon rivers. Reared salmon constitute between 80 and 90 percent of the total biomass of salmon in the Baltic Sea and most of the time they are mixed with wild salmon on the fishing grounds.

Source: ICES. 1996. *Report of the ICES Advisory Committee on Fishery Management*, 1995. ICES Cooperative Research Report.

Inland water fisheries

Capture fishery production from the region's inland waters has decreased by almost 50 percent during the last decade, falling from 820 000 tonnes in 1984 to 420 000 tonnes in 1994. The main species include rainbow trout, Azov Sea sprat and common carp. It should be remembered, however, that official data for inland water capture fisheries may in many cases be underestimated. Production from subsistence and recreational fisheries is seldom accurately reflected in the statistics and it is likely that production from these sectors plays a rather important role for food supplies in the transition countries. Nevertheless, commercial catches have declined owing to political changes and the collapse of infrastructure and distribution systems in the former centrally planned economies. Pollution, infrastructure projects and competition for water resources from other sectors have also had a negative impact on fisheries production. All countries in the eastern subregion used to manage their inland fisheries through stocking and fertilization programmes to enhance capture fisheries. In the Russian Federation, this activity is still being subsidized, whereas it appears that the practice has been discontinued in other countries owing to the economic difficulties inherent in the transitional period.

In the industrialized countries, inland waters are managed primarily for sport fisheries; commercial fishing is secondary except in the large lakes. The stocking of selected species, such as rainbow trout, stringent antipollution laws and rehabilitation programmes are common components of the management programme for these fisheries.

Aquaculture

In 1994, regional aquaculture production accounted for 6 and 10 percent of total global production in quantity and value, respectively. In 1994, 1.5 million tonnes were produced at a value of US$3.8 billion, of which 1.3 million tonnes came from the industrialized countries and 195 000 tonnes from the transition states. In the former, about half of production is molluscs[6] and the second largest component is diadromous fish, i.e. salmon and rainbow trout. In fact, the aquaculture sector has undergone a revolution because of the success of, in particular, salmon farming.

[6] It should be noted that for molluscs only about 10 percent of the gross weight is actually consumed; the greater part of the production volume is shell.

In the eastern part of the region, total production fell by half between 1991 and 1992 owing to economic and social difficulties when the centrally planned system collapsed. This decline was felt most in the countries of the former USSR; production in Hungary, Poland and former Czechoslovakia remained more stable. Farming of carp (Chinese and common carp) and other cyprinids is most common even though the production of higher-value species is being introduced and a further switch could be expected when production levels revive.

Figure 41. Fish utilization and food supply

PRODUCTS AND MARKETS

Almost all European industrialized countries have some kind of processing industry such as canning, smoking, freezing or otherwise curing of fish. There is also a fishmeal industry in the region. The production of convenience food is the fastest growing sector of the EU fish processing industry and large retailers in the market are active in introducing new products. There is also a trend in some countries towards more fresh and chilled fish and supermarkets are increasing their market share of fish sales.

In the transition countries, much of the processing industry needs modernization and new investments. During the Soviet era, some of the coastal countries and republics had an important processing industry (e.g. Estonia, Latvia and Lithuania) of which only a portion is used today, following the fall in raw material supply. Moreover, in the past, the distribution of fish and fishery products was carried out by large state-owned companies which failed to survive the transition. The old system has not yet been fully replaced, but new private distribution companies and supermarket chains are emerging - through joint ventures - together with a wholesale infrastructure. Likewise, some of the processing plants have been modernized and are now producing value-added products that meet EU

standards for export. Only Poland still has substantial processing facilities at sea; fish is frozen on-board distant-water fishing vessels and exported, mainly to the EU.

Figure 42. Fishery imports and exports (including intraregional trade)

Fish consumption levels vary considerably among subregions and countries. In the region as a whole, average per caput food fish supply was 17 kg (live weight equivalent) in 1994. However, in the industrialized countries the average supply is about 22.5 kg per year, with variations between, for example Iceland, where the mean fish supply per person and year is over 90 kg, and Albania, Bosnia, Croatia and the Federal Republic of Yugoslavia, where supply is less than 2 kg. In general, however, consumers' perceptions of fish are positive and the demand for fish is likely to increase in the future. This volume cannot be supplied by local production and the area is a net importer of fishery products. In the EU, fish is the second largest food import item, although members of EU 12 accounted for 20 percent of world fish exports in 1994; this includes the value of intraregional trade.

Figure 43. Fishery production by species categories

A recent development in the region is the exertion of consumer pressure on the fishing industry to foster environmental objectives. Initiatives within this area include improved marine stewardship under the Unilever/World Wide Fund for Nature's ecolabelling of products, the agreement by Unilever and Sainsbury not to use fish oil from industrial fisheries, the proposed import ban on cultured shrimp in Sweden and packaging laws in Germany.

In the transition countries, fish consumption has fallen dramatically recently owing to the lack of supplies; in the Russian Federation, annual per caput consumption decreased from 29 kg to 9 kg between 1989 and 1993. With regard to trade, traditional import and export patterns have changed completely over recent years. Eastern Europe and the republics of the former USSR are now increasingly exporting high-value species in order to generate foreign exchange - groundfish species such as Alaska pollock and cod are among the most common of these. At the same time, low-value products are being imported increasingly as local production decreases. The region is a net fish importer in volume but the value of exports exceeded that of imports by US$1.2 million in 1994.

Figure 44. Fishery imports and exports for major trading countries in 1994

FISHERIES POLICY AND MANAGEMENT

In the new republics of the former USSR, the fisheries administrations are newly established government entities because in the past the sector was centrally managed from Moscow. During the years of transition, the administrative structure has undergone several changes and may still need modifications, such as a strengthening of the socioeconomic capacity. In spite of the availability of excellent natural scientists, qualified social scientists are usually lacking and the concept of planning the sector needs

to be (re)introduced. So far, fisheries policies have concentrated on maintaining access to distant-water fishing grounds, improving fisheries management in the national zones and, as appropriate, harmonizing national legislation with that of the EU. Efforts have been made to restructure and privatize the fisheries sector in all countries, but obstacles such as high interest rates have often been encountered.

BOX 11
The new Common Fisheries Policy of the EU

The Common Fisheries Policy (CFP) of the EU came into existence in 1983. Since then it has developed and been adjusted in accordance with international developments and changes within the EU itself. The CFP has a holistic view of the industry and covers access to resources, conservation of fish stocks and monitoring of fishing activities on the production side as well as marketing of fishery products and research. One important component is the structural policies element. The main programmes are the Financial Instrument for Fisheries Guidance (FIFG) and the PESCA Community Initiative. Since 1993, these structural measures have been integrated into the EU's system of structural funds (the European Regional Development Fund and the European Social Fund). FIFG has been allocated a budget of approximately 2.6 billion European Currency Units (ECU) for the period 1994 to 1999 (based on a 12-member EU) and can help to finance the following:

· adjustment of fishing effort (granting of premiums for permanent withdrawals and for creating joint enterprises and joint ventures);

· fleet withdrawal and modernization of vessels;

· aid in investment in aquaculture and the establishment of coastal marine areas, fishing port facilities and the processing and marketing of products. In each instance, priority will be given to measures that seek to improve quality, health conditions, environmental impact and statistical instruments;

· other measures such as promoting and searching for new outlets and measures implemented by the fishing industry (e.g. the management of fishing quotas by a producers' organization or temporary withdrawals).

PESCA was specially designed for assisting geographical areas that are dependent on fisheries. It has the following objectives:

· enabling the fishing industry to accomplish its transformation process successfully, by lending support to the sector, in addition to the assistance rendered under Objective 5a of the Structural Funds;

· helping the fishing industry to cope with the social and economic repercussions of transformation by providing aid towards retraining and the diversification of businesses in the sector;

· contributing to the diversification of the coastal regions concerned, through job expansion schemes.

Moreover, under certain circumstances, FIFG can contribute to the financing of national early-retirement schemes for fishermen.

In 1992, within the framework of the Multi-Annual Guidance Programmes (MAGPs), new targets for fleet capacity reductions were agreed for each EU member country. These targets focused on gradually diminishing fishing capacity - without prejudice to the modernization of the fishing units - in order to improve safety conditions and the preservation of fish on board, thus creating better conditions to improve the profitability of the remaining units. The goal of the MAGP is to reduce the fishing effort by 20 percent by 1996, measured in tonnage volume (gross registered tonnage or GRT) and engine power (kilowatts or kW).

Source: European Commission. 1995. *Structural policy to assist fisheries and aquaculture*. Santiago de Compostela, Spain, European Commission, Directorate-General XIV Fisheries.

In the EU, there is a Common Fisheries Policy (CFP), parallel to the Common Agriculture Policy, "with common rules throughout EC member countries covering all aspects of the fishing industry from the sea to the consumer"[7] (Box 11).

[7] European Commission. 1994. The new Common Fisheries Policy. Luxembourg, European Commission, Directorate-General XIV Fisheries.

A number of fisheries management systems exist in the region. The EU Common Fisheries Policy uses a system of total allowable catch (TAC) and quota allocations supplemented by technical measures. In the Baltic Sea, TACs and national quota allocations are agreed by the International Baltic Sea Fishery Commission (IBSFC) based on advice from ICES, which also gives management advice for other parts of the northeast Atlantic. In the Mediterranean, individual countries set national policies which differ by country although the EU coordinates the national policies of its members with advisory inputs from the General Fisheries Council for the Mediterranean (GFCM). Management focuses on measures such as controls of licences and subsidies to the sector,

rather than quota control. There is also a serious lack of information on the actual status of stocks. In the Black Sea, no quota or effort controls apply and there is a considerable degree of fleet overcapitalization. A new convention for a Black Sea Commission is now being negotiated among the coastal states.

BOX 12
The Norwegian no-discards policy

In 1983, Norway introduced a new act concerning discarding in marine fisheries. The legislation stated that it is reasonable to throw back fish into the sea if they survive. Obviously this would be unusual; in most cases, the fish caught would be dead or dying or would die after being discarded. As discarding is a waste of valuable marine resources, Norway completely banned the discarding of all economically valuable species. Such a conservation policy made Norway pioneers in the field and gained them support from the Russian Federation, which shares important fish stocks with Norway in the Barents Sea. Canada, Iceland and the Faeroe Islands also introduced similar policies in their respective 200-mile zones, based on the Norwegian model. The prohibition of discarding and a legal obligation to land the whole catch aim at ensuring both rational management of valid stocks and adherence to agreed quota limits.

Clearly a discard ban is difficult to implement without constant monitoring of all fishery operations. Nevertheless, the very existence of a ban has helped change attitudes to discarding. To overcome the problems of discarding juvenile fish and the reality of exploiting multispecies fisheries, the discarding ban has been complemented by other conservation measures such as temporary closures of fishing areas and improved gear selectivity. In summary, the policy has had a positive effect on developing better exploitation of marine resources.

Source: orwegian Directorate of Fisheries, 1996, correspondence to FAO.

Discarding is a serious issue in the region. The northwest Pacific has the highest discard volume in the world, estimated at 9.1 million tonnes, followed by the northeast Atlantic with 3.7 million tonnes. In the Atlantic, the phenomenon appears in part to be a consequence of single species management by quota in what are mixed species fisheries, encouraging “high grading” and discard practices that can sometimes approach 50 percent of the demersal catches although the general absence of observers on-board commercial vessels makes quantification difficult. Norway, as one of the major fishing nations in the area, has introduced a no-discards policy (Box 12). In the Mediterranean

and Black seas, discard problems may be less acute, except for the large-scale gill-net fisheries which still operate despite the UN ban.

Other problems facing fisheries management organizations and arrangements in the northeast Atlantic include pollution, misreporting and a lack of appropriate enforcement. The North Sea Task Force[8] has undertaken one of the most comprehensive quality status reports ever made for a marine ecosystem and made recommendations for the development of a strategy to protect species and habitats.[9]

[8] Members of the task force are the eight North Sea states - Belgium, Denmark, France, the Netherlands, Germany, Norway, Sweden and the United Kingdom - as well as relevant representatives of the European Commission.

[9] North Sea Task Force. 1993. *North Sea Quality Status Report* 1993.

A major problem is referred to as “black fish landings”, i.e. unrecorded landings that are made to avoid quota restrictions. Efforts to improve monitoring, control and surveillance (MCS) capabilities have included the use of vessel monitoring systems, and the EU intends to implement further post-harvest audits of logbooks and sales documents.

Traditional management methods of catch limitations have repeatedly failed to reduce fish mortality in the northeast Atlantic and are largely discredited. A major reduction of fleet capacity as well as more extensive use of direct fishing effort control, as is currently being considered by the EU, could prove more effective.

OUTLOOK

The demand for fish in Europe is likely to increase in the future, given the positive perception of fish as a food item in the western part of the region and the recovery of previous consumption levels in the eastern part. However, for rapid recovery, supplies of inexpensive products will be needed.

Fish production in the transition countries, in particular the Russian Federation, should stop declining soon and start to recover slowly. The revitalized fishing industry will be very different from that of the 1980s; it is likely that the distant-water fishing sector will play only a minor role and that emphasis will instead be on better utilization of resources in home waters. A sound restructuring programme would include a renovation of the fleets - as already started in the Russian Federation - and a reduction of overcapacity in the fishing sector.

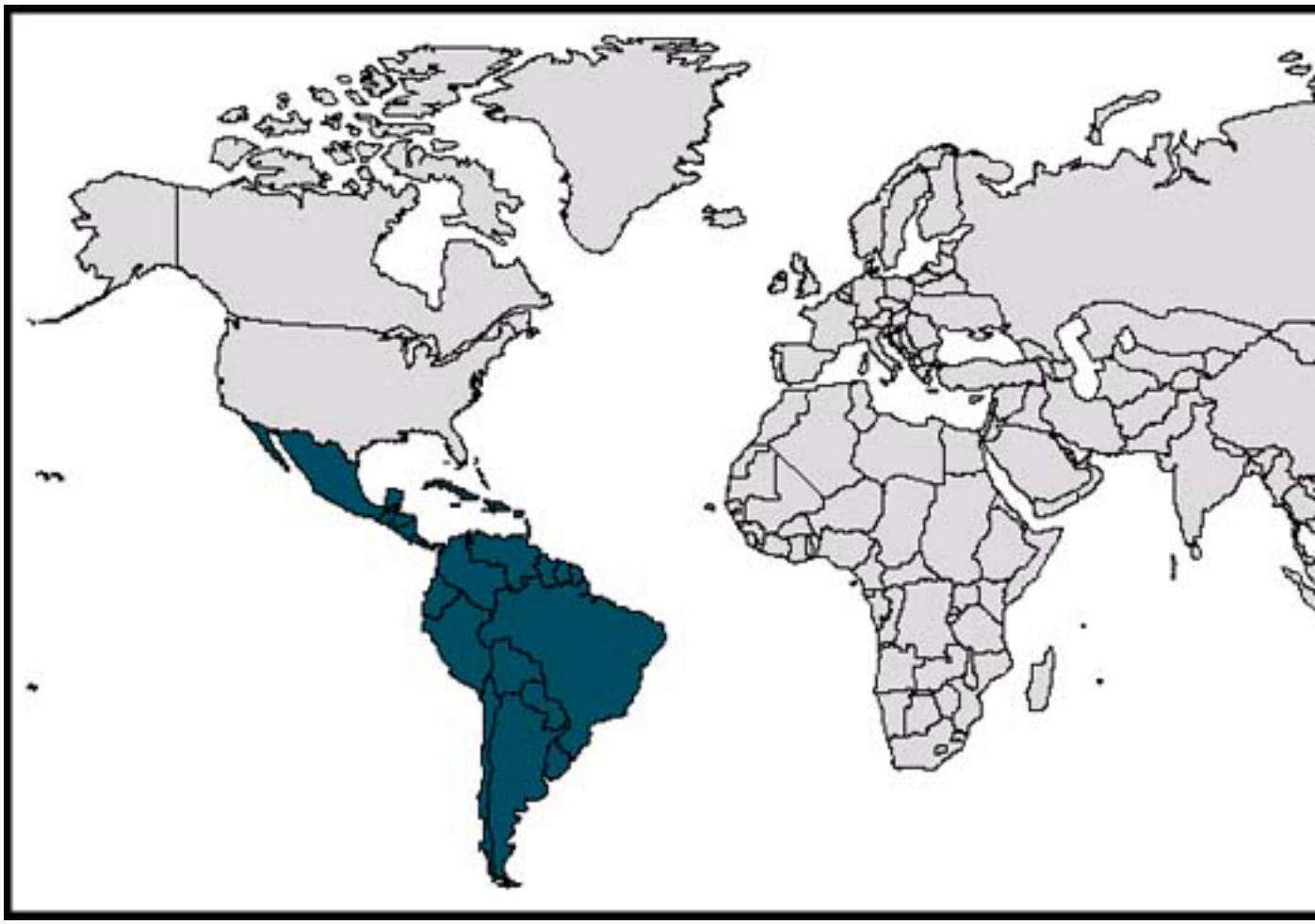
Future fishing prospects for the industrialized countries depend mainly on the effectiveness of fisheries management in the northeast Atlantic. As mentioned above, the elimination of overcapacity and a more direct control of fishing efforts could be two components of a scheme for improved management.

Inland fishery resources are already considerably exploited, and their main orientation is changing from food production to recreation. Nevertheless, some increases in food fish production from inland waters - especially in the transition countries - could be achieved by better management. Although aquaculture production may increase in western Europe, it is likely to be constrained by limited site availability, competition for aquatic resources, stricter environmental controls and cheaper imports from other regions. However, given the potential markets in industrialized countries, aquaculture production in transition countries is likely to diversify into the culture of higher-value species such as salmon and eels.

Trade in fishery products has continued to grow, albeit at a slower rate, over the last three years. In order to meet future demand, the region as a whole will continue to be a net importer of fish.

4. Latin America and the Caribbean[1]

[1] This review is based on the regional study prepared by the FAO interdepartmental task force, headed by A. Gumy, Fishery Policy and Planning Division/Development Planning Service (FIPP).



The region covers the South American continent, Central America and Mexico, as well as the island states and territories of the Caribbean. The region is surrounded by the southern parts of the Atlantic and Pacific oceans and includes the semi-closed seas of the Gulf of Mexico and the Caribbean Sea.

Latin American and Caribbean fish production reached record levels in 1994 of 24 million tonnes, representing 22 percent of the world total. Small pelagic marine fish make up about 75 percent of the total catch. The contribution of the sector to the economy is highly concentrated in coastal rural areas where it is the key - and often only - source of employment and income. Internally, it plays a minor role. Food fish consumption has been less than the global average at a per caput supply of about 9 kg annually (live weight equivalent). Latin American countries are major exporting countries of fish and fishery products and account for 11 percent of world exports, with Chile as the main net exporter. Shrimp and fishmeal are the main exports.

RESOURCES AND PRODUCTION

Marine fisheries

Total marine landings in the region amounted to 23.1 million tonnes in 1994, 85 percent of which derived from the southeast Pacific, where catches reached a record high in that year. Total production is still dominated by Peruvian anchoveta and fluctuations in total volume are the result of this species' variability. Catches from anchoveta fisheries collapsed in the 1970s from 13.1 million tonnes in 1970 to 1.7 million tonnes in 1973 and down to only 94 000 tonnes in 1984. Since then the stock has recovered and landings reached 11.9 million tonnes in 1994. While heavy fishing played a major role in the collapse, climatic change through the *El Niño* was also a primary cause of recruitment failure and stock decline (Box 13). Although the two main substocks of the Peruvian anchoveta are now reported to be fully exploited, rigorous monitoring and surveillance measures are necessary to avoid overfishing.

Other small pelagic stocks such as the South American pilchard, the Chilean horse mackerel and mackerel started to increase when the Peruvian anchoveta fishery collapsed; the first two species are now major components of production in the area, although the pilchard is considered fully exploited and even overexploited in part of its range.

In the southwest Atlantic, production has been increasing recently. The dominant species are squid and hake, followed by basses, congers and other demersals. Squids, shrimps, lobsters and crabs, as well as small pelagic species such as sardinella and Argentine anchoveta, are also fished. Until the 1980s, this was one of the few fishing areas of the world to have a large expansion potential but, since then, several industrialized long-range fisheries have developed and most of the fish stocks are now considered to be fully exploited, while some have been overexploited over the last few years.

Figure 45. Regional fish production and share of world production in percentage

In the western central Atlantic area, most pelagic fisheries, including billfish, tuna and swordfish, are fully or overexploited. There is general concern about finfish, especially sharks and rays, and many species of reef fish have been fully or overexploited, as has the queen conch. In the eastern central Pacific, fish production has generally decreased despite a slight increase between 1993 and 1994. The most dramatic steady decline in catch since the mid-1980s has been in the Californian anchovy and sardine fisheries, which has had a negative impact on Mexican production levels. The production of tunas and other large pelagics has also increased slightly over the past 20 years. Shrimps and prawns sustain particularly valuable and important fisheries throughout the area.

While the Latin America region depended heavily on imported vessels and fishing gear in the past, recently more up-to-date, harvesting technology has been transferred to the region, in particular from northern Europe. Regional shipyards can now build and fit fishing vessels to high standards while local manufacturers can make every type of fishing gear and gear handling machinery. This transfer is reflected in the large and state-of-the-art equipped purse seiners built by yards in both Peru and Chile. In the southern part of the Pacific, purse seining for small pelagics is a very large-scale operation aimed mainly at supplying raw material to fishmeal and fish oil plants. In the north, shrimp trawling is more common. On the Atlantic coast, the main harvesting methods vary from trawling for shrimp and demersal species with medium-sized vessels in the region north of the Amazon river, to larger-scale bottom and midwater trawling by large freezer stern trawlers south of the River Plate. In addition, there is a seasonal purse-seine fishery for small pelagics in southern Brazil and important tuna purse-seine fisheries in Venezuela. Longlining is also practised all along the coastline.

BOX 13
Environmental impacts on marine fisheries with particular reference to the *El Niño* phenomena

The Latin America and Caribbean region, particularly along the west coast of South and Central America, seems susceptible to the impact of environmental changes on marine fishery stocks. Quite dramatic fluctuations at decadal scales in the Pacific basin have severely affected overall abundance and total production of small pelagics, as well as other stocks.

The environmental impact of *El Niño* is particularly important; the 1972-73 *El Niño* contributed to the collapse of the Peruvian anchoveta fishery, and the one in 1982-83 had a negative impact on fish abundance and actual production in the whole Pacific area. All species of fish have been affected. Furthermore, changes in the overall distribution and local abundance of squids, tunas, coastal shrimps, hakes and a relatively wide variety of other species reported for both

the Pacific and Atlantic coasts of the Americas could be related to changes in *El Niño* southern oscillations.

Other examples of environmental impacts include the advance of Antarctic waters into the southwest Atlantic, hurricanes and typhoons in the Caribbean and various other decadal changes in environmental conditions.

Efforts clearly need to be made to improve forecasting capabilities for such changes, both to reduce negative impacts on fisheries and also to benefit from some of the positive effects these changes may bring. (See also Box 8 on p. 59.)

Source: FAO. 1994. *Review of the state of world marine fishery resources*. FAO Fisheries Technical Paper No. 335. Rome; plus many other sources.

In the small island Caribbean states, fisheries are mainly small-scale and artisanal, utilizing passive gear such as hooks and lines, gill-nets and pots and traps. In most cases, artisanal vessels are traditionally built for harvesting demersal resources and crustaceans close to the islands.

According to data from Lloyd's Maritime Information Services, the Latin American fleet has been increasing at an annual rate of about 5 percent over the last decade. Even allowing for the open ship registers of Panama and Honduras, there has been an increase in the number of large vessels in the region. Lloyd's Register of Shipping shows a total of 3 156 vessels with a tonnage exceeding 100 gross registered tonnage (GRT) registered in the region in 1995, compared with 2 238 in 1985.[2] This expansion of the industrial fishing fleet has meant excess fishing capacity is now an issue, even in several hake and tropical shrimp fisheries.

[2] When the fleets of Honduras and Panama are excluded, the corresponding figures are 2 152 in 1995 and 1 787 in 1985.

Inland water fisheries

After rapid growth in inland fisheries production up until 1987, when the combined regional catch topped 580 000 tonnes, catches stabilized and even declined to about 450 000 tonnes in 1991. In 1994, total reported catches attained some 500 000 tonnes, which is far below the potential yield for the inland waters of the continent and much lower than reported production from similar areas of the tropics in Africa and Asia. These falling figures may partly be owing to inadequate statistics (generally data for recreational and subsistence activities are not recorded), but are probably mainly attributable to generally low productivity.

Inland fisheries are concentrated in areas near the main water courses. Although exploitation is low, localized regions show signs of overfishing. Elsewhere the effects of overfishing have been exacerbated by environmental degradation. Three main exploitation patterns characterize the region: in the south, i.e. in Argentina, Chile and parts of Brazil, commercial fisheries have usually been closed and resources are now reserved mainly for recreational and subsistence activities; in the central part of the region, commercial fisheries on rivers and reservoirs are less intensive; and in the north, particularly in the drought polygon of Brazil, in Cuba and in Mexico, an increasing trend towards the intensive management of reservoirs through stocking and species introductions has led these areas to record the highest growth in recent years.

Most Caribbean islands do not have any inland waters of importance; consequently inland water fisheries are virtually non-existent there.

Aquaculture

In 1994, total aquaculture production reached 472 000 tonnes, representing about 2 and 5 percent of world production by volume and value, respectively. Aquaculture makes a similar contribution to total regional fisheries production, with six countries accounting for most of the production. Shrimp culture has increased very rapidly and represented over 80 percent of the total value of regional production in 1994. Salmon culture has also developed, although almost exclusively in Chile. However, profit margins for both species have been declining. Freshwater fish and mollusc cultures are also carried out, for example tilapia, trout and carps.

Figure 46. Fish Utilization and food supply

Industrial export-oriented aquaculture has expanded significantly and still has moderate growth potential. Finally, aquaculture oriented towards producing low-cost products has developed to a minor extent.

PRODUCTS AND MARKETS

Fish consumption levels vary widely among countries as well as within countries. The regional average of per caput food fish supply is around 9 kg annually (live weight equivalent), which is well below the world average of about 13 kg. However, consumption has been increasing slightly over the last decades. For about 5 percent of the total population, i.e. for the inhabitants of the English-speaking Caribbean islands and of Chile, per caput annual supplies top 30 kg. Conversely, most Central American countries show levels of less than 5 kg per year. As a result, the contribution of fishery products to animal protein supplies is less critical in Latin America than in many other developing countries, although fish is still a vital food item in some local communities.

Figure 47. Fishery imports and exports (including intraregional trade)

The abundance of small pelagic fish provides the basis for an important fish reduction industry in Latin America, where more than two-thirds of the total catch are oriented to non-food products. The main items are fishmeal and fish oil used as feed in the animal husbandry, poultry and aquaculture industries. Chile, Peru and, to a lesser extent, Ecuador use the bulk of the raw material destined for fishmeal. Other non-food uses, such as for bait and pet food, do not represent substantial shares of fisheries output. Long-standing efforts have been made to reduce the quantities used for fishmeal production and to find alternative uses for direct human consumption but no sustained success and economic feasibility have been achieved to date, largely owing to the ready availability of fishmeal raw material and reluctance to invest in market development.

Figure 48. Fishery production by species categories

The disposition of catches for direct human consumption shows the important share of fresh fish, i.e. over 50 percent, with frozen and canned in the order of 20 percent each. The utilization of fish supplies by processing type has generally followed historical patterns determined by the available resources and market forces, in particular international demand. Although the international market still prevails, the industry now seems to be more eager to adapt available technologies to any positive domestic market trends. Naturally, fish utilization varies at the subregional level - in the Caribbean, for example, fish utilization is influenced by the requirements of tourism.

Figure 49. Fishery imports and exports for major trading commodities in 1993

Latin American countries are major exporters of fish and fishery products, accounting for 11 percent of world exports. Equipped with modern processing plants, the region can manufacture to international standards and ensure safe and wholesome products. Shrimp and fishmeal are the main exports. Chile and Peru dominate the world fishmeal market, with exports going mainly to the Asian market, and Mexico and Ecuador are exporters of shrimp. Most Latin American shrimp exports go to the United States market; only recently have Ecuadorian shrimp exporters managed to penetrate the European shrimp market. While the Mexican shrimp export industry is still dominated by wild shrimp, Ecuador almost exclusively exports cultured shrimp products. Tuna has traditionally also been one of the main fish exports but the enforcement of a “dolphin-safe” policy by the United States Government in 1991 created substantial problems for Latin American tuna fisheries.

As fish-importing countries, Latin America makes up only about 2 percent of the world total. Intraregional trade is also still quite limited.

FISHERIES POLICY AND MANAGEMENT

In most countries, fisheries policy has been strongly influenced by macroeconomic policies that form part of stabilization programmes. Measures include the privatization of production units, the facilitation of foreign trade, reduction or elimination of economic incentives and providing incentives to foreign investment in the fisheries sector. These

policies have also aimed at streamlining the administrative and technical structures of public administrations, including fisheries administration. In the transition period, the research and management capacity of fisheries administration has been affected in terms of functions, budget allocation and technical and administrative staff. Lately, however, the situation seems to have improved in several countries.

Most regional fishing nations have legal provisions to regulate and limit access to their main fisheries through various types of licensing schemes that regulate or limit the total number of vessels, fishermen, gears, accumulated engine power or other unit of fishing capacity that can enter most major fisheries. As a result, fisheries recognized to be near, or at, the state of full exploitation are theoretically under a closed-access regime, meaning that no new fisher can enter without replacing an existing one. Some countries also use individual quota systems to allocate access to resources, thus keeping fishing capacity under control. Individual transferable quota (ITQ) regimes are not in force at present in any nation of the region but a few countries are contemplating setting them up in some fisheries after assessing the technical and socio-economic factors involved.

National legislation to keep fishing capacity under control has not always proved very successful in the region. While the actual legislation may be adequate, non-existent or over-permissive surveillance and enforcement practices might be a major cause of excess fishing capacity in some highly profitable fisheries.

The regional institutional framework for fisheries cooperation, management and development is formed by several regional bodies. These bodies differ totally or partially from one another in legal nature, membership, areas of competence, mandate and geographical coverage. Two of them are FAO bodies: the Western Central Atlantic Fishery Commission (WECAFC) and the Commission for Inland Fisheries of Latin America (COPESCAL); the rest are non-FAO intergovernmental organizations such as the Organization of Eastern Caribbean States (OECS), the Caribbean Community and Common Market (CARICOM), the Permanent South Pacific Commission (CPPS) and the Latin American Organization for Fisheries Development (OLDEPESCA).

Latin American fisheries generally account for a rather small percentage of total discard volumes, estimated at around 5 percent. This relatively low figure is mainly owing to the high landings by Peru and Chile of fishmeal species, which yield very few or no discards. These two countries were reported to land 18.6 million tonnes of sardines, anchoveta and jacks mainly for their fishmeal industries, leaving the remaining catch of the area as less than 4.8 million tonnes. Nevertheless, these fisheries still generate some waste (Box 14).

Coastal area degradation is reducing the fishing potential in many places, particularly in small-scale fisheries. These fisheries continue to play a key role in supplying food and employment in marginal coastal areas and several countries are taking steps to introduce integrated coastal area management approaches as an alternative to other resource management schemes.

OUTLOOK

Fish consumption in Latin America and the Caribbean has been increasing gradually over the last 20 years and will probably continue to increase in the future. Taking population and economic growth into account, it is estimated that demand will increase by about 2 million to 3 million tonnes by 2010.

Increased supplies could come from the reduction of discards and post-harvest losses. The increased utilization of small pelagics for direct human consumption could be another key issue for the region, but will need to be based on economic, technological and marketing feasibility. Regarding increased landings, commercially exploited marine species are generally in an advanced state of exploitation and existing stocks will need better management to meet future demand. In addition, fish production in the Latin America and the Caribbean region will fluctuate according to the variability in abundance of small pelagic stocks.

Current inland fisheries production trends will probably become more pronounced in the future. In the south - Argentina, Chile and parts of Brazil - trends to close fisheries to commercial exploitation and to reserve them for recreational and subsistence activities will continue. In the central part of the region, commercial fisheries on rivers and reservoirs will continue at generally low productivity levels. In the north, and in particular in the drought polygon of Brazil, in Cuba and Mexico, the intensified management of reservoirs through stocking and species introduction is expected to continue. Given these trends, increased production will be possible subject to careful management and the enhancement of Latin American reservoirs.

Export-oriented industrial aquaculture has expanded significantly in the region and still has moderate growth potential. Other types of aquaculture, such as pond-based fisheries in reservoirs, freshwater fish culture, mollusc and aquatic plants culture, have all grown less than expected. Regional aquaculture potential derives not only from available resources (water, land, coasts, temperature, agriculture, etc.) but also from the existing institutional set-up, research and entrepreneurial capacity. Most problems regarding the slow growth of aquaculture concern these factors. One important consequence is that socially oriented aquaculture as well as aquaculture oriented towards producing low-value products for low-income social sectors have developed little. A future challenge will be to institute measures that take advantage of the existing potential for these types of aquaculture production.

BOX 14
By-catch issues in South and Central America

Three particular problems relate to by-catch and discards in the Latin America and Caribbean region: by-catches of groundfish and of turtles during shrimp fishing and by-catches of dolphins during tuna fishing.

Shrimp fishing has always been notorious for the widespread discarding of groundfish and turtles as by-catch and, as many discards are juveniles, the abundance and sustainability of these stocks are threatened. Shrimp fisheries in Brazil and Mexico provide good examples of measures to counter the problem. Multiple trawls with sharper tapers were introduced, resulting in improved fishing selectivity and efficiency - by-catches were reduced by 18 percent and shrimp catches increased by 5 percent. Nevertheless, traditional trawling persists in inshore fisheries, where the by-catch is used for human consumption.

The by-catch of shrimp trawls has been described by the National Research Council of the United States as the major human-induced cause of turtle mortality. Many turtle excluder devices (TEDs) to reduce turtle discards have been, and continue to be, developed. Turtle catches can be reduced by 97 percent using such devices. Following a United States ban on imports of shrimp from countries that do not use TEDs to conserve turtle stocks, certain countries in the region, for example Mexico and Venezuela in 1993, have enforced the use of TEDs.

Dolphin catches in eastern tropical Pacific tuna fisheries have been a cause for concern for some time. Since the early 1970s, dolphin populations seem to have stabilized as a result of deliberate efforts to reduce by-catches: training skippers to undertake “backdown procedures”; helping dolphins to get out of the nets; and making suitable gear modifications. The International Dolphin Conservation Programme (IDCP) has also been instrumental in conserving stocks, and imports to the United States of tuna from nations participating in the IDCP are encouraged.

The discarding of by-catches and its impact on other stocks clearly requires action. There is an urgent need for gear and fishing practices that ensure the sustainable utilization of resources for the benefit of those people who depend on fisheries for their livelihood and for future generations.

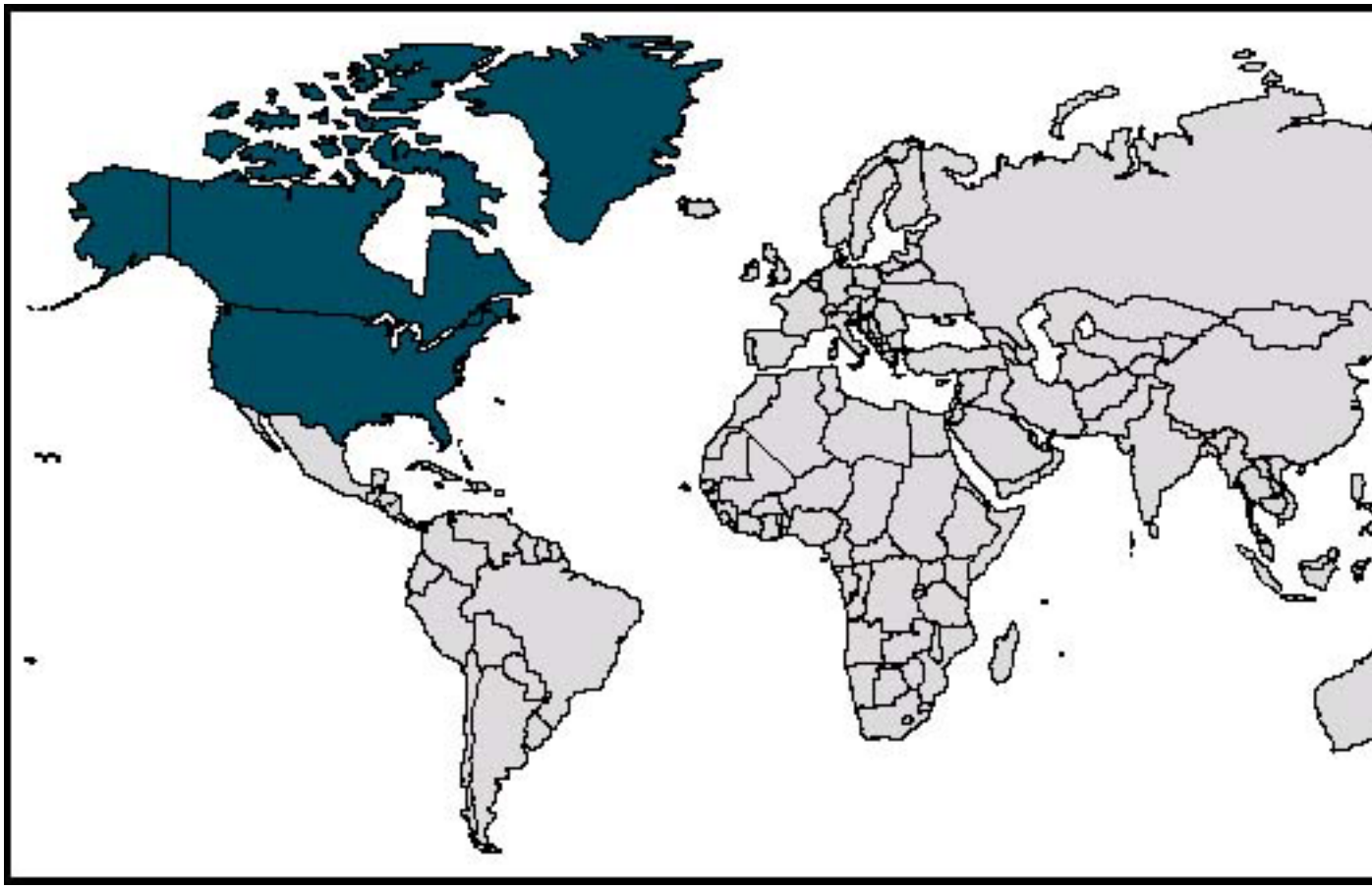
Source: FAO. 1994. A *global assessment of fisheries by-catch and discards*. FAO Fisheries Technical Paper No. 339, Rome.

Fish-eating countries, particularly in the Caribbean, will continue to depend on fish imports although improved management of their resources and exploitation of large pelagics could bring some relief to the import bill. In parallel, other foods may replace fish to a certain extent.

Given the strong influence of international demand in terms of volume and unit value, and the orientation of the regional export industry towards foreign markets, the value of fish exports should continue to grow. One important condition is that macroeconomic and sector policies help keep regional products competitive. The trend of producing more value-added products rather than selling only raw material for the processing industries will probably continue in the coming years. Measures relating to trade and environment could generate economic problems for some sectors of the fishing industry as with the tuna-dolphin and shrimp-turtle issues.

5. North America[1]

[1] This review is based on the regional study prepared by the FAO interdepartmental task force, headed by M. Lizarraga, Fishery Policy and Planning Division/International Institutions and Liaison Service (FIPL).



The region includes Canada, Greenland and the United States (excluding the Caribbean and the South Pacific islands but including Bermuda and Saint-Pierre-et-Miquelon as well as Alaska) and the adjacent fishing areas of the northwest and central Atlantic and the northeast Pacific. Owing to the structure of available data, the review is mainly concentrated on the situation in Canada and the United States.

With a total production of 7.1 million tonnes in 1994, the North American region contributes about 6 percent of global fish catch. Marine commercial landings have fluctuated somewhat during the last decade with catches from the north Atlantic decreasing. Aquaculture and recreational fisheries show a more steady growth. Food fish consumption averages a per caput supply of some 22 to 23 kg (live weight equivalent) annually and has been stable during the last few years. The United States in particular, but also Canada, is a major importer as well as an exporter of fish and fishery products. In Greenland, fish represents over 90 percent of the total export value of the island.

RESOURCES AND PRODUCTION

Marine fisheries

In 1994, total marine catches of the North American region were 6.5 million tonnes, representing a slight decrease in volume compared with 1993 but higher than in 1992. Production has been fluctuating after a steady upward trend over about 20 years up to 1990, when regional landings peaked at 7.2 million tonnes. The main reason behind the recent stagnation derives from the overexploitation of the principal commercial groundfish stocks in some areas where fisheries are now closed or subject to restrictions. For example, in the north Atlantic, cod, which used to contribute the majority of landings, is under moratorium off the northeast coast of Canada and, thus, attains only a small fraction of earlier production values. Furthermore, such restrictions have brought about socio-economic change in many communities in that area which depended completely on the marine harvest for their livelihoods.

Figure 50. Regional fish production and share of world production in percentage

On the other hand, the main pelagic fish stocks, i.e. herring and mackerel, appear much healthier, except in localized areas. Shrimp, snow crab and lobster resources are also doing well, and it has been conjectured that shrimp may actually have benefited from less predation in some areas after cod stocks collapsed.

In the north Pacific, the most important fish species include Alaska pollock, Pacific cod, herring, yellowfin sole, north Pacific hake, tunas and salmons. Alaska pollock is by far the most important species, constituting 40 percent of Pacific catch volume in 1994. Species that are considered fully utilized include Pacific cod (in the Gulf of Alaska), Pacific halibut, sablefish, groundfish stocks off the United States Pacific coast and Pacific whiting (hake). The status of Pacific salmon resources varies considerably from area to area with most stocks considered fully utilized and coho and chinook stocks overexploited.

Flatfishes other than halibut are abundant and underutilized in the Bering Sea and the Gulf of Alaska owing to by-catch restrictions on other species caught in the same gear. Jack mackerel is also underutilized. Although the abundance of Pacific herring varies, the trend is for fairly healthy stock levels.

Regional fleets are characterized by high technology. Excess capacity is an important issue for the United States and Canada, which have both implemented programmes to address this. During 1995, the United States embarked on two regional programmes to reduce the fishing effort. In the northwest Atlantic, groundfish capacity is being reduced by scrapping vessels and surrendering permits while, in the northeast Pacific, hundreds of salmon fishing permits are being withdrawn. Fishing Family Assistance Centres are being established to complement the vessel and permit buyout programmes (see also Fisheries policy and management on p. 82).

In Canada, there is overcapacity in the domestic fleets on both coasts, although much of the Atlantic groundfish fleet has been idle and fleets have been downsized in recent years. In the Atlantic region, a licence withdrawal plan for groundfish was implemented in 1994. In addition, an early retirement plan for fishers was announced in 1995 and a licence withdrawal scheme is available for Pacific salmon.

Inland water fisheries

In inland fisheries, the catch from commercial small-scale fisheries is steadily decreasing owing to displacement by expanding recreational fisheries. It is believed that the level of United States freshwater recreational catch now well exceeds the commercial catch for all of North America. Federal aid to the restoration of sport fishing is considerable and in 1995 seven federal agencies involved in administration took various measures to develop recreational fishery programmes. In addition, in the central and Arctic regions of Canada, recreational catch exceeds the commercial production from inland water capture fisheries. The total reported commercial catch for 1994 was 71 000 tonnes.

Aquaculture

Aquaculture in North America is a diversified industry which includes marine and freshwater fishes, crustaceans, molluscs and plants. The emphasis in the Canadian industry is on cold-water species such as salmon, trout and molluscs. In the United States, the main species include catfish, cupped oysters, rainbow trout, golden shiner (used for bait), salmon and crawfish. For some species, for example tilapia and shrimp, growth has been particularly rapid. On average, the United States aquaculture industry grew at about 2 percent a year over the decade to 1994, compared with Canadian growth of over 20 percent. In value, the Canadian aquaculture industry is expected to reach a quarter of the value of commercial fisheries by the year 2000. Total regional aquaculture production attained almost 0.5 million tonnes in 1994.

Figure 51. Fish utilization and food supply

PRODUCTS AND MARKETS

North American fish consumption increased from a supply of 14.7 kg per person in 1970 to almost 22 kg in the late 1980s and has since remained static. Real prices of fish have increased compared with meat products and there appears to be a trend of more

expenditure on seafood and a shift of demand in favour of seafood relative to red meat. The most popular fishery products are tuna (primarily canned), shrimp, pollock, cod, salmon, catfish, flatfish, clams, crab and scallops. Three main themes have influenced - both negatively and positively - consumers' perceptions and the demand for fish and fishery products in the United States: more awareness of the health benefits of seafood consumption; concern over the safety of seafood products; and greater consumer awareness of the marine environment as well as concern for marine mammals, in particular dolphins and whales, sea turtles and endangered or threatened species in general (Box 15).

Figure 52. Fishery imports and exports (including intraregional trade)

BOX 15
Environment and resource conservation

Both fisheries and aquaculture in North America are influenced by strong environmental and resource conservation awareness among the general public and consumers. In the United States, this is reflected in many government regulatory provisions for protecting the aquatic environment and its associated aquatic biological diversity. Legislation includes the Endangered Species Act, the Marine Mammal Protection Act, the Coastal Fisheries Protection Act and the proposed Fisheries Act (Bill C-115), all referring to species protection and conservation of habitats. Furthermore, American interest groups that aim at promoting environmental issues have been exerting pressure to use international trade to influence the fishing methods and gear used. This has, for example, been translated into a requirement to reduce the imports of some fish species when they are not fished by gear and methods that meet certain conditions. Such stipulations are sometimes independent of scientific evidence and could therefore be challenged under international market rules.

Source: United States Department of Commerce. 1995. *Our living oceans*. Report on the Status of United States Living Marine Resources; and other sources.

As with the fishing subsector, the processing industry of the region is highly technically developed. New developments in transport, distribution and in freezing techniques have taken place and the shelf-life of fresh and live fish has been prolonged, signifying more trade in these types of products beyond local markets. As a result, most domestic landings are utilized in a fresh or frozen form, with the trend in consumption towards a greater share of fresh and frozen aquaculture products, particularly catfish and salmon. In contrast, many of the traditional wild fisheries, such as cod, flatfish, clams and scallops,

have shown declines in per caput consumption. For canned fishery products, consumption has increased only slightly since 1970, indicating a shift of the United States consumer towards higher-value seafood. With the improved distribution system, fresh fish and shellfish are increasingly available in urban centres all year-round. An estimated 70 percent of United States seafood expenditure is associated with food service purchases; higher-value seafood appears to be more frequently consumed in restaurants, and this trend of away-from-home consumption is expected to continue.

The United States is one of the top fish-importing as well as exporting countries, and Canada is among the leading exporters in the world. The United States is the second largest importer after Japan, with food fish imports valued at US$6.6 billion in 1994. Shrimp constitutes over one-third of imports, supplied mainly by Ecuador and Thailand. There are also substantial imports of groundfish fillets and blocks, mainly from the Russian Federation and China. United States exports amounted to US$3.1 billion in the same year, consisting mainly of Pacific salmon and groundfish.[2] Export fisheries statistics for Canada indicate an export value of more than US$2 billion in 1994. Major markets for Canadian exports are the United States, Japan and the European Union (EU). Greenland exported fishery products at a value of US$266 million in 1994 and fish represents over 90 percent of the island's total exports.[3]

[2] United States Department of Commerce. 1995. Fisheries of the United States 1994. Current Fishery Statistics No. 9400. Silver Spring, Md, USA.

[3] Danmarks Statistik. 1996. External trade of Denmark 1994. Copenhagen.

FISHERIES POLICY AND MANAGEMENT

In the United States, marine fisheries are administered nationally by the National Oceanic and Atmospheric Administration (NOAA) through the National Marine Fisheries Service (NMFS) and by the eight regional fishery management councils. Federal and state agencies administer inland fisheries and the regional councils are responsible for the marine resources management in their respective jurisdictional areas.

In Canada, federal fisheries jurisdiction is exercised by the Department of Fisheries and Oceans, the management objectives of which are to conserve and protect the resource and, in partnership with commercial, aboriginal and recreational users, to ensure a sustainable fishery and fishing industry. The Department of Fisheries and Oceans also exercises some jurisdiction with regard to inland resources, the most important area being the central and Arctic region, which contains about 67 percent of Canada's freshwater and seven of the largest lakes in the world.

The loss or degradation of habitat is perhaps the most serious environmental issue facing the fisheries sector in the region.

In the northwest Pacific (the United States) and British Columbia (Canada), an estimated 80 percent of spawning and riverine habitat which supported Pacific salmon and

steelhead runs has been lost. The most widely used techniques to rebuild capture fisheries include stocking or hatchery enhancement, the construction of artificial reefs, the development of aquatic reserves or protected areas and habitat restoration. Hatcheries are now common and billions of juveniles are released every year. However, although the federal governments in the United States and Canada provide an umbrella of environmental protection policies, socio-economic and political interests often influence the way these policies are implemented and enforced.

Figure 53. Fishery production by species categories

Current national policies for fisheries conservation and management in the United States are based on fishery management plans developed through extensive consultations with government agencies, public interest and user groups and relevant international organizations. Almost all federal fisheries are under some sort of controlled access (licences and permits). To date, only three federal individual transferable quota (ITQ) systems have been implemented for some fisheries and these are believed to contribute to substantial fishing vessel reduction. Programmes for reducing excess fishing capacity have also been introduced. Technology development in the United States has recently been influenced by ecological and market concerns. There have been some advances in gear selectivity and improvements in the post-harvest sector are expected to continue as a result of demand for value-added products. In addition, a mandatory seafood inspection programme is being developed.

Figure 54. Fishery imports and exports for major trading commodities in 1993

In Atlantic Canada, management takes into account recommendations of the Fisheries Resource Conservation Council, which was created to bring together the knowledge of fishermen, the fishing industry and scientists in a common effort to guide the conduct of the Atlantic fishery. A similar body has been created for the Pacific region. In addition to implementing moratoria on various species, Canadian management requires fleets to submit acceptable conservation harvesting plans before each fishing season. To manage excess capacity, there has been a shift towards enterprise allocations, ITQs, individual quotas and community quotas.

BOX 16
The NMFS strategic plan regarding by-catch

The United States National Marine Fisheries Service (NMFS) has a ten-year strategic plan for sponsored research on by-catch and management initiatives. Priorities include: i) by-catch data to identify fisheries where by-catch is significant; ii) assessment of the biological, economic, social and ecosystem effects of by-catch mitigation alternatives, their scale and characteristics; and iii) conservation

engineering. The plan will include recommended priorities, strategies to achieve approved goals, a schedule for implementation and procedures for monitoring and assessing selected alternatives. The NMFS Marine Fisheries Advisory Committee, which is examining long-term solutions to by-catch issues, has considered various measures, including gear design and modification, development of the mariculture industry for fisheries with heavily fished wild stocks, management techniques to monitor the problem and market-driven approaches, which have met with success in Alaska.

Source: United States Department of Commerce, Fisheries Service, correspondence to FAO, 1996.

Management measures for various areas and species are recommended by regional fisheries organizations and arrangements in which Canada and the United States participate, including the Northwest Atlantic Fisheries Organization (NAFO), the North Atlantic Salmon Conservation Organization (NASCO), the Pacific Salmon Commission, the North Pacific Anadromous Fish Commission and the International Pacific Halibut Commission. Canada and the United States cooperate to some extent in managing highly migratory species and straddling stocks through these regional fisheries organizations. Both countries also have regulations concerning aquaculture development.

Regulations and regional agreements with regard to by-catch have already been in place for some years and discards are relatively low for most species, in both the northwest Atlantic and the northeast Pacific. The issue continues to receive attention and, for example in the United States, NMFS is currently preparing a ten-year strategic plan for research and management initiatives (Box 16).

OUTLOOK

Future seafood demand in North America will probably be influenced by the growing perception of fish as healthy food on the one hand and of sanitary and environmental concerns on the other. In aggregate, it is difficult to quantify the exact impact of the different issues upon consumption patterns. Nevertheless, it is expected that the demand for fish and fishery products will increase in the future. A further shift to higher-value seafood could also be expected.

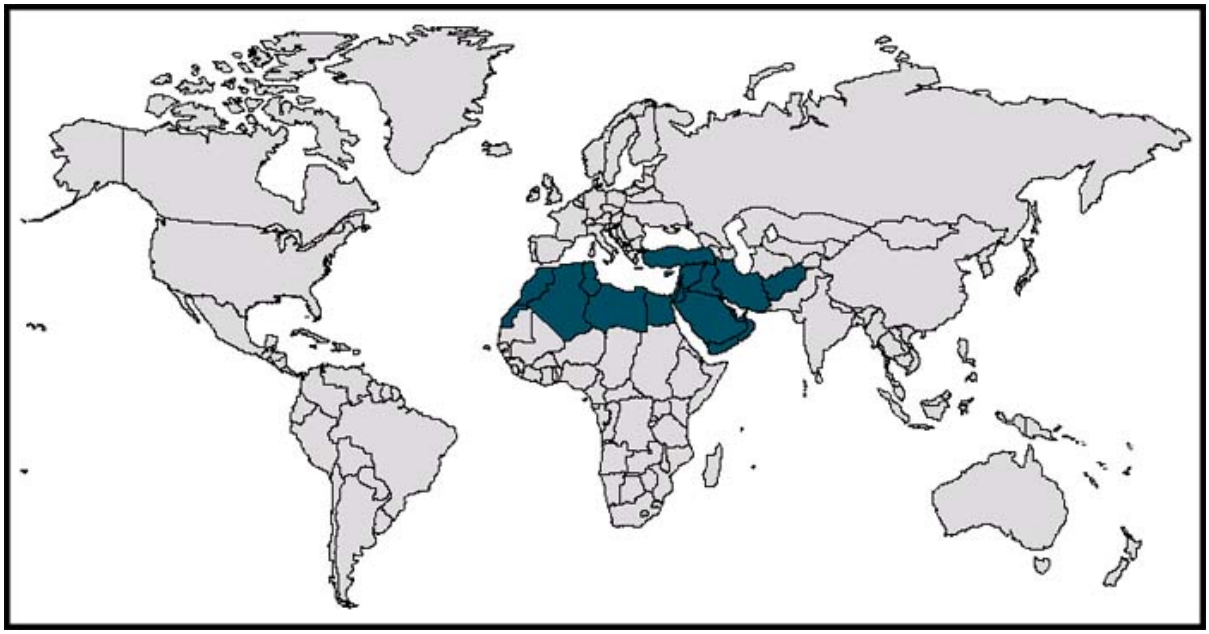
The marine capture fisheries of the region have practically reached a plateau of production where most commercial fish stocks are fully fished or overexploited. Free and open access as well as traditional management measures are considered increasingly inadequate and there is an emerging trend towards new systems for resource allocation and conservation, which tend to be more oriented towards privatization and the direct involvement of private industry in monitoring activities. It is, however, much too early to predict the consequences for production levels and composition in the future.

The few underutilized stocks, mainly small pelagic species, do not appear to have an immediate market. Consequently, increased production will probably come from aquaculture. Considering past trends, this development will probably be technology-intensive and will have to pay due attention to environmental issues.

Supply could also be boosted by more imports, increasing the potential for developing countries with growing aquaculture industries, particularly in Southeast Asia, to increase exports to North America. The United States in particular will therefore continue to be a major importer of fishery products, although environmental and quality control aspects will continue to influence imports to the region and consumption patterns.

6. Near East and North Africa[1]

[1] This review is based on the regional study prepared by the FAO interdepartmental task force, headed by G.V. Everett, Fisheries Policy and Planning Division, Development Planning Service (FIPP).



The region extends from the Atlantic coast of Morocco along the Mediterranean coast of North Africa (excluding Malta but including Cyprus) to the coast of the eastern Mediterranean and Turkey and also includes Egypt, Jordan and the countries of the Arabian peninsula (bordering the Red Sea, the Gulf of Aden, the Gulf of Oman and the Arabian Sea) and the countries of central Asia. Other main water bodies of the region include the Black Sea (which is also discussed in the review of Europe on p. 64), the Caspian Sea and the Aral Sea.

No country in the Near East and North Africa region depends substantially on fish and fishery products as a mainstay of its economy. Fisheries are diversified, ranging from those based on relatively abundant resources off the Atlantic coast of Morocco, to coastal and inland water fisheries with relatively poor resources. Total production reached some

2.8 million tonnes in 1994, of which Moroccan landings represented more than one-quarter. Food fish consumption varies widely throughout the region and is low relative to meat. In Yemen, supply reaches 40 kg per caput, while Afghanistan has the lowest per caput consumption at 0.1 kg (live weight equivalent). In general, the region is not a substantial contributor to international trade in fisheries.

RESOURCES AND PRODUCTION

Marine fisheries

In 1994, after years of low catches, total marine catches in the region amounted to 2.2 million tonnes, almost reaching the 1988 level when landings were at their peak.

Figure 55. Regional fish production and share of world production in percentage

Morocco, which borders both the Atlantic and the Mediterranean, has the most abundant fish resources. The eastern central Atlantic contributes about one-third of the region's total marine production. High-value species targeted include cephalopods, hake, seabream and crustaceans. There are also important small pelagic resources, such as sardine, mackerel, horse mackerel and sardinella, of which the sardine is the most important species. The cephalopod and demersal fisheries are considered to be overexploited and in need of reductions in fishing effort. Some of the small pelagic resources are in better condition, in particular the sardinella stocks shared with Mauritania in the south.

The eastern Mediterranean has little potential for increased landings from capture fisheries. On the whole, it seems unlikely that any underexploited stocks have been left in the Mediterranean, although some small pelagic stocks can increase suddenly from time to time, possibly owing to temporary environmental conditions. Relatively rich trawling grounds are found in the Gulf of Gabes in Tunisia, the Gulf of Syria in the Libyan Arab Jamahiriya and off the Nile Delta in Egypt. The major Mediterranean species include sardines, anchovy and horse mackerels. Catches from the Black Sea declined drastically a few years ago, in particular Turkish landings of anchovy. Overfishing, pollution and the introduction of exotic species appeared to be the reasons for the decline.

Fisheries resources in the main seas of the area are not abundant, but provide local coastal fishermen with employment. There are reliable estimates of substantial mesopelagic resources which could be exploited in the Arabian Sea off Oman, the Islamic Republic of Iran and Pakistan, but the commercial viability of such operations is not at all certain. However, all commercially valuable stocks in the waters of eastern Saudi Arabia, Bahrain, Qatar and the United Arab Emirates are fully exploited and there are various estimates of the potential of the Red Sea. Considering the coral reefs and associated fish communities in the sea, the resources tend to be vulnerable to overfishing. Important commercial species exploited include Indian spiny lobster and shrimp.

Throughout the area, fisheries are threatened by environmental degradation from oil spills and industrial, urban and agricultural run-off. The comb-jelly, which devastated the Black Sea ecosystem, is now also present in the northeastern Mediterranean. By-catch and consequent discards are a serious problem in the waters of Kuwait, Iran, Saudi Arabia and Bahrain, where the by-catch of shrimp trawlers can be as much as 95 percent of the catch - about 35 000 tonnes in 1994. The situation is even more disturbing in the cephalopod trawler, hake and crustacean fisheries off northwestern Africa, which has an estimated by-catch approaching 350 000 tonnes.

In most countries throughout the region it is difficult to estimate the state of the stocks because of the absence of surveys and to monitor fishing effort, and only inferences based on catch trends are possible. It can reasonably be assumed that, if catches have decreased, it is because of overfishing rather than reductions in the fishing effort. A problem of excess fishing capacity has surfaced in the southern Mediterranean with fleet expansion plans in the Libyan Arab Jamahiriya and relocation of part of the Turkish Black Sea anchovy fleet to the Turkish Mediterranean. Recently, some governments have been reducing the availability of grants and low-cost loans for investment in order to slow down the rate of capitalization. Nevertheless, vessels are generally becoming more sophisticated with improved navigational aids, gear and handling techniques, although the very large distant-water fishing vessels are less frequently seen than previously, in particular as the Eastern European countries have been restructuring their fleets. In Morocco, the new access agreement with the European Union (EU) provides for a reduced number of vessels. As a consequence, Morocco expects to modernize its inshore fleet to take advantage of the reduced foreign fishing effort in its fishing zone; nevertheless, further investments in the already overcapitalized cephalopod fishery may be discouraged.

Figure 56. Fish utilization and food supply

Inland water fisheries

The total inland water production of the region amounted to 452 000 tonnes in 1994. Egypt accounts for a quarter of the total volume, with fisheries based on the River Nile and Lake Nasser. Iraq, Iran, Turkey and Israel also have sizeable inland capture fishery resources.

In the Caspian Sea, which dominates Iran’s inland water resources, sturgeon, Caspian shad and silver carp are the main species exploited and there are also small pelagics such as kilka. Of major concern is the state of sturgeon stocks, which have been heavily fished over an extensive period. The area has also suffered environmental degradation over the past decades, from both climatic factors and human activities. However, sturgeon stocks are being maintained by hatchery programmes and the small pelagic resources are believed to be only lightly exploited (Box 17).

In central Asia the damming of rivers, the creation of reservoirs and gradual environmental degradation of the Aral Sea have impeded the healthy development of

fisheries. The depth of the Aral Sea has been significantly reduced and all commercial fishing ceased in 1982 (Box 18).

Figure 57. Fishery imports and exports (including intraregional trade)

Aquaculture

The 1994 value of aquaculture production in the region was only about 2 percent of the world total and the weight represented only 0.6 percent; 148 000 tonnes at a value of US$875 million. Six countries account for about 90 percent of production, which consists almost entirely of finfish, with common carp, Nile tilapia and silver carp as the main cultured species. Molluscs and crustaceans make up the small balance.

BOX 17
Iranian fisheries in the Caspian Sea

The Caspian Sea is suffering from severe pollution and environmental problems which threaten the biological marine resources. Fish resources have also been affected by heavy fishing and sturgeon stocks are particularly damaged. The sea constitutes one of the main fishing areas for the Islamic Republic of Iran, which has recently developed a strategic plan to improve the status of fishery resources, one objective of which is to increase sturgeon production.
To this end, Iran has set up an extensive hatchery programme and concluded international agreements with neighbouring countries to determine catch shares and control poaching. Moreover, the gill-net fishery for bonefish is being phased out through a licence buy-back scheme as the by-catch of sturgeon is significant in this fishery. Displaced fishermen are being encouraged into the beach seine and kilka fisheries, which do not involve sturgeon by-catches. Good potential exists for increasing kilka production and the sustainable catch could be doubled if new fishing grounds are opened. Kilka is a high-volume low-value fish used mainly for fishmeal, although there are initiatives to divert the fish into direct human consumption. Some kilka is already used for canning and frozen packs for domestic consumption.

Source: FAO. 1996. *The formulation, evaluation and implementation of fisheries management practices in the Islamic Republic of Iran*. TCP Technical Report (restricted), FI:TCP/IRA/4559. Rome.

BOX 18
The Aral Sea catchment

The Aral Sea is fed by two major rivers, the Amu-Darya and the Sur-Darya. Since 1960, however, the sea has been subject to desiccation. In addition to climatic causes such as a series of dry years in the 1970s the sea has been drained by the diversion of water from its two feeder rivers for irrigation.

There is a long tradition of irrigated agriculture in the region, but water use was significantly intensified after 1960. In the Amu-Darya basin, the irrigated area increased by 37 percent between 1961 and 1980, requiring extra resources and increasing water consumption by 80 percent. In addition, water was diverted into the Karakum Canal, also for irrigation. At approximately the same time, the irrigated land area of the Sur-Darya basin expanded by 31 percent and the corresponding water consumption by 22 percent. In order to manage these irrigation systems, reservoirs were built and canal systems expanded. Return water was also being reused for boosting river runoffs. Increased salinity had already occurred, particularly in dry years, but salinity levels increased drastically in rivers and water storage reservoirs following the new regime.

The intensification of water uptake for irrigation purposes in the basins of the Sur-Darya and Amu-Darya has been disastrous to the river deltas as well as to the Aral Sea. Fish stocks have been considerably affected and there has been a substantial reduction in spawning and nursery habitats. Many smaller lakes of the delta have disappeared and the Aral Sea has shrunk considerably. The sea has ceased to be of importance to fisheries; all commercial fishing came to an end in 1982 and, with the disappearance of the fish, 60 000 jobs were lost, causing a social and economic disaster for local communities.

In 1993, a multinational agreement was signed by the five states of the Aral Sea watershed area, i.e. Kazakstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan, to improve the management of the region's water resources. However, given the economic and political problems currently faced by these countries, it has proved difficult to make a rescue plan materialize.

Source: FAO. 1995. *Indo-Pacific Fishery Commission: Papers contributed to the Regional symposium on sustainable development of inland fisheries under environmental constraints*. (5. Case Study 2: The Aral Sea catchment, edited by T. Petr and M. Morris. Bangkok,

Thailand, 19 to 21 October 1994. FAO Fisheries Report No. 512 Suppl.; People and the Planet Magazine. 1995. Requiem for a dying sea. Vol. 4 No. 2.

For freshwater production, the main systems are based on the culture of combinations of herbivorous and omnivirous finfish species. Such systems are characterized by low to moderate production inputs (extensive and semi-extensive systems) using local sources. In Egypt, which makes up 26 percent of total regional production volume, common carp culture is carried out in rice fields. The culture of marine finfish is conducted mostly in intensive culture systems such as nearshore cages and, to a lesser extent, in coastal raceways and lagoons; these systems depend totally on nutritionally complete aquafeeds with high fishmeal and oil content. In summary, aquaculture production has continued to grow well above global rates and there is good potential for expansion. In addition, in some countries, aquaculture makes a useful contribution to overall fish production; 70 percent in Israel, 50 percent in the Syrian Arab Republic and 17 percent in Egypt.

Figure 58. Fishery production by species categories

PRODUCTS AND MARKETS

Fish consumption in the Near East and North Africa varies widely among subregions and countries and even within countries. For instance, fish consumption in Afghanistan is among the lowest in the world at a food fish supply of 0.1 kg per person per year (live weight equivalent) while in Aden (in Yemen) the corresponding figure is 40 kg per person per year. The average per caput supply in the region is only 5 kg annually. Around the Mediterranean, fish is a traditional food item prepared in many ways and with a predominant place in the cuisine, yet, even in the Mediterranean, small pelagic fish such as sardines are not as accepted as demersal fish such as seabream or large pelagic fish such as swordfish. Among small pelagics, anchovies are usually more in demand than sardines.

Figure 59. Fishery imports and exports for major trading countries in 1994

Fish are usually consumed fresh, particularly demersal fish, cephalopods and shellfish. Small Mediterranean pelagics such as sardines and anchovies are used in fresh, canned or salted form, and tuna is mainly canned. In Yemen and Oman, small pelagic fish are also dried on the beach to be used as animal feed and in Morocco and Iran they are utilized for producing fishmeal and oil. Sardines have been canned in Morocco since the First World War and the industry continues to contribute significantly to the economy. The large resources of small (4-cm long) mesopelagic fish in the Arabian Sea are not yet being exploited commercially, but exploratory fishing with vessels based in Oman and Iran has been initiated in order to produce fishmeal.

In general, the region does not contribute substantially to international fish trade, although Morocco is a major exporter of fish and is expected to increase its exports as the

European demand for high-value fish increases and the Moroccan national fleet expands. Its sardine processing sector has incorporated the latest technology to allow competitive production at world prices. Other countries export mostly high-value fish, with some cephalopods and crustaceans, to European markets and Japan. A number of countries have a modest but expanding trade in fresh and frozen fish to Europe, and intraregional trade to Saudi Arabia, Israel, Bahrain, Qatar and the United Arab Emirates.

FISHERIES POLICY AND MANAGEMENT

As fisheries play a minor role in most regional countries, national fisheries administrations tend to be small and, as greater efficiency becomes necessary, some administrations are shrinking, with fewer staff and funds available to provide support to the sector. In many countries, the private sector has assumed the leading role previously held by the national administration. This is particularly true in extension activities, where the sale of technical papers and back-up support by gear and engine manufacturers provide much-needed support to fishermen.

The countries of the former USSR in central Asia have been struggling to adjust to the transitional situation, and a number of operations have been divested to the private sector. Regional examples of divestment include privatizing fish farms and hatcheries, harbours, fleet and trading companies.

In general, governments have taken few firm conservation and management decisions, and only a few countries have set limits on the fishing effort or the catch of different species. In addition, in many countries, management decisions are not enforced. Management measures in the region include a total ban on trawling in the United Arab Emirates and seasonal openings only in Iran; setting a minimum mesh size for nets; protecting artisanal fisheries by creating an inshore zone from which industrial fishing is banned; closed fishing seasons; and fishing effort control.

Given the growing pressure on stocks, some governments have been reducing the availability of grants and low-cost loans for investment and steps are taken to manage the excess fishing capacity; for example, Tunisia has withdrawn all support for investment in new vessels designed to fish the overexploited Gulf of Gabes fishery and the Iranian Government has undertaken a fleet reduction programme after banning trawling in the adjacent sea as well as a fisheries management plan for the Caspian Sea (Box 17). Most governments, however, do not tax the fuel used in fishing operations and some actually provide fuel at below the world price while subsidies are generally widespread, although the current trend is to reduce public subsidies.

FAO regional fishery bodies cover most fishing areas in this region, except for inland fisheries of the central Asia region. These bodies include the Indian Ocean Fishery Commission, the FAO General Fisheries Council for the Mediterranean and the FAO Fishery Committee for the Eastern Central Atlantic (CECAF). CECAF will be used for scientific and management purposes by the Ministerial Conference on Fisheries Cooperation among African States bordering the Atlantic Ocean.

OUTLOOK

Assuming that fish consumption in the region remains relatively low by world standards, it would seem reasonable to expect that, at least until 2010, a slight increase in demand could be met from higher regional landings of fish if these are not diverted for export. Factors contributing to possible increased consumption in some North African countries include economic expansion and the development of tourism. Morocco will probably show a high increase in fish consumption as the economy and fisheries sector expand. Fish consumption in Near Eastern countries is expected to remain relatively modest. The fish supply does not play, and is not expected to play, any substantial role in the food security of the subregion, but fish nonetheless constitutes an important alternative food source.

Improved management should allow greater catches of some of the stocks that are exploited intensively at present through reduced effective fishing effort; small pelagic resources in particular should form a basis for increased landings throughout the region. The Atlantic waters of Morocco have good potential to meet an increased demand for fish and fishery products. Canned sardines are sold throughout the world often to low-income groups and contribute to food security. There are also substantial stocks of mesopelagics off the coasts of Yemen, Oman, Pakistan and Iran. Relatively low-cost harvesting and processing methods will need to be developed for these stocks. In the Near Eastern subregion, aquaculture represents the main potential for increasing the fish supply. Aquaculture should also expand in the northern African coastal lagoons and sheltered areas.

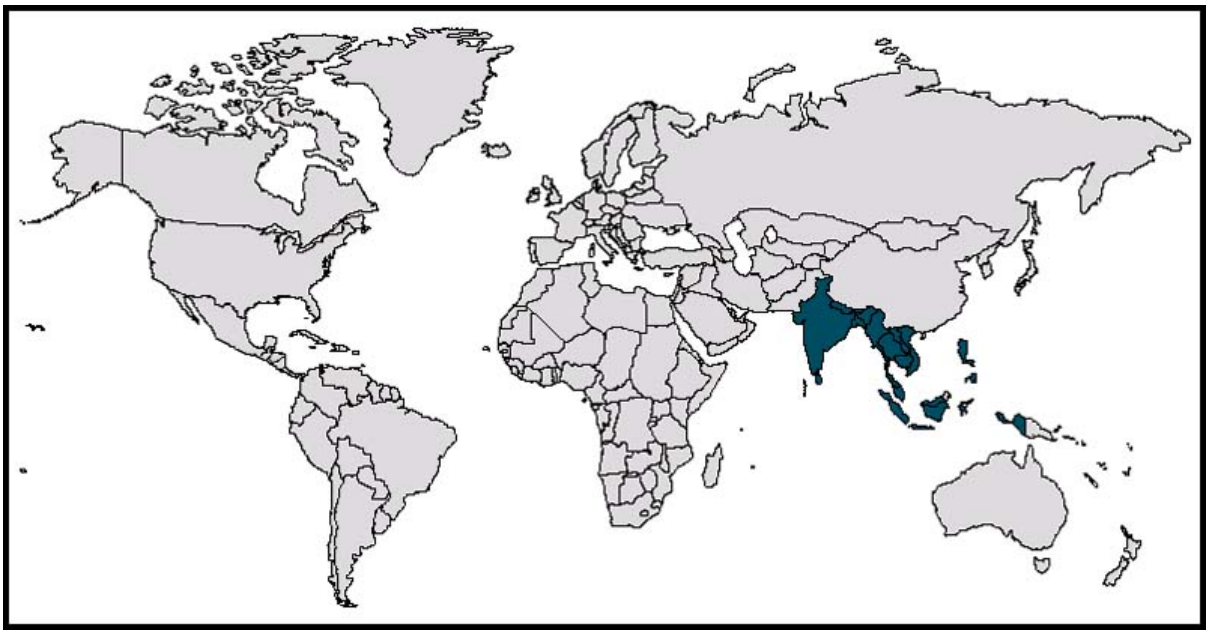
Future issues facing regional aquaculture development include competition for freshwater, suitable sites and feed ingredients. There is a lack of intersectoral development planning, especially between agriculture and aquaculture. Countries facing these constraints are turning to fish culture in existing inland waters and coastal marine waters to avoid the use of arable land. In marine aquaculture, market saturation and lower prices have stimulated greater production efficiency and diversification of cultured species.

The expansion of the European market for high-value fish has led to numerous small-scale fishing enterprises being set up in Morocco, as well as improved investment in onshore processing, handling and distribution facilities.

This is a trend that could continue, although future trade with Europe may be affected by the entry into force of EU sanitary control regulations as member countries adjust to the new requirements.

7. South and Southeast Asia[1]

[1] This review is based on the regional study prepared by the FAO interdepartmental task force, headed by M. Hotta, Fishery Policy and Planning Division, Development Planning Service (FIPP).



The region includes the countries of South and Southeast Asia, from Pakistan in the west to Indonesia in the east. The main fishing areas for these countries are the northern part of the Indian Ocean, including the Bay of Bengal and the Arabian Sea, the South China Sea and the western central part of the Pacific Ocean.

South and Southeast Asia include some of the most productive fishing waters in the world. Total regional fish production was 19.5 million tonnes in 1994, representing 27 percent of the global catch. It has been estimated that over 10 million people are employed in fisheries. Consumption of food fish varies considerably among the different subregions and countries, with particularly high per caput supplies in coastal parts of Southeast Asia and much lower consumption levels in the northern inland regions of South Asia. On average, per caput fish supplies were 9 kg in 1994 (live weight equivalent). Fish trade has expanded significantly in the region over the last decade and Thailand is the world's leading exporter of fish and fishery products.

RESOURCES AND PRODUCTION

Marine fisheries

Figure 60. Regional fish production and share of world production in percentage

Total marine catches in South and Southeast Asia increased steadily from 9.1 million tonnes in 1984 to over 13.4 million tonnes in 1994, representing an annual compound growth rate of 3.9 percent. In the major fishing nations - India, Indonesia, Thailand and the Philippines - aggregate production represented more than 73 percent of total regional output. Small pelagics are more important for food supplies in this region than in any other. They accounted for somewhat less than one-third of the landings in 1994, followed by demersal species (16 percent) and tuna (10 percent). Although Penaeus shrimp catches

make up less than 10 percent of the total weight, it is by far the most valuable species group exploited. Cephalopods currently provide only a small fraction of the total catch, but production has grown significantly at an annual rate of 11 percent over the last ten years.

In 1994, 64 percent of marine production (or 7.9 million tonnes) derived from the western central Pacific. Some of the main species are scads, sardinellas, tunas, snappers, shrimps and mackerels. Another 3.7 million tonnes were caught in the eastern Indian Ocean and 2.4 million tonnes in the western Indian Ocean, with mackerels, shad, shrimps and oil sardine among the major species. However, many regional landings are classified as unidentified in fishery statistics.

Most known fish stocks are approaching levels of full exploitation. Coastal demersal species have generally been heavily exploited, whereas offshore resources may have been less intensively fished to date. The general lack of catch and effort statistics make it difficult to assess these stocks, but it is believed that small pelagic stocks are still less heavily exploited in certain waters. Most stocks of *Penaeus* shrimp appear to be fully exploited or even depleted. Tuna stocks vary but in many areas they are fully utilized.

Cephalopod yields could increase in the future since they appear to be only moderately exploited.

A large variety of fishing methods and gear are used. Regional countries count an estimated total of 1.3 million fishing vessels, mostly small traditional boats operated often with simple gear near the coast or in rivers and flood plains. Decked vessels with inboard engines total about 99 300, with a total tonnage of 1.37 million gross registered tonnage (GRT). Between 1984 and 1992 there was a moderate increase in the number of vessels and a faster growth in total tonnage. There are also fewer very small boats, and consequently investment per fisher is increasing.

The development of national fleets means that foreign countries tend to fish less and less in the region, although distant-water fishing by developed countries is still quite common in regional waters, especially for tuna. Thailand, in particular, harvests large amounts of fish outside the region.

Inland water fisheries

Regional production from inland water fisheries increased slightly from 2.2 million tonnes in 1984 to 2.3 million tonnes in 1994. About a quarter of the total catch is taken from the extensive inland water fisheries of Bangladesh, where production reached 570 000 tonnes in 1994. Some countries have recently undertaken large-scale stocking programmes, and the increase in freshwater fish production in Bangladesh is partly owing to fisheries enhancement. India and Indonesia have considerable inland water fisheries resources and together contribute another 35 percent of total regional output. All fish catches by landlocked Laos, Bhutan and Nepal as well as most fish supplies in Cambodia come from inland waters. Furthermore, as catch statistics for inland waters in many

countries do not include subsistence fishing, total production figures as well as the relative importance of freshwater fish in food supplies may be underestimated. In Thailand, it is estimated that direct consumption by fishers and their families may amount to 25 percent of the reported catch.

AQUACULTURE

Total aquaculture production in the region increased spectacularly by 2.4 times from 1.8 million tonnes in 1984 to 4.4 million tonnes in 1994 (including aquatic plants). The increase in value over the same period was even more important - US$1 570 million to $9 240 million. The regional contribution to global aquaculture production was 17 percent in volume and 23 percent in value. In volume, the main producers are India, the Philippines, Indonesia and Thailand. Finfish is the main species group in volume, followed by crustaceans, aquatic plants and molluscs. Crustaceans represented more than 50 percent of the total value in 1994.

Total production of farmed finfish was 3 million tonnes in 1994, mainly from freshwater. The bulk of freshwater production is a polyculture within traditional semi-intensive pond-based farming systems that contributes a low-priced source of food fish for mass domestic consumption, especially in India. The principal species cultivated belong to the cyprinid family, including roho, catla and Mrigal carp. Other species are cultivated in pens and cages (e.g. tilapia) or in coastal ponds (e.g. milkfish).

Farmed shrimp culture has developed dramatically over the last decade and production in 1994 was 692 000 tonnes. The region contributes 75 percent of total world production of cultured shrimp, the giant tiger prawn is the most popular species cultivated and the major shrimp-producing countries are Thailand and Indonesia. In several locations in the region, coastal environments have suffered from the rapid expansion of shrimp farming (Box 19).

Figure 61. Fish utilization and food supply

Figure 62. Fishery imports and exports (including intraregional trade)

PRODUCTS AND MARKETS

Fish consumption varies throughout the region, with relatively high consumption in coastal areas and large urban centres, particularly in the eastern part of the region. In Singapore and the Philippines, average per caput food fish supplies are of some 36 kg annually (live weight equivalent), in Malaysia almost 30 kg and in Thailand around 25 kg. The Maldives has the highest annual fish supply in the world, 126 kg per person. On the other hand, in India, the most populous country of the region, the corresponding figure is only 4 kg and, as a result, the total regional average is only about 9 kg. It should be remembered, however, that consumption patterns in India vary significantly and certain coastal communities depend heavily on fish for their diet.

BOX 19
Shrimp culture and the environment

The rapid growth and expansion of shrimp farming, fuelled by high profitability and demand from mainly affluent consumers, has provided the developing countries in the South and Southeast Asian region with considerable foreign currency earnings. However, the expansion has been accompanied by environmental trade-offs. In particular, the expansion of shrimp pond areas has contributed, sometimes signficantly, to the loss of mangroves which were already under pressure from other sources. Nevertheless, many shrimp farms have been built in more suitable non-mangrove areas or in zones where mangroves had already been cleared for other reasons.

Other major environmental concerns include the salination of groundwaters and agricultural land, the impacts on shrimp larvae abundance of the collection of wild seed and pollution from the effluents of shrimp farms concentrated in areas with poorly flushed coastal waters, which often results in pollution of the surrounding waters and outbreaks of shrimp disease. Despite the recent availability of more reports on environmental impacts, the extent and severity of the effects have not always been studied with the necessary objectivity and insight. Nevertheless, it is now generally recognized that the public perception of shrimp farming, and of aquaculture generally, might be damaged by the irresponsible practices of some entrepreneurs who have caused serious environmental degradation and social disruption.

The long-term sustainability of shrimp farming is being addressed at national and international levels. Many governments, private-sector representatives, international organizations and non-governmental organizations (NGOs) now advocate shrimp farming practices that are environmentally and socially acceptable. Regional activities include promoting the sustainable intensification of the traditionally extensive farming systems, environmental management in the various farming systems, integrating shrimp production and silviculture and elaborating specific policy and legal measures.

Source: ADB/NACA. 1996. *Aquaculture sustainability action plan. Regional study and workshop on aquaculture sustainability and the environment (RETa 5534).* Asian Development Bank (ADB) and Network of Aquaculture Centres in Asia-Pacific (NACA). Bangkok, NACA. 21 pp.; FAO. 1995. *Code of Conduct for Responsible*

Fisheries. Rome. 48 pp.; FAO/NACA. 1995. *Regional Study and Workshop on the Environmental Assessment and Management of Aquaculture Development in Asia-Pacific.* NACA Environment and Aquaculture Development Series No. 1. Bangkok, NACA. 492 pp.

Although half the fish landed is marketed fresh, more frozen fish is being marketed. Fish utilization is also characterized by greater production of a wide range of value-added products or preparations, for both national and international markets. Thai processing factories still produce block-frozen tiger shrimp, but many now produce peeled and breaded shrimp and use imported raw materials from countries such as New Zealand, India and the United States when local supplies are not enough. Minced fish products, including surimi, are also produced and widely consumed in the region. Cured fish, for example dried or salted, particularly of small pelagic species, is also important. Canned fish is a popular commodity and is produced in Thailand, Indonesia and the Philippines. The Thai canning industry uses imported raw material, particularly skipjack tuna, and re-exports the final products. In general, throughout the region, more and more fish processors rely on imports of raw material.

Post-harvest losses of fish have been substantially reduced in recent years as a result of improved infrastructure for landing, storage, transport and marketing. However, considerable seasonal losses in value still occur in some fisheries. Losses from oversupply are increasingly being channelled into feed for aquaculture.

Economic growth and policies of open trade have meant that the fish trade has expanded significantly over the last decade. Some countries, particularly the new members of the World Trade Organization (WTO), Malaysia, the Philippines and India, are currently lowering their tariffs following the outcome of the General Agreement on Tariffs and Trade (GATT) Uruguay Round. The percentage of catch going into international trade has increased steadily and Thailand has ranked as the world leading exporter of fish and fishery products since 1993. Indonesia and India are the second and third most important regional exporters. Apart from Singapore, all regional countries were net exporters in value terms. Shrimp and frozen tuna contribute most to the regional export earnings from fisheries, with canned tuna and cephalopods also featuring.

FISHERIES POLICY AND MANAGEMENT

The sustainability of fishery resources is a central issue in many countries. Coastal resources are generally severely overfished by an overcrowded small-scale fishery sector, where catch rates, fish sizes and quality and, in some cases, fishers' incomes, are declining. Conflicts between small-scale fisheries and trawlers in the coastal zones are frequent and fisheries administration is made more complicated by the lack of detailed stock assessment data. Coastal fisheries management is complicated further by the variety in both resources and exploitation methods used. Experience indicates that the current centralized state management systems in many countries are not able to regulate fisheries properly over the widely scattered fishing grounds. In some countries, a partnership

between local communities and central government is evolving to develop a community-based fisheries management system for local resources. Various other management measures are also implemented to improve the situation, and the fishing effort is generally regulated by some kind of licensing system concerning the number of boats or gear. The banning of trawl fishing in some areas of Indonesia is an interesting example. Trawl fishers banned from trawling switched to offshore pelagic fisheries and shrimp culture, with the result that conflicts decreased significantly.

Figure 63. Fishery production by species categories

Figure 64. Fishery imports and exports for major trading commodities in 1993

Coastal resources and habitat are severely threatened by rapid environmental degradation. Environmental degradation caused by humans through aquaculture and fish farming is a serious problem. Environmental requirements in international trade concerning the selectivity of fishing gear have affected Asia. The benefits of environmentally friendly devices, such as by-catch reduction devices and turtle excluder devices (TEDs) and the effects of using them are being reviewed. Asian protests against United States requirements to use TEDs in order to gain access to its market have been brought to the attention of WTO as a violation of international trade agreements. By-catches from shrimp and finfish trawlers are prevalent in the region. Before coastal mariculture was intensified, most by-catch was discarded at sea and only a small portion brought ashore. With the development of refrigerated sea-water systems for on-board storage and the greater demand for feed from aquaculture, much more of the by-catch is now landed. Better-quality fish is used as fish or crab feed. Other parts of the by-catch are reduced to fishmeal. In addition, the processing of fish and fish-based products has created ready markets for by-catch, although the utilization of by-catch is still influenced by the location of fishing grounds and ports, the socio-economic status of fishing communities and the available infrastructure. In poorly developed fisheries in remote areas, there may be no alternative but to discard the by-catch (Box 20).

OUTLOOK

The regional population is growing rapidly and fish is a customary source of animal protein for most people. Domestic markets are expected to grow rapidly in response to rising incomes, and higher prices on international markets will help to expand exports of high-value wild and farmed fishery products. Higher incomes also mean more intraregional trade for both high-value products and low-price fish for general consumption. By 2010, fish supplies will need to increase by 6 million tonnes merely to maintain current per caput consumption levels; the effect of economic growth on demand means even higher volumes will be needed.

Nevertheless, marine fishery resources are generally fully exploited and offer few opportunities for regional countries to increase their domestic protein supplies. Most of the pelagic fish, crustaceans and demersal species in coastal fishing grounds in the Gulf of Thailand, the Tonkin Bay, the Bay of Bengal and the South China Sea have been fully

exploited or depleted. Despite some moderately exploited fish stocks (e.g. anchovies and smaller tunas and cephalopods in the western central Pacific), it is unlikely that future demand will be met from significant increases in marine fish production. In fact, many heavily fished stocks will need to be rehabilitated urgently through drastic reductions in the fishing effort.

Aquaculture and, to a lesser, extent inland fisheries may provide considerable opportunities for further development to increase regional fish production, particularly in Bangladesh, Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Thailand and Viet Nam. Nevertheless, the region will probably need to rely more and more on imports of fishery products for its future supplies.

BOX 20
By-catch and discards in Malaysian shrimp fisheries

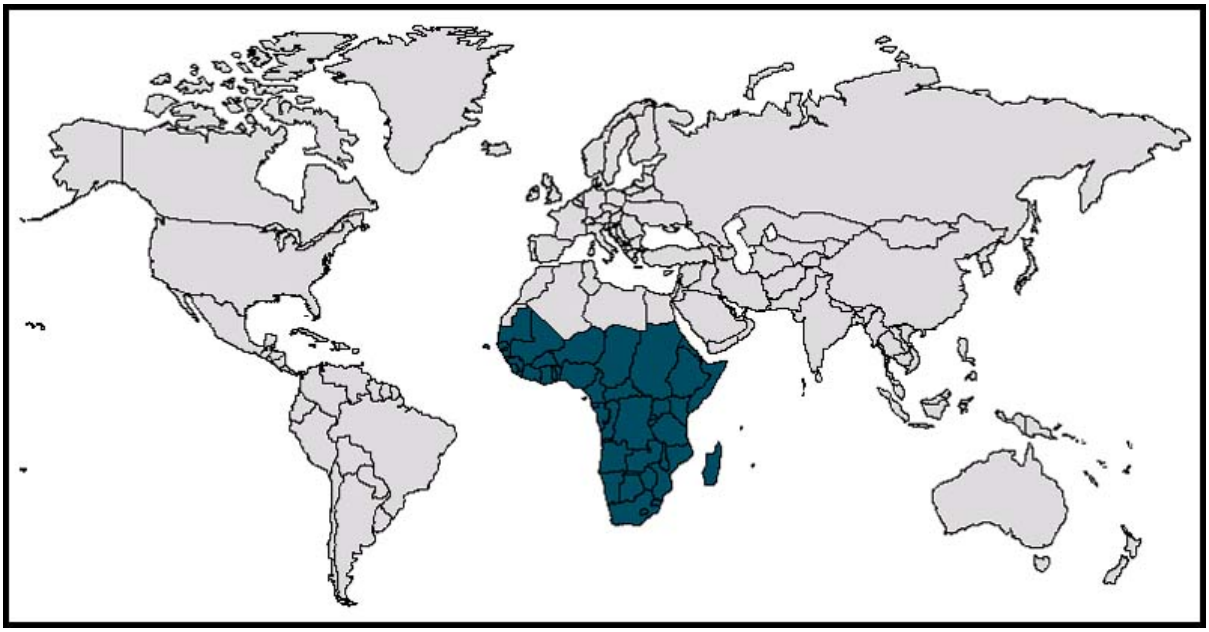
Shrimp trawl by-catch in Malaysia generally includes finfish, cephalopods, shells and other less-valued crustaceans. Although most of the by-catch that can be marketed as food is usually taken home or sold by the fishermen, much of the remainder is considered trash fish and not used as food, although trash fish is often landed and sold as aquaculture feed.

The results of a study of the shrimp fisheries in Kuala Sepetang on the west coast of peninsular Malaysia in 1992 indicate that the by-catch of traditional fishing gear is less than that of commercial trawlerss. The shrimp trawlers had a shrimp-to-fish ratio of between 1:1.6 and 1:6.1, whereas the trammel net by-catch ratio generally ranged between 1:0.4 and 1:1.2 (with the exception of two months of the year when the by-catch volume was larger). Part of the by-catch from traditional fishing was used as feed in local aquaculture activities operated by artisanal fishermen but some shrimp trawlers discard their by-catch at sea as they can earn enough from their main catch alone and the lack of a local trash fish processing industry was given as another explanation for discarding at sea.

Source: Adnan bin Nuruddin, A. and Fong, L.C. 1994. *Biosocio-economics of fishing for shrimp in Kuala Sepetang, Malaysia*. Madras, India; Chee, P.E. (n.p.). *A review of the by-catch and discards in the fisheries of Southeast Asia*. Penang, Malaysia Fisheries Research Institute.

8. Sub-Saharan Africa[1]

[1] This review is based on the regional study prepared by the FAO interdepartmental task force, headed by A. Bonzon, Fishery Policy and Planning Division, Development Planning Service (FIPP).



The region covers the African continent except for the North African states bordering the Mediterranean (including Morocco). Marine fishing is concentrated in the eastern central Atlantic, the southeast Atlantic and the western Indian Ocean.

Fisheries play an important role in many sub-Saharan African countries as a major contributor to animal protein supplies, a foreign exchange earner and a generator of rural employment. An estimated 8 million people are directly or indirectly employed in the sector. Total production by the countries of the region amounted to 3.9 million tonnes in 1994.2 Food fish consumption has declined recently, from an average per caput supply of about 9 kg in 1990 to less than 7 kg in 1994 (live weight equivalent). The overall trade balance of the region has been positive (in value terms) for the past decade, even though the region plays only a marginal role in international trade.

[2] Excluding the production of foreign fleets that was not landed in the region.

RESOURCES AND PRODUCTION

Marine fisheries

Marine capture fisheries make up about 60 percent of regional fish production and attained some 4.2 million tonnes in 1994, including 2.3 million tonnes by regional fleets and 1.8 million tonnes caught by foreign vessels. Fisheries are concentrated in four main areas.

Figure 65. Regional fish production and share of world production in percentage

In the south, which includes the waters of Angola, Namibia and South Africa, Cape hakes provide the highest catch volumes. The main pelagic stocks are sardine and anchovy. Anchovy stocks have varied considerably, with an overall declining trend. Red crab and rock lobster are the primary crustaceans, but rock lobster catches have decreased steadily since the 1950s. Apart from some small pelagic species, most stocks are fully exploited, including most of the demersal stocks.

In the central zone, from Gabon to Guinea, resources are less abundant. The large trigger fish stock has now virtually disappeared. Traditional offshore stocks are heavily fished and the fishing effort has been increasing since 1984. In one area, recent assessments show a decrease of about 50 percent of total biomass but there are opportunities for further exploitation of the small pelagics and the demersal stocks of the deep shelf and slope in most of the southern Gulf of Guinea. Economically important localized stocks of shrimp are found primarily off the river mouths and lagoon entrances, in the Gulf of Guinea and off the northern part of the coast and resources are abundant in the northern area of the western coast. Most of the demersal stocks are fully exploited but from Mauritania to Guinea-Bissau, small pelagic species are generally abundant, with sardinellas, horse mackerels and sardines being the predominant species. Landings of these resources have decreased drastically owing to the declining fishing effort. Cephalopods are fished off Senegal, Mauritania and southern Morocco.[3]

[3] Moroccan fisheries are examined in the review of the Near East and North Africa on p. 85.

Off the eastern coast of Africa, catches represent less than 10 percent of the total regional harvest (foreign and domestic production combined). Small pelagics are less abundant than off the western coast. Most finfish species and crustaceans are intensively fished, except off Somalia and Eritrea.

Tunas, bonitos and other large pelagics are captured offshore (by large purse seiners) and inshore (by pole and line) throughout the whole sub-Saharan Africa region.

Almost half of total regional marine production is still harvested by foreign fleets, mostly in the Atlantic Ocean, even though their catches have been declining rapidly over the last few years. Following the partial withdrawal of Eastern European and former USSR fleets from the West African coast, the total production of small pelagic species is estimated to have dropped by 72 percent between 1990 and 1992. Artisanal fisheries (canoes and small craft) land over 70 percent of domestic landings on the eastern coast and about one-half on the western coast. It appears that the artisanal sector has improved its efficiency substantially, reporting higher catches per canoe in 1990 than in 1980. The sector is labour-intensive and in some of the small island countries more than one-third of agricultural workers also work in fishery-related activities.

With few exceptions, the economic performances of both the foreign (with the exception of the tuna fishery) and domestic industrial fleets are generally weak. There is a significant turnover of local enterprises. Industrial demersal fisheries may be unstable owing to overcapacity and, more generally, to a lack of proper management - overcapacity is particularly pertinent for vessels that target cephalopods and shrimp. In terms of tonnage, the available data indicate that the domestic fleet probably doubled over the period 1980 to 1990 (mainly on the western coast). However, the increase in local vessels should not be interpreted as a net increase in fishing effort since it has been accompanied by a decrease in the fishing effort of foreign fleets.

Figure 66. Fish utilization and food supply

A large amount of by-catch, particularly from demersal and crustacean fisheries, is discarded. In shrimp fisheries, for example, only 10 to 15 percent of an estimated by-catch of about 1 million tonnes is landed. However, there is a trend towards the better utilization of by-catch through the introduction of specific regulations and the development of collecting systems at sea by local fishermen (Box 21).

Inland water fisheries

Inland water capture fisheries production has increased over the past decade at an annual rate of about 3.5 percent, attaining 1.6 million tonnes in 1994 and representing over 40 percent of total regional fish production. The main species include Nile perch, tilapia and catfish. Inland fisheries are clearly important to local food supplies; apart from the export of a few tonnes of Nile perch, the overall inland production is consumed in the region, representing nearly one-half of local supplies (imports excluded). Kenya, Nigeria, the United Republic of Tanzania, Uganda and Zaire are sub-Saharan Africa's top freshwater fish-producing countries, contributing 70 percent of total harvests. Sub-Saharan African freshwater production is relatively localized, with Lake Victoria alone contributing one-quarter of the total.

Freshwater fisheries are almost all artisanal, and proper management is urgently needed as most fishing grounds now show signs of intensive exploitation. Reservoirs continue to be created, but their natural productivity needs to be enhanced. The current production of the larger lake systems is very close to their potential and only the lightly exploited pelagic offshore stocks can sustain higher pressure.

Figure 67. Fishery imports and exports (including intraregional trade)

Aquaculture

Although not a traditional practice as it is in Asia, aquaculture in sub-Saharan Africa is starting to expand. Still, the continent contributes only 0.2 percent of total global production and several countries have only incipient or erratic aquaculture production. A total of 33 000 tonnes of fish were produced by the region's aquaculture in 1994. Only Kenya, Madagascar, Nigeria, South Africa and Zambia produced more than 1 000 tonnes

each, but these countries have doubled their annual production several times over the last ten years.

BOX 21
Utilization of by-catch from shrimp fisheries in the United Republic of Tanzania

Although some by-catch from shrimp trawlers has been landed in the United Republic of Tanzania since industrial trawling began in the 1960s, most has been discarded at sea. It is difficult to quantify discards, but an average shrimp-to-fish catch ratio could be estimated at 1:3 and 40 to 60 percent of the fish would be discarded. Discarding is not only a problem in industrial shrimp trawling, but also in the artisanal sector.

As well as being a marketing problem, the discarding of by-catches has often been associated with the lack of preservation facilities on-board shrimp trawlers. Recently, however, lower daily shrimp catch rates per boat mean that there is now the potential to store by-catch. Fishermen have also become more interested in selling by-catch to supplement their incomes and the government has started to regulate the landing of by-catch: shrimp trawlers should be accompanied by a fisheries officer as an observer; fishing should stop at 18.00 hours to allow the by-catch to be collected and to prevent the destruction of artisanal gear set in the same fishing grounds; and the renewal of annual fishing licences has been made conditional on landing a certain amount of by-catch. The measures are showing results as by-catch sales are increasing again and more fishermen are joining the trade; for example, in 1989, there was no by-catch collector in Bagamoyo town while in 1993 there were about ten collectors.

Nevertheless, by-catch collectors face problems regarding the type of sales agreements they use. Official negotiation with the trawling company can take up much time and involve much travelling, direct negotiation with the captain of the trawler makes the outcome of the transaction uncertain, while bartering with artisanal fishers and the crew (e.g. exchanging cigarettes or vegetables for fish) with no previous arrangements causes delays in receiving the by-catch and does not guarantee supplies. Transport can also be a problem owing to a lack of motorized craft, high costs and poor access roads to markets. Potential collectors might be discouraged by the prohibitive cost of retrieving by-catches.

Nevertheless, it appears that there is a market for by-catch and the present infrastructure can handle increased volumes of fish. By undertaking more work on the by-catch from shrimp trawlers, the system could be improved in the future with the result of improved food supplies for Tanzanian people.

Source: Government of Madagascar/UNDP-TCDC/FAO. 1995. *Utilization of by-catch from shrimp trawlers*. Report and proceedings of a United Nations Development Programme in Technical Co-operation among Developing Countries (UNDP-TCDC) Work-shop, Nosy Be, Madagascar, 6 to 8 June 1995.

The major species cultured include finfish (tilapias, catfish, carp), molluscs and shrimp. Freshwater fish make up over 80 percent of the total aquaculture harvest and almost all sub-Saharan African fish farming is carried out by subsistence rural operators in small freshwater ponds as a secondary activity to agriculture. Commercial shrimp culture is developing in some countries, including Madagascar, Mozambique, Guinea and Kenya. Nevertheless, further aquaculture development is hampered by weak institutional support, climatic change and reliance on external assistance for aquaculture development projects, which means that efforts are not very sustainable.

PRODUCTS AND MARKETS

Fish is a popular food item in sub-Saharan Africa and provides 18 percent of total animal protein intake, with a share as high as 40 to 60 percent in some West African states. Fish is often consumed in small amounts with daily meals, which otherwise consist mainly of staple starch food items. Since most parts of the fish are eaten, it also contributes significantly to calcium and iodine supplies.

Considering these consumption patterns, fish consumption in the region may be more important than the per caput food fish supply figures actually suggest. According to FAO statistics, fish consumption has declined by more than 2 kg per person annually over the past few years - from a per caput supply of 8.8 kg in 1984 to 6.8 kg in 1994 (live weight equivalent). This is owing mainly to rapid population growth, a drop in imports aggravated by the weaker purchasing power of some countries bordering the Gulf of Guinea and the ever-smaller share of domestic production retained for local markets as artisanal fisheries increasingly turn to lucrative export markets. Nevertheless, most fisheries production is still utilized as food for local people. It is worth noting that there has been a similar decline in meat consumption in recent years.

Figure 68. Fishery production by species categories

Locally produced fishery products are generally marketed fresh, smoked-and-dried or salted-and-dried. Consumers prefer fresh products and about one-half of the consumption volume consists of fresh finfish, although, owing to transport difficulties, fresh products

are usually available only near production centres. Women play an important role in processing and marketing, especially in western Africa. Imports are mainly of frozen products.

Constraints to intraregional trade include high transport and storage costs, poor handling practices, limited distribution networks and a lack of harmonization and proper enforcement of fish trade regulations. Tariff barriers and other trade restrictions persist among countries belonging to customs unions. The main trade is in exports of small frozen pelagics from the northwest coast southwards to the Gulf of Guinea countries.

Figure 69. Fishery imports and exports for major trading countries in 1994

Although the regional trade balance has been positive in value since the mid-1980s, sub-Saharan Africa remains a net fish importer in volume terms. Many countries have a small but growing export trade in fresh and frozen demersal fish and crustaceans, mainly to the European Union (EU), but the overall positive trade balance is based on the relatively large export volumes of only a handful of countries. Reliance on the EU market could cause difficulties in the future as trade is liberalized and African, Caribbean and Pacific (ACP) countries lose their preferential status (Box 22).

FISHERIES POLICY AND MANAGEMENT

Since the mid-1980s, many countries have aimed at developing medium-term sectoral plans tailored to support government macroeconomic policies, but these plans have often not come to fruition. The main obstacles to good fisheries management planning in the region are low budgets, the weak institutional base and the lack of political will to implement management policies and measures. Structural adjustments and related budget cuts have also led to fewer subsidies being granted to fisheries than previously.

BOX 22
The GATT Uruguay Round of Multilateral Trade Negotiations and sub-Saharan African exports of fishery products to the EU

A number of developing countries currently have access to the European Union (EU) market according to the trade provision of the Lomé Convention, an agreement between the EU and 69 countries in Africa, the Caribbean and the Pacific (the ACP countries). Under this agreement, fishery exports from ACP countries can enter the EU tariff-free. The sub-Saharan African ACP countries depend considerably on the EU market, to which they export 75 to 85 percent of their total fish exports. In addition to various demersal fish, two main fishery product types are exported: crustaceans, which represent about one-quarter of

the value of fish exports from the region, mainly shrimp from Côte d'Ivoire, Senegal, Madagascar and Mozambique; and tuna, one-third of total export value, mainly canned tuna from Côte d'Ivoire, Mauritius and Senegal.

The GATT Uruguay Round in 1994 concluded that customs regimes need to be harmonized globally. For fishery products, the main outcome of the negotiations was an agreement to lower customs duties by an average of 26 percent, meaning that many importing countries will lower the tariffs for a number of products. Generally, the reduction of tariffs will be done progressively over a period of five years but, while Japan and the United States are reducing their customs duties considerably, several of the EU tariffs for fishery products remain almost unchanged. An important exception for sub-Saharan African exporters is that import tariffs for tropical shrimp will be cut from 18 to 12 percent. Canned tuna, on the other hand, will remain subject to an import tariff of 24 percent. However, current EU concessions are subject to renegotiation and further reductions may be made in the future.

For the sub-Saharan ACP countries, this development will eventually mean increased competition from other developing countries. First, the preferential margin enjoyed by the ACP countries will be eroded and, even more significant, in the spirit of the GATT principle that all trading partners should be treated equally, the future of the Lomé Convention may be in doubt. Nevertheless, the outcome of the recently negotiated international trade agreements will probably not have any immediate effects on sub-Saharan African fisheries, although in the interim period of adjustment to these trade regimes the industry will need to adapt to new conditions in order to remain competitive.

Source: FAO. 1995. Impact of the last Act of the Uruguay Round on the fisheries of sub-Saharan Africa. FAO Fisheries Circular No. 897. Rome; FAO/GLOBEFISH. 1995. *Impact of the Uruguay Round on international fish trade*, by A. Filhol. AO/GLOBEFISH Re-search Programme Vol. 38. Rome.

The most common measures in marine resource management are quota and licensing systems. In many coastal countries, licences are an important source of foreign exchange. Fishing agreements frequently form part of more complex negotiations, including trade. Moreover, subsistence fishers operate within the framework of traditional management systems, making resource management a complicated and delicate task.

The main characteristic of sub-Saharan African freshwater fisheries potential is its annual variability. Systems that fluctuate seasonally and from year to year in surface area -

reservoirs, swamps and river flood plains - account for almost 60 percent of the total water surface area and, clearly, the biological and social management of such fisheries is particularly difficult.

Regional cooperation in fisheries policy and management has traditionally been carried out through FAO subsidiary bodies such as the Fishery Committee for the Eastern Central Atlantic (CECAF). In recent years, efforts have been made to strengthen the mandate of fisheries organizations in aspects related to management or to establish new bodies such as the Ministerial Conference of African States Bordering the Atlantic Ocean and the Lake Victoria Fisheries Commission. This is expected to complement the functions of the numerous economic groupings of the continent with authority in fisheries matters but which, with the exception of the Southern African Development Community (SADC), have generally not built up the necessary capacity to implement effective fisheries policy and management strategies.

OUTLOOK

United Nations projections for population growth indicate a regional population of 700 million by the year 2000 and 915 million by 2010. Assuming current levels of per caput food fish consumption, an increase of total supplies in the order of 2 million tonnes would be needed to meet demand in 2010.

The main future possibilities for increasing food fish supplies in the sub-Saharan Africa region include productivity enhancement programmes in small water bodies, aquaculture development, better utilization of small pelagic fish, relocalization of foreign fleets and increased imports. Further gains could be obtained by implementing sound fisheries management regimes, reducing discards from industrial fisheries and better post-harvest handling practices and distribution networks.

Given the modest gross domestic product (GDP) growth forecasts over the next 15 years, future prospects appear rather poor. Likely trends include further constraints on imports, increases in real fish prices, a continued demand for mainly low-value species and the continuing export of most demersal production. At the same time, lower public subsidies will increase production costs and weaken competitiveness on export markets in the process.

The implications for food security and supplies as well as for foreign exchange earnings are difficult to quantify, but might be a cause for concern in the future.

FISHERY ACTIVITIES OF COUNTRY GROUPINGS

Andean Pact

The Andean Pact was established through the Cartagena Agreement on 26 May 1969. Current members are Bolivia, Colombia, Ecuador, Peru and Venezuela. The general objectives of the Andean Pact as revised by the 7th Andean Presidential Council which met in Quito, Ecuador, on 5 September 1995, are to:

· strengthen the Andean integration process;

· coordinate and subsidize economic policies in order to achieve sustainable development;

· define social policies that will improve the quality of life and promote the participation of all social groups in the benefits of regional development;

· strengthen integration in Latin America and the Southern Hemisphere.

FISHERIES: PURPOSE AND ACTIVITIES

The Andean Pact has no subsidiary body that deals exclusively with fishery matters.

FISH PRODUCTION AND TRADE

The total fish production of Andean Pact countries rose steadily over recent years from 2.2 million tonnes in 1983 to 12 million tonnes in 1994. Peru's catches of anchovy and sardine accounted for almost 85 percent of the total fish production in 1994. Aquaculture production remains very small compared with capture fisheries. The total export of fish and fish products by member countries of the Andean Pact has also been increasing consistently over recent years.

Andean Pact: fishery production and trade

	1980	1985	1990	1994
Fishery production				
Inland production *('000 tonnes)*	79	98	97	124
Percentage of world total	1.05	0.92	0.66	0.65
Marine production *('000 tonnes)*	3 533	5 466	7 636	12 355
Percentage of world total	5.49	7.21	9.19	13.67
Total production *('000 tonnes)*	3 613	5 564	7 733	12 479
Percentage of world total	5.02	6.43	7.90	11.39
Trade in fishery commodities				
Total imports *(US$ million)*	127	90	88	187
Percentage of world total	0.80	0.49	0.22	0.36
Total exports *(US$ million)*	790	989	1 401	2 999
Percentage of world total	5.13	5.74	3.92	6.39

Data reflect the membership in force in August 1996.

COOPERATION WITH FAO

Several regional and national projects support fisheries in the countries of the Andean Pact. Of particular relevance is a regional project funded by the European Union (EU) to support fisheries development in Venezuela, Colombia, Ecuador and Peru (Programa de Pesca VECEP). There are also FAO projects in Venezuela, Colombia, Ecuador, Peru and Bolivia.

League of Arab States

The League of Arab States, more generally known as the Arab League, was founded in March 1945. The League is composed of 21 states: Algeria, Bahrain, 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 countries in economic, cultural, scientific, social and military fields. To do so, the League has established 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 League Educational, Cultural and Scientific Organization (Tunis, Tunisia); the Arab Organization for Agricultural Development (Khartoum, the Sudan); the Arab Maritime Transport Academy (Alexandria, Egypt); and the Inter-Arab Investment Guarantee Corporation.

FISHERIES: PURPOSE AND ACTIVITIES

The Arab League has no subsidiary body or institution that deals exclusively with fishery matters.

FISH PRODUCTION AND TRADE

League of Arab States: fishery production and trade

	1980	**1985**	**1990**	**1994**
Fishery production				
Inland production *('000 tonnes)*	160	232	295	296
Percentage of world total	2.11	2.17	2.00	1.55
Marine production *('000 tonnes)*	815	1 113	1 287	1 568
Percentage of world total	1.27	1.47	1.55	1.73
Total production *('000 tonnes)*	975	1 346	1 582	1 865
Percentage of world total	1.35	1.56	1.62	1.70
Trade in fishery commodities				
Total imports *(US$ million)*	171	251	219	269
Percentage of world total	1.07	1.35	0.56	0.52
Total exports *(US$ million)*	114	282	316	332
Percentage of world total	0.74	1.64	0.89	0.71

Data reflect the membership in force in 1996.

COOPERATION WITH FAO

There is little direct cooperation between FAO and the Arab League at the present time. FAO has participated in several meetings organized by the subsidiary bodies of the League and has also provided technical assistance in fisheries to the Arab Union of Fish Producers through the Centre for Marketing Information and Advisory Services for Fishery Products in the Arab Region (INFOSAMAK).

Association of Southeast Asian Nations

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

In 1992, the ASEAN Heads of Government adopted the Singapore Declaration and the Framework Agreement of Enhancing ASEAN Economic Cooperation, including a decision to establish the ASEAN Free Trade Area (AFTA) within 15 years. Member countries also signed the Agreement on the Common Effective Preferential Tariff (CEPT) scheme which is the main instrument to establish AFTA.

FISHERIES: PURPOSE AND ACTIVITIES

The 15th Meeting of ASEAN Ministers of Agriculture and Forestry in Bandar Seri Begawan, Brunei Darussalam, 28 to 30 October 1993, agreed that the medium-term programme of action for ASEAN cooperation in food, agriculture, fisheries and forestry shall cover the following priority areas:

· strengthening food security in the region;

· facilitation and promotion of intra- and extra-ASEAN trade in food, agriculture, fishery and forest products;

· technology generation and transfer to increase productivity and develop the agribusiness and silvibusiness;

· agricultural rural community and human resources development;

· private-sector involvement and investment;

· management and conservation of natural resources for sustainable development;

· strengthening ASEAN cooperation and joint approaches in addressing international and regional issues.

FISH PRODUCTION AND TRADE

ASEAN: fishery production and trade

	1980	**1985**	**1990**	**1994**
Fishery production				
Inland production *('000 tonnes)*	1 184	1 528	1 884	2 175
Percentage of world total	15.60	14.25	12.73	11.34
Marine production *('000 tonnes)*	5 323	6 536	8 136	9 828
Percentage of world total	8.27	8.62	9.80	10.87
Total production *('000 tonnes)*	6 508	8 065	10 020	12 004
Percentage of world total	9.04	9.32	10.24	10.95
Trade in fishery commodities				
Total imports *(US$ million)*	441	617	1 207	1 969
Percentage of world total	2.76	3.32	3.06	3.82
Total exports *(US$ million)*	606	851	1 491	2 188
Percentage of world total	3.94	4.93	4.17	4.66

Data reflect the membership in force in 1996.

COOPERATION WITH FAO

The Indo-Pacific Fishery Commission (IPFC - now known as the Asia-Pacific Fishery Commission, APFIC), at its 24th Session held in Bangkok in December 1993, agreed that the IPFC Secretariat should consult the Secretariats of ASEAN and the Southeast Asian Fisheries Development Centre (SEAFDEC) informally to consider ways and means of strengthening regional technical cooperation in fisheries. Indonesia, in its capacity as Chairman of the IPFC Committee on Marine Fisheries, was requested to convene an informal meeting among the Secretariats of ASEAN, SEAFDEC and IPFC where it was agreed that a joint working group composed of ASEAN, FAO and SEAFDEC be organized. In late April 1994, Indonesia requested that the proposed ASEAN-FAO-SEAFDEC joint working group be considered favourably and included in the agenda of the forthcoming ASEAN meeting.

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 the member countries.

The membership of CARICOM comprises Antigua and Barbuda, the Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Montserrat, Saint Lucia, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Suriname and Trinidad and Tobago. The British Virgin Islands and the Turks and Caicos Islands are associate members. A number of other states from Latin America and the Caribbean, including Anguilla, Aruba, Bermuda, the Cayman Islands, Colombia, the Dominican Republic, Haiti, Mexico, the Netherlands Antilles, Puerto Rico and Venezuela enjoy observer status in various institutions of the community and in the CARICOM ministerial bodies.

FISHERIES: PURPOSE AND ACTIVITIES

The CARICOM Fisheries Resource Assessment and Management Program (CFRAMP) is a sustainable development initiative of 12 member countries of CARICOM. The CARICOM countries not currently participating in CFRAMP are the Bahamas and Suriname. CFRAMP is funded jointly by the Inter-American Committee for Agricultural Development (CIDA) and the participating countries. CFRAMP's goal is to promote sustainable development and conservation of the region's fish stocks to permit sustainable use of these resources by the people of the region. The specific purpose of the programme is to enhance the institutional capacity and information base to enable sustainable management of the fisheries. CFRAMP will also define and establish a permanent regional fisheries mechanism which will continue to provide policy and technical support and coordination for sustainable fisheries development at the CARICOM level.

FISH PRODUCTION AND TRADE

All CARICOM countries are maritime states with significant quantities of living and non-living marine resources within their waters. The fisheries sector contributes significantly to food supply and employment in the CARICOM area. Per caput consumption is high (23 to 25 kg per year), well above the world average. Most countries are net fish importers, but they also export and supply their higher-value catches to the tourism market. Small-scale fisheries predominate in the structure of the fisheries sector. Most inshore fishery resources are considered to be fully or overexploited and potential for expansion lies in the better management of existing fisheries and the development of fisheries for large pelagic species.

CARICOM: fishery production and trade

	1980	**1985**	**1990**	**1994**
Fishery production				
Inland production *('000 tonnes)*	0.827	2	4	4
Percentage of world total	0.01	0.02	0.03	0.02
Marine production *('000 tonnes)*	64	76	83	99
Percentage of world total	0.10	0.10	0.10	0.11
Total production *('000 tonnes)*	65	78	88	103
Percentage of world total	0.09	0.09	0.09	0.09
Trade in fishery commodities				
Total imports *(US$ million)*	28	24	24	26
Percentage of world total	0.18	0.13	0.06	0.05
Total exports *(US$ million)*	6	7	18	17
Percentage of world total	0.05	0.04	0.05	0.04

Data reflect the membership in force in August 1996.

COOPERATION WITH FAO

The working relationship between CARICOM and FAO has been mainly through the Western Central Atlantic Fishery Commission (WECAFC), since its establishment in 1975. WECAFC has conducted several activities including, inter alia, training on stock assessment and the assessment of major fish stocks in the area.

Commonwealth of Independent States

The Commonwealth of Independent States (CIS) was established in December 1991. It is a voluntary association consisting of 12 states: Armenia, Azerbaijan, Belarus, Georgia, Kazakstan, Kyrgyzstan, the Republic of Moldova, the Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. The main scope of CIS is to develop and strengthen cooperation and to serve the cause of peace and security.

FISHERIES: PURPOSE AND ACTIVITIES

The member countries of CIS can be divided into two groups: states that have inland water fisheries and aquaculture only (Armenia, Azerbaijan, Belarus, Kazakstan, Kyrgyzstan, Moldova, Tajikistan, Turkmenistan and Uzbekistan); and states that have a well-developed distant-water fisheries (the Russian Federation, Ukraine and - to a certain extent - Georgia).

The main features of fisheries in the Russian Federation and Ukraine are access to exclusive economic zones (EEZs), a large number of distant-water fishing vessels, a strong fish processing industry and highly developed inland water fisheries and aquaculture.

To date, no common fisheries policy has been elaborated. Coordination is achieved through bilateral and multilateral agreements. On 24 September 1992 the governments of the Russian Federation and Ukraine signed an agreement to cooperate in fishery activities and this was followed by a second agreement signed on 14 September 1993. Recently, the Russian Federation, Azerbaijan and Kazakstan have started to negotiate a cooperation agreement on fisheries in the Caspian Sea.

No agreements concerning the division of the former-USSR fleet were developed. The fishing fleet was divided by location of ship owners and board of vessel registration.

FISH PRODUCTION AND TRADE

CIS: fishery production and trade

	1980	**1985**	**1990**	**1994**
Fishery production				
Inland production *('000 tonnes)*			970	517
Percentage of world total	0.00	0.00	6.55	2.70
Marine production *('000 tonnes)*			8 233	3 772
Percentage of world total	0.00	0.00	9.91	4.17
Total production *('000 tonnes)*			9 203	4 289
Percentage of world total	0.00	0.00	9.41	3.91
Trade in fishery commodities				
Total imports *(US$ million)*				156
Percentage of world total	0.00	0.00	0.00	0.30
Total exports *(US$ million)*				1 091
Percentage of world total	0.00	0.00	0.00	2.32

Data reflect the membership in force in August 1996.

COOPERATION WITH FAO

To date there is no agreed policy within the CIS countries concerning their cooperation with FAO. Each state acts independently in fishery 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 objectives as the promotion of cooperation and development in all fields of economic activity.

FISHERIES: PURPOSE AND ACTIVITIES

Cooperation in the development of agriculture, forestry, animal husbandry and fisheries is one of the primary aims of ECOWAS. 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.

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 countries and also to ensure the conservation of fisheries resources in the region. This conference made several recommendations on research, surveillance, harmonization of fishing agreements and legislation, trade in fish and fishery products,data collection etc. These formed the basis of the fisheries component of a United Nations Development Programme (UNDP)-financed project (RAF/88/047-Support to ECOWAS). The report of this project was forwarded to the ECOWAS Secretariat in 1993 by FAO.

FISH PRODUCTION AND TRADE

ECOWAS: fishery production and trade

	1980	**1985**	**1990**	**1994**
Fishery production				
Inland production *('000 tonnes)*	353	297	343	350
Percentage of world total	4.66	2.77	2.32	1.83
Marine production *('000 tonnes)*	737	918	1 108	1 087
Percentage of world total	1.15	1.21	1.33	1.20
Total production *('000 tonnes)*	1 091	1 215	1 451	1 437
Percentage of world total	1.52	1.40	1.48	1.31

Trade in fishery commodities				
Total imports *(US$ million)*	733	461	779	510
Percentage of world total	4.58	2.48	1.98	0.99
Total exports *(US$ million)*	149	250	260	199
Percentage of world total	0.97	1.45	0.73	0.42

Data reflect the membership in force in August 1996.

COOPERATION WITH FAO

ECOWAS's 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 the signing of this agreement, FAO has cooperated with ECOWAS in various fields within the mandate of FAO.

In fisheries, the Secretariat of ECOWAS was assisted in organizing and running its Conference on Sea Fishing in Dakar, Senegal, 25 to 29 March 1985. FAO was also designated the executing agency for the UNDP-funded project (RAF/88/047-Assistance to ECOWAS for Strengthening Economic Cooperation and Integration among West African Countries). Furthermore, FAO regional projects have been cooperating with ECOWAS member countries in their efforts to manage their fisheries resources, especially in the artisanal subsector. ECOWAS, as an organization, is not a member of any of the FAO statutory bodies.

European Free Trade Association

The European Free Trade Association (EFTA) was established in 1960 by Austria, Denmark, Norway, Sweden, Switzerland and the United Kingdom. Finland, Iceland and Liechtenstein joined later. The main aim of EFTA is to work for the removal of trade barriers and for economic cooperation in Western Europe. In 1991 EFTA and European Economic Community (EEC) agreed to create a European economic area. With the expansion of the EU, the membership of EFTA has declined and in 1996 consisted of Norway, Iceland, Liechtenstein and Switzerland.

FISHERIES: PURPOSE AND ACTIVITIES

EFTA does not have a formal body for fishery matters or a specific policy towards the sector. Of the four EFTA members two - Norway and Iceland - are major fishing nations, while fisheries in Switzerland and Liechtenstein is a negligible economic activity. Norway and Iceland discuss fisheries on shared stocks bilaterally and through regional fishery groups. Their government officials, fishery organizations and their members discuss fishery matters within the framework of the Nordic Council (constituted by Denmark, Finland, Iceland, Norway and Sweden).

FISH PRODUCTION AND TRADE

EFTA: fishery production and trade

	1980	1985	1990	1994
Fishery production				
Inland production *('000 tonnes)*	4	5	5	4
Percentage of world total	0.06	0.05	0.04	0.02
Marine production *('000 tonnes)*	3 922	3 798	3 251	4 110
Percentage of world total	6.09	5.01	3.92	4.55
Total production *('000 tonnes)*	3 927	3 803	3 257	4 114
Percentage of world total	5.46	4.40	3.33	3.75
Trade in fishery commodities				
Total imports *(US$ million)*	213	246	298	505
Percentage of world total	1.34	1.33	0.76	0.98
Total exports *(US$ million)*	1 202	1 402	1 418	2 037
Percentage of world total	7.81	8.13	3.97	4.34

Data reflect the membership in force in August 1996.

COOPERATION WITH FAO

Individual members of EFTA cooperate with FAO, but EFTA itself has no cooperation in fishery matters with FAO.

European Union

The Treaty of Rome established the European Economic Community in 1957. In 1993 the Treaty of Maastricht established the European Union (EU). The aims of the EU include the expansion of trade, the abolition of restrictive trading practices, free movement of capital and labour within the union and the establishment of a closer union among European people. A single market with free movement of goods and capital was established in January 1993. The following countries are members of the EU: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

FISHERIES: PURPOSE AND ACTIVITIES

The Common Fisheries Policy (CFP) of the EU came into existence in 1983. It has since then developed and been adjusted continuously in accordance with international developments and changes within the EU itself. The CFP has a holistic view of the industry and covers access to resources, conservation of fish stocks and the monitoring of fishing activities as well as marketing of fishery products and research.

One important component of the CFP is the structural policies element. The main programmes are the Financial Instrument for Fisheries Guidance (FIFG) and PESCA.

Since 1993, these structural measures have been integrated into the EU's system of structural funds. FIFG can help to finance the following: adjustment of the fishing effort; fleet withdrawal and modernization of vessels; investment in aquaculture; assistance to fishing port facilities and to the processing and marketing of products; and other measures such as promotion of new outlets for products and the management of fishing quotas by a producers' organization or temporary withdrawals. PESCA has been designed for assisting geographical areas that are dependent on fisheries.

In 1992, within the framework of the Multi-Annual Guidance Programme (MAGP), targets for fleet capacity reductions were agreed for each EU member country. Targets were expressed as a reduction in gross registered tonnage volume (GRT) and engine power (kW).

FISH PRODUCTION AND TRADE

EU: fishery production and trade

	1980	**1985**	**1990**	**1994**
Fishery production				
Inland production *('000 tonnes)*	237	277	322	337
Percentage of world total	3.13	2.59	2.18	1.76
Marine production *('000 tonnes)*	7 083	7 418	6 786	7 457
Percentage of world total	11.00	9.79	8.17	8.25
Total production *('000 tonnes)*	7 321	7 695	7 108	7 795
Percentage of world total	10.17	8.89	7.26	7.11
Trade in fishery commodities				
Total imports *(US$ million)*	3 347	4 317	5 566	6 459
Percentage of world total	20.93	23.22	14.10	12.54
Total exports *(US$ million)*	2 049	2 643	3 089	4 087
Percentage of world total	13.31	15.33	8.65	8.70

Data reflect the membership in force in August 1996; trade data include intra-EU trade.

COOPERATION WITH FAO

The EU is a full member of FAO. The EU is also a member of most FAO regional fishery bodies and participates in the work of the General Fisheries Council for the Mediterranean (GFCM), the European Inland Fisheries Advisory Committee (EIFAC) and the Fishery Committee for the Eastern Central Atlantic (CECAF).

The European Development Fund of the EU has contributed to several technical assistance projects in the field of fisheries executed by FAO, the most notable of which is the project for improvement of the legal framework for fisheries cooperation,

management and development of coastal states of West Africa (GCP/RAF/302/EEC), based in Dakar, Senegal. This project was initiated in 1994.

Free trade agreement between Mexico, Colombia and Venezuela

The Treaty on Free Trade between the United Mexican States, Colombia and Venezuela was established on 1 January 1995. The main objectives of this Treaty are to:

· stimulate the expansion and diversification of trade among the parties;
· eliminate barriers to trade and facilitate the movement of goods and services among the parties;
· promote conditions of fair competition in the trade among the parties;
· increase substantially investment opportunities in the territories of the parties;
· protect and enforce intellectual property rights.

FISHERIES: PURPOSE AND ACTIVITIES

The operational structure of the Treaty includes an already functional subcommittee on fisheries. The subcommittee also serves as a forum for the discussion and negotiation of fisheries policy and trade issues (e.g. on the tuna-dolphin issue).

FISH PRODUCTION AND TRADE

Free trade agreement between Mexico, Colombia and Venezuela: fishery production and trade

	1980	**1985**	**1990**	**1994**
Fishery production				
Inland production *('000 tonnes)*	72	178	250	250
Percentage of world total	0.96	1.66	1.69	1.31
Marine production *('000 tonnes)*	2 896	2 946	3 470	3 362
Percentage of world total	4.50	3.89	4.18	3.72
Total production *('000 tonnes)*	2 969	3 124	3 721	3 613
Percentage of world total	4.12	3.61	3.80	3.30
Trade in fishery commodities				
Total imports *(US$ million)*	123	59	109	269
Percentage of world total	0.77	0.32	0.28	0.52
Total exports *(US$ million)*	619	537	573	839
Percentage of world total	4.03	3.12	1.61	1.79

Data reflect the membership in force in August 1996.

COOPERATION WITH FAO

The Treaty has no formal cooperation with FAO on fishery matters.

Southern Common Market

On 26 March 1991 the Treaty of Asunción was signed by Argentina, Brazil, Paraguay and Uruguay creating the Southern Common Market (MERCOSUR). Recently, Chile became an associate member. The main objective of MERCOSUR is to increase the efficiency and competitiveness of the four participating economies by: opening markets and accelerating economic development; making better use of the available resources and ensuring conservation of the environment; improving communications; and coordinating macroeconomic polices. Although MERCOSUR operates as a customs union its final target is to become a common market.

FISHERIES: PURPOSE AND ACTIVITIES

At present, MERCOSUR has no specific policy or programme in fisheries.

FISH PRODUCTION AND TRADE

MERCOSUR: fishery production and trade

	1980	**1985**	**1990**	**1994**
Fishery production				
Inland production *('000 tonnes)*	199	229	233	247
Percentage of world total	2.63	2.14	1.57	1.29
Marine production *('000 tonnes)*	1 117	1 291	1 228	1 656
Percentage of world total	1.74	1.70	1.48	1.83
Total production *('000 tonnes)*	1 317	1 520	1 461	1 903
Percentage of world total	1.83	1.76	1.49	1.74
Trade in fishery commodities				
Total imports *(US$ million)*	90	49	180	195
Percentage of world total	0.57	0.27	0.46	0.38
Total exports *(US$ million)*	272	277	352	661
Percentage of world total	1.77	1.61	0.99	1.41

Data reflect the membership in force in August 1996.

COOPERATION WITH FAO

There are no cooperative programmes between MERCOSUR and FAO in the field of fisheries.

Southern African Development Community

The Southern African Development Community (SADC) was formed in 1992 with the primary aim of promoting economic integration and, eventually, a common market.

Twelve southern African states belong to SADC: Angola, Botswana, Lesotho, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, the United Republic of Tanzania, Zambia and Zimbabwe. Of these, five border the oceans - Angola, Namibia, South Africa, Mozambique and Tanzania.

FISHERIES: PURPOSE AND ACTIVITIES

Within SADC, the Food, Agriculture and Resources Sector has the principal objectives of regional food security, agricultural development and natural resources development. There are six subsectors within the sector and these include the Marine Fisheries and Resource Coordinating Unit (MFR) and the Inland Fisheries, Forestry and Wildlife Coordinating Unit (IFFW).

The specific objectives of MFR, as specified in its Marine Fisheries Regional Policy, include, among others: raising production and improving processing methods, marketing and distribution of fish and fish products; undertaking marine research, stock assessment, management, monitoring, control and surveillance; protecting and enhancing marine and coastal environments; and providing training and assistance to fishers.

Within IFFW, the development of freshwater fisheries has focused on aquaculture projects and their integration into the rural community structure.

FISH PRODUCTION AND TRADE

SADC: fishery production and trade

	1980	**1985**	**1990**	**1994**
Fishery production				
Inland production *(‘000 tonnes)*	334	419	539	466
Percentage of world total	4.41	3.91	3.64	2.43
Marine production *(‘000 tonnes)*	1 015	943	999	977
Percentage of world total	1.58	1.25	1.20	1.08
Total production *(‘000 tonnes)*	1 350	1 362	1 538	1 443
Percentage of world total	1.88	1.58	1.57	1.32
Trade in fishery commodities				
Total imports *(US$ million)*	82*	300	301	324
Percentage of world total	0.51	1.62	0.76	0.63
Total exports *(US$ million)*	74*	76	74	211
Percentage of world total	0.49	0.44	0.21	0.45

The 1980 data exclude Angola for which none are available; otherwise data reflect the membership in force in August 1996.

COOPERATION WITH FAO

Within the marine sector, the FAO Aquaculture for Local Community Development Programme (ALCOM) collaborated with MFR in a study on mariculture in the SADC states. The study reviewed the present state of mariculture in the region and the potential for further development. In addition, there has been considerable informal cooperation between the MFR offices in Namibia and the FAO project on institutional support in fisheries management policy and planning.

Within IFFW, ALCOM has been endorsed as a SADC project and the coordinator of the SADC inland fisheries sector is an observer on the ALCOM steering committee. ALCOM has worked with SADC countries since it started in 1986, and investigations are currently under way into the possible integration of ALCOM into the SADC system.

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 that are common to members, including the promotion of a free trade area in the South Pacific region. In 1996 the members of SPF and its affiliated agencies were: Australia, the Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu. SPF has a secretariat (Forum Secretariat) which promotes regional cooperation among members on important economic issues.

FISHERIES: PURPOSE AND ACTIVITIES

The South Pacific Forum Fisheries Agency (FFA), established as a specialized agency by SPF in 1977, facilitates and coordinates cooperation and mutual assistance among its members in fishery policy matters, while seeking to secure the maximum benefits from the region's living marine resources for Pacific islanders. SPF, the Forum Secretariat and the FFA agencies maintain close working relations with important intergovernmental and non-governmental organizations.

FFA is mandated by its convention, inter alia, to collect, analyse, evaluate and disseminate to members relevant information.

Within this mandate, 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. FFA also facilitated the development of regionally adopted minimum terms and conditions of fisheries access for its members (including the Regional Register of Fishing Vessels); the 1992 Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region (Niue Treaty) which provides for reciprocal and joint surveillance and enforcement in the region; the 1992 Palau Arrangement for the Management of Western Pacific Purse-Seine Fishery (Palau Arrangement) for the limitation on purse-seine fishing effort in the region; and the 1994 Federated States of Micronesia Arrangement for

Regional Fisheries Access (Federated States of Micronesia Arrangement) which provides for regional fishing access for vessels of FFA member countries.

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 the fishing effort (e.g. in the purse-seine tuna fishery) have also been of tangible benefit to FFA member countries.

FISH PRODUCTION AND TRADE

Fisheries production by SPF members has trended strongly upwards, particularly after 1990. In addition to the catches reported by SPF countries there are large tuna catches in the region by foreign flag vessels.

In terms of world trade in fishery products SPF countries play a relatively small role. By volume total imports have risen robustly, although declining as a proportion of world trade. A similar situation is apparent for exports of fishery products from the region.

SPF: fishery production and trade

	1980	**1985**	**1990**	**1994**
Fishery production				
Inland production *('000 tonnes)*	10	20	23	27
Percentage of world total	0.14	0.19	0.16	0.15
Marine production *('000 tonnes)*	402	489	728	825
Percentage of world total	0.62	0.65	0.88	0.91
Total production *('000 tonnes)*	412	509	751	853
Percentage of world total	0.57	0.59	0.77	0.78
Trade in fishery commodities				
Total imports *(US$ million)*	137	158	206	255
Percentage of world total	0.86	0.85	0.52	0.50
Total exports *(US$ million)*	223	225	271	393
Percentage of world total	1.45	1.31	0.76	0.84

Data reflect the membership in force in August 1996.

COOPERATION WITH FAO

FFA has formal relations with FAO, which cooperates with FFA on a range of technical issues, including such matters as joint training exercises (most recently in 1995 in fisheries monitoring, control and surveillance) and exchanges of technical information. In the past FAO has also provided direct technical support to FFA through the funding of two staff positions. FFA also participated actively in the elaboration of the Code of

Conduct for Responsible Fisheries and the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas. FAO participates in the annual FFA meeting as an observer.

Tratado di Cooperación Amazonica

The aim of the Tratado de Cooperación Amazonica (the Amazonian Cooperation Treaty) is to ensure collaboration among the countries of the Amazon basin in all matters connected with agriculture, forestry, fisheries and the protection of the environment. At present, it is composed of the following countries: Brazil, Bolivia, Colombia, Ecuador, Guyana, Peru, Surinam and Venezuela.

FISHERIES: PURPOSE AND ACTIVITIES

The principal aims of the Treaty with respect to fisheries are:

· to ensure collaboration among the member countries in the collection and interpretation of information on the fishery resources of the Amazon river;

· to contribute to research in inland fisheries and aquaculture through common projects;

· eventually to develop common elements in national management plans for the Amazonian fishery resources.

Progress has been slow owing to the lack of funds.

FISH PRODUCTION AND TRADE

Production figures for the Amazon are unreliable as they are derived mainly from the few major urban landings. These indicate annual yields of about 220 000 tonnes for the whole Amazon basin but, undoubtedly, the actual production is far larger as most local communities rely heavily on subsistence fisheries for their animal protein. Most commercial fisheries are for supply to the major cities, Belem, Manaus, Iquitos and Leticia. There is some export of luxury table fish from the region to other urban centres in Brazil and Peru.

Tratado de Cooperación Amazonica: fishery production and trade

	1980	**1985**	**1990**	**1994**
Fishery production				
Inland production *('000 tonnes)*	268	310	307	345
Percentage of world total	3.53	2.90	2.08	1.80
Marine production *('000 tonnes)*	4 188	6 263	8 271	13 015
Percentage of world total	6.50	8.26	9.96	14.40

Total production *('000 tonnes)*	4 456	6 574	8 579	13 360
Percentage of world total	6.19	7.60	8.77	12.19
Trade in fishery commodities				
Total imports *(US$ million)*	200	129	261	351
Percentage of world total	1.25	0.70	0.66	0.68
Total exports *(US$ million)*	830	1 054	1 443	3 049
Percentage of world total	5.40	6.12	4.04	6.49

Data reflect the membership in force in August 1996.

COOPERATION WITH FAO

The Secretariat of the Treaty is provided by a FAO-managed trust fund project funded by the Netherlands, by a UNDP project and by diverse funding from other donors such as the EU. Fisheries is one of 12 components addressing the natural and human environment of the Amazon basin. TheTreaty reports to the Commission for Inland Fisheries of Latin America (COPESCAL) on fisheries matters and COPESCAL has organized technical meetings in support of fishery management activities.

Central African Customs and Economic Union

The Central African Customs and Economic (CACEU) was established by the Treaty of Brazzaville (the Congo) in 1964. Headquarters are at Bangui (the Central African Republic) and member countries are: Cameroon, the Central African Republic, Chad, the Congo, Equatorial Guinea and Gabon.

The main objective of CACEU is to establish a common market and the revised Treaty of 1974 emphasizes the implementation of common economic integration policies in, inter alia, the fields of industrialization, agriculture and utilization of natural resources, as well as the harmonization of development plans. In December 1987, the CACEU Conference of Ministers responsible for Agriculture, Livestock, Water and Forestry, Game and Fisheries established an Economic Community for Livestock and Fishery Resources (CEBEVIRHA).

FISHERIES: PURPOSE AND ACTIVITIES

CEBEVIRHA is headed by a director-general and has its headquarters at N'Djamena (Chad). It deals with fisheries issues with the objective of promoting a harmonized and balanced development of production and trade. It coordinates development policies and plans to undertake training of the fisheries workforce. Since its inception, CEBEVIRHA has promoted aid projects in fisheries, a regional fisheries centre, the establishment of a regional joint venture and processing company and the formulation of joint monitoring, control and surveillance (MCS) schemes.

FISH PRODUCTION AND TRADE

Per caput fish consumption in the CACEU countries is traditionally among the highest in Africa at an average of 20 kg per year over the past decade, which compares with the figure of about 7 kg for sub-Saharan Africa as a whole. However, total fish production in CACEU is marginal at 0.2 percent of the world total. Over the last two decades, domestic production has been stable reaching 224 000 tonnes in 1994, out of which 38 percent derives from the Gulf of Guinea. CACEU's trade balance in fish is negative both in quantity and volume. Exports comprise essentially shrimps from Gabon, Cameroon and, more recently, the Congo. One of the salient features of the last decade is the drastic decline of fish imports (by 46 percent).

CACEU: fishery production and trade

	1980	**1985**	**1990**	**1994**
Fishery production				
Inland production *('000 tonnes)*	102	104	123	137
Percentage of world total	1.35	0.97	0.84	0.72
Marine production *('000 tonnes)*	102	92	91	86
Percentage of world total	0.16	0.12	0.11	0.10
Total production *('000 tonnes)*	205	196	215	224
Percentage of world total	0.29	0.23	0.22	0.20
Trade in fishery commodities				
Total imports *(US$ million)*	42	110	98	59
Percentage of world total	0.27	0.59	0.25	0.11
Total exports *(US$ million)*	3	11	4	3
Percentage of world total	0.02	0.07	0.01	0.01

Data reflect the membership in force in August 1996; trade among CACEU members is excluded.

Cooperation with FAO

CACEU has no formal cooperation with FAO in fishery matters. Fisheries is not part of the ongoing UNDP/FAO project that aims at formulating medium- and long-term strategies for the group.