Food and Agriculture Organization of the United Nations

# THE STATE OF WORLD FISHERIES AND AQUACULTURE

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# THE STATE OF WORLD FISHERIES AND AQUACULTURE

FAO Fisheries Department

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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# Contents

## Abstract

This report reviews the state of world fisheries and aquaculture in 1994, with particular attention to developments since 1989.
Following consideration of world fish production and growth in demand for fish, marine fisheries production and issues are addressed in detail.
Problems of fleet overcapacity and overinvestment in marine capture fisheries, leading to an unsustainable impact on resources, are highlighted.
An analysis of inland capture fisheries and aquaculture is presented, noting that aquaculture will be expected to play a greater role in the food security equation in future.
Fish utilization and the fish trade are reviewed.
The report also provides a regional analysis of supply and demand prospects.
It ends with an outlook on the prospects of satisfying global demand for food fish to the year 2010.

# INTRODUCTION

The 1982 United Nations Convention on the Law of the Sea came into effect on 16 November 1994. At the Forty-ninth Session of the United Nations General Assembly (UNGA) in 1994, a resolution was adopted which said that the 1982 convention "... must be considered not only as one of the most important legal regimes in history but also as a major achievement in treaty-making and in multilateral cooperation".

In the special chapter of *The State of Food and Agriculture 1992*[1] entitled "Marine fisheries and the law of the sea: a decade of change", it was noted that some ten years after the signing of the 1982 United Nations Convention on the Law of the Sea, a number of coastal states had gained large benefits from the introduction of extended jurisdiction, while a few distant-water fishing nations (DWFNs) had incurred large losses. At the same time, there had been continuing investment in large-scale vessels and a significant growth in fishing effort on the high seas. It was further pointed out that there were major difficulties in improving the conservation and management of fisheries within national jurisdictions. The need for better fisheries conservation and management and for greater national and international cooperation was emphasized.

At several international fora, including the Twentieth Session of the FAO Committee on Fisheries in 1993, the 1992 United Nations Conference on Environment and Development (UNCED), the 1992 International Conference on Responsible Fishing, and the ongoing United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks, concern has been expressed about the significant overexploitation and economic losses being incurred by world fisheries. These losses have resulted from fleet overcapacity and overinvestment, supported in some instances by states providing subsidies to keep the operations of certain fleets financially viable.[2] The international community now recognizes that excess fleet capacity and overinvestment undermine fisheries conservation and management efforts, threaten the long-term sustainability of fisheries, and in turn harm the contribution that fisheries might make to food security.

It is increasingly evident that there are other factors that also affect the productive capacity of fish stocks. Long-term trends and fluctuations in environmental conditions are of key importance to fisheries production. Decadal-scale changes in ocean conditions cause fluctuations in recruitment in entirely separated regions of the world's oceans (see Box 1). Increased run-off of materials and nutrients into coastal and semi-enclosed seas is changing basic productivity and species composition and therefore catch trends. The voluntary or accidental introduction of exotic species by human beings has also impacted on other species in the ecosystem.

At the Forty-ninth Session of UNGA five fisheries resolutions were adopted. In general, these resolutions focused on post-UNCED sustainability issues, reflecting UNGA's preoccupation with continuing practices that degrade fisheries resources through unsustainable utilization. The five fisheries resolutions related to: *i*) the continuing use of large-scale pelagic driftnets in some parts of the world; *ii*) the continuation of the United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks in 1995; *iii*) the implementation of the 1982 UN Convention on the Law of the Sea; *iv*) fisheries bycatch and discards and their impact on the sustainable use of the world's living marine resources; and *v*) unauthorized fishing in zones of national jurisdiction and its impact on the living marine resources of the world's oceans and seas.

[1] **FAO.** 1992. *The State of Food and Agriculture 1992.* Rome. 262 pp.

[2] Annual economic losses were estimated to amount to more than US$50 000 million and were being compensated by subsidies. In addition, 46 percent of the landed value of total world catches were required as a return on capital invested in the fleet and this was disproportionately high. Other problems stem from the inadequate quality of catch and effort data, the persistence of unauthorized fishing, insufficiently selective gear, and increasing competition between artisanal and industrial fisheries. In addition, a number of environments and habitats critical to fisheries productivity were damaged, sometimes by fishing itself, but nearly always by other coastal and non-coastal activities.

*BOX 1*

**Environmental issues in marine fisheries**

Within the last few years, a dramatic change of viewpoint has begun to overtake fisheries science. It is becoming recognized that the most dramatic marine fish population fluctuations tend to appear as decadal-scale "regime" changes. Moreover, these changes have appeared to be in synchrony in very widely separated regions of the world's oceans. Global climatic "teleconnections" appear to be the most likely explanation.

For example, a pattern of population increases from the mid-1970s to the mid-1980s, followed by population declines after the mid-1980s, seems to have been remarkably widespread and consistent in a large number of marine ecosystems distributed over the world's oceans. During that decadal period, the ocean-atmosphere system of the Pacific Ocean basin seems to have been in an enhanced "El Niño"-type state, characterized by a relaxed dynamic situation in the equatorial Pacific (diminished trade wind circulation, etc.). This appears to have been countered by intensified situations in many other regions of the world. It is possible that intensified ecological situations may promote population growth of some types of fishery resources. For example, the mid-1970s to mid-1980s was a period of phenomenal productivity and growth of the major groundfish populations of the subarctic North Pacific. Conversely, since the mid-1980s many of these populations are in decline. The period also appears to have been particularly productive in the tropical central North Pacific (lobsters, sea birds, seals, coral reef fishes, etc.). The very large sardine fisheries of the Pacific began sudden rapid growth near the mid-1970s. Towards the latter part of the 1980s, sardine landings around the Pacific began to fall rapidly.

Anchovy populations have been generally out of phase with the sardine populations in the Pacific. Notably, the fishery for Peruvian anchoveta peaked in 1970 at more than 13 million tonnes, constituting by far the largest single fishery that has ever existed on earth. It then collapsed and remained at a relatively low level until the mid-1980s. More recently, the Peruvian anchoveta population has been in a phase of explosive growth. Thus, while sardines appear to have prospered during periods of intensified El Niño activity, anchovies have done relatively poorly. Conversely, there are indications that the anchovy and sardine populations off southwestern Africa may tend to experience population alterations that are directly out of phase with those in the Pacific systems.

Many other examples can be found of major marine population effects occurring during this same period of the mid-1970s to mid-1980s. The North Pacific albacore tuna appears to have suffered a steep population decline during the mid-1970s to mid-1980s. This was also a period of increasing survival of Greenland halibut, a period of dramatic growth in the lobster landings in eastern Canada and a period of large increase in Newfoundland spawning northern cod stock, etc.

# FISHERIES TODAY

## WORLD FISH PRODUCTION SINCE 1989

Figure 1 shows world production between 1950 and 1993 for inland and marine capture fisheries. The growth rate in marine fisheries increased at an average rate of 6.8 percent in the 1950s, increasing to 7.4 percent in the 1960s. It decreased to 1.7 percent in the 1970s as a result of the collapse of the Peruvian anchoveta. In the 1980s the average rate of increase was 3.6 percent primarily as a result of increased catches of five species: Alaska pollack, Chilean jack mackerel, Peruvian anchoveta, Japanese pilchard and South American pilchard. In the first three years of the 1990s, total catches increased by an average rate of 0.5 percent.

In 1989 world fish production reached 100.3 million tonnes. Production declined in 1990 and 1991 to 97 million tonnes, but increased to 98.7 million tonnes in 1992, and to 101.3 million tonnes in 1993.

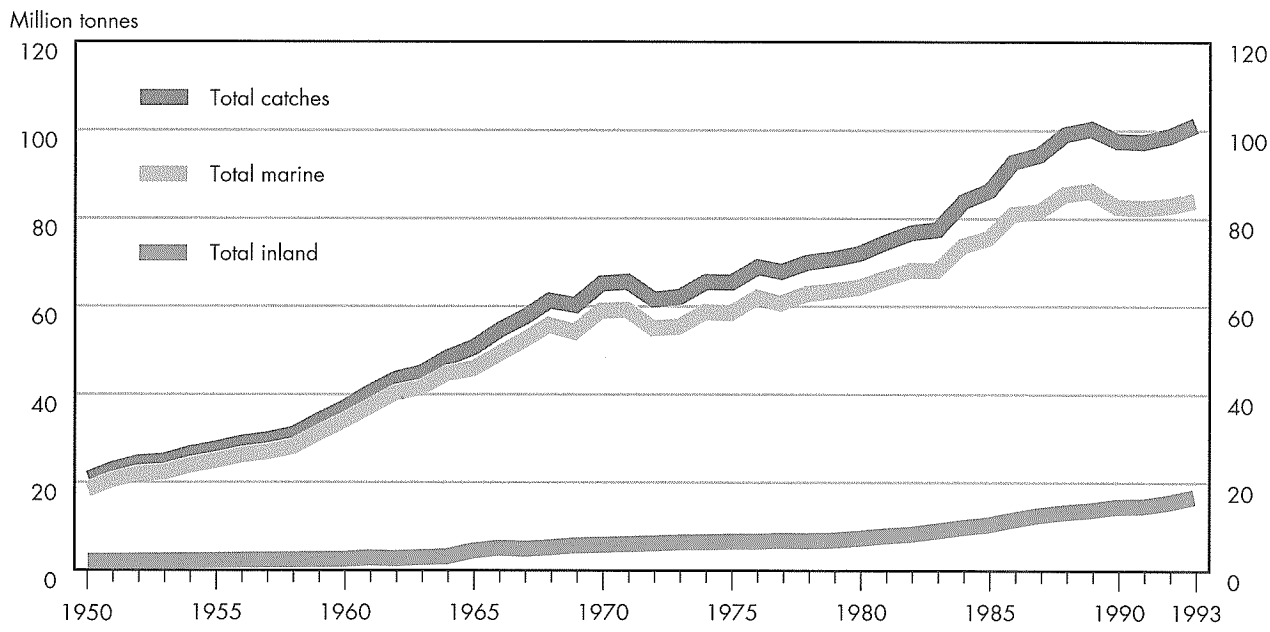
The increase in total production between 1992 and 1993 came almost entirely from aquaculture. Both marine and freshwater capture fisheries have slightly declined since the major drop of 3.5 million tonnes between 1989 and 1990 while aquaculture has been increasing by over 1 million tonnes a year since 1991 (Figure 2).

Declining production and international concern about the sustainability of capture fisheries require nations to improve their conservation and management of stocks. In the short to intermediate term, nations will need to constrain production in order to facilitate stock rehabilitation. In the case of some longer-lived demersal species and some tunas the time required for stock rebuilding may take up to, or even exceed, ten years.

In this connection, the plateaux in production from capture fisheries, or even some decreases in production, should be welcomed as an indication that some stock rebuilding of the world's fisheries may have started as a result of reductions in total fishing effort. This rehabilitation will help ensure future long-term

*Figure 1*

WORLD TOTAL FISH PRODUCTION BY MARINE AND INLAND WATERS, 1950-93

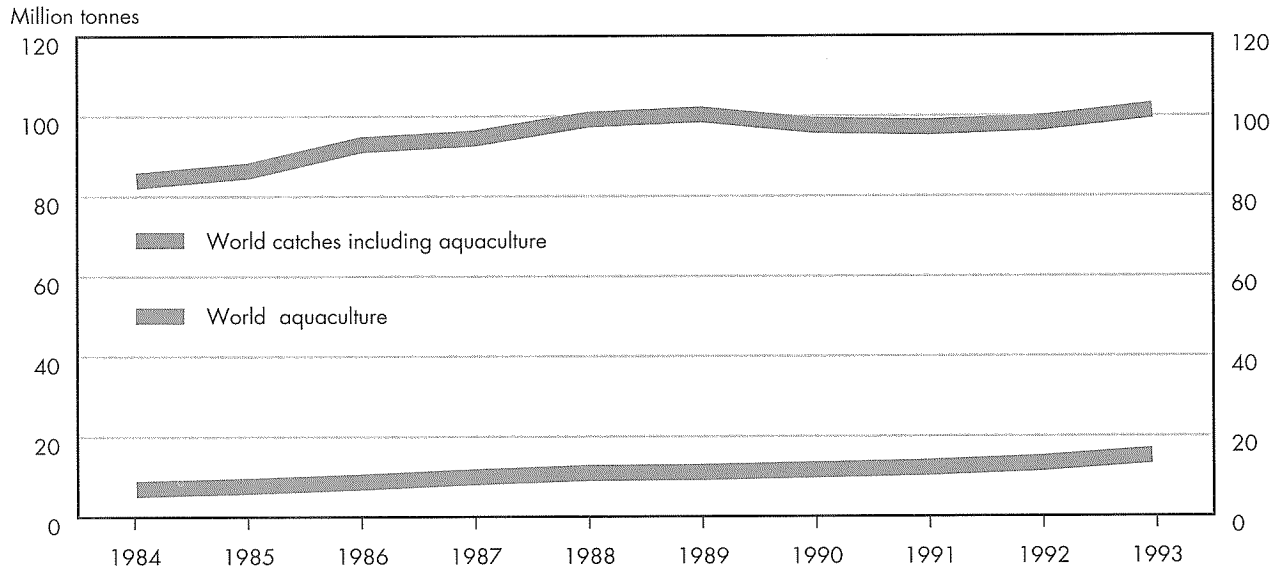



*Notes:* 1993 data, preliminary; includes aquaculture data

*Source:* FAO

*Figure 2*

WORLD TOTAL FISH PRODUCTION COMPARED WITH AQUACULTURE, 1984-93

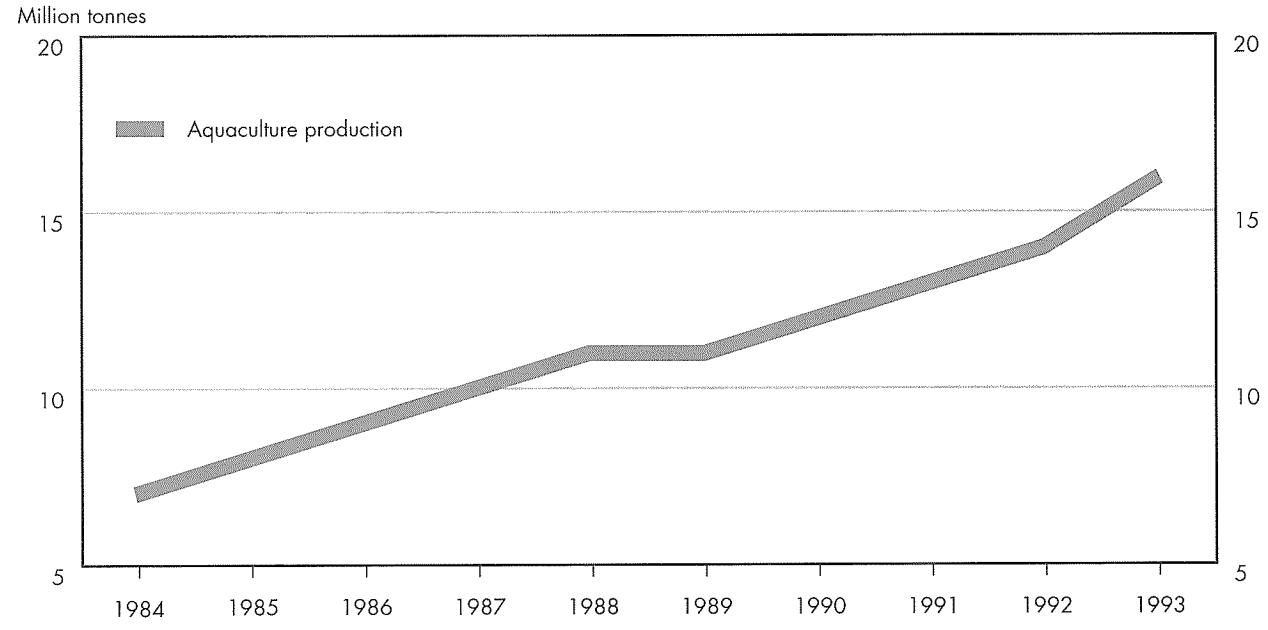



*Note:* 1993 data, preliminary

*Source:* FAO

*Figure 3*

AQUACULTURE PRODUCTION, 1984-93




*Note:* 1993 data, preliminary

*Source:* FAO

sustainability. Without corrective measures, continued increases in capture fisheries production from fishing down the food chain or from changes in species composition would signal that conservation and management of stocks are not being applied effectively.

Since 1984, when FAO started collecting aquaculture statistics from various countries, production has doubled: from almost 7 million tonnes in 1984 to 14 million tonnes in 1992 (Figure 3). The rate of increase expanded from 600 000 tonnes per year between 1989 and 1991, to over 1 million tonnes per year in 1992. In 1993 it is estimated that aquaculture production increased by almost 2 million tonnes to 16 million tonnes (or 16 percent of total world production of fish and 23 percent of food fish supplies).

Significantly, in recent years aquaculture production has increased at a rate sufficient to offset the decreases from capture fisheries, and in 1993 the rate increased further to bring world production beyond previous production levels. The production from aquaculture of freshwater fishes already exceeds that of production from freshwater capture fisheries. Production from salmon culture is approaching the production level of wild salmon fisheries and shrimp culture is equal to 50 percent of shrimp caught.

## GROWTH IN DEMAND FOR FISH

The projections provided in FAO's *Agriculture: towards 2010*[3] indicated that to maintain present per caput fish consumption levels of 13.0 kg per year to the year 2010 (with a forecasted population level of 7 032 million in 2010), 91 million tonnes of food fish would be required. This requirement implies an increase of 19 million tonnes of food fish over the 1993 level of 72.3 million tonnes.

Such an increase in the production of food fish is considered feasible if aquaculture production can be doubled in the next 15 years, and if significant improvements can be achieved in the conservation and management of capture fisheries, through stock rebuilding and more rational harvesting practices, and with the application of food technology to improve utilization of bycatches and small pelagic fish yields for direct human consumption.

[3] **FAO.** 1993. *Agriculture: towards 2010.* Document C 93/24. Rome. 320 pp plus appendices.

# MARINE FISHERIES PRODUCTION AND ISSUES

Marine living resources provide an important source of protein in many countries and their use is of major importance to local communities and indigenous people. Such resources provide food and livelihoods to millions of people and, if sustainably utilized, offer increased potential to meet nutritional and social needs, particularly in developing countries. These have significantly increased their share of the total world catch and international trade during the 1970s and 1980s, overtaking that of the developed countries since 1985.

At the beginning of the 1990s, about 69 percent of the world's conventional species were fully exploited, overexploited, depleted or in the process of rebuilding as a result of depletion. This situation is globally non-sustainable and major ecological and economic damage is already visible. The satisfaction of the demand for food from the sea in the next two decades requires progress in both fisheries conservation and management and in aquaculture. Improved management requires emphasis on: the control of fishing effort and the reduction of industry's overcapacity; resource allocation decisions; the establishment of more effective user's rights; greater participation in decision-making on resource use; and the adoption of multispecies and ecosystems based on precautionary approaches to fishery conservation and management.

Mariculture and coastal aquaculture offer significant potential for improvement of ocean productivity but their potential will not be realized without improved environmental management.

Major changes are therefore required in fisheries development strategies, as well as in defence of fisheries habitats and environments from non-fisheries activities, in order to improve the economic viability of fisheries and the conservation of their resource base. To realize this potential requires improved knowledge of marine living resources, particularly of underutilized stocks and species, transfer and use of new technologies, better handling and processing facilities to avoid wastage, and improved training of the skilled personnel required to manage and conserve effectively the marine living resources.

It must also be recognized that problems extend beyond fisheries. Coral reefs and other marine and coastal habitats, such as mangroves and estuaries, are among the most highly diverse, integrated and productive of the earth's ecosystems. They often serve important ecological functions, provide coastal protection, and are critical resources for food, energy, tourism and economic development. In many parts of the world, such marine and coastal systems are under stress or are threatened from a variety of sources, both human and natural.

## CATCH LEVELS

Although marine catches have increased over the last 20 years, there have been important changes (Figure 4). In 1973 the catch of Alaska pollack exceeded that of any other single species. The catch of Atlantic cod was the second largest. The remaining principal species were the pelagics. By 1983, Alaska pollack catches had increased further and it remained the principal species. Atlantic cod, however, had fallen to fifth place. By 1993 Alaska pollack was second and cod ninth in importance, after skipjack tuna.

The significance of these changes is that increases in marine catches have, since 1983, primarily come from four shoaling pelagic species as well as from Alaska pollack. The cods, hakes and haddocks have been in steady decline, with the exception of increased haddock catches in the northeast Atlantic after 1991.

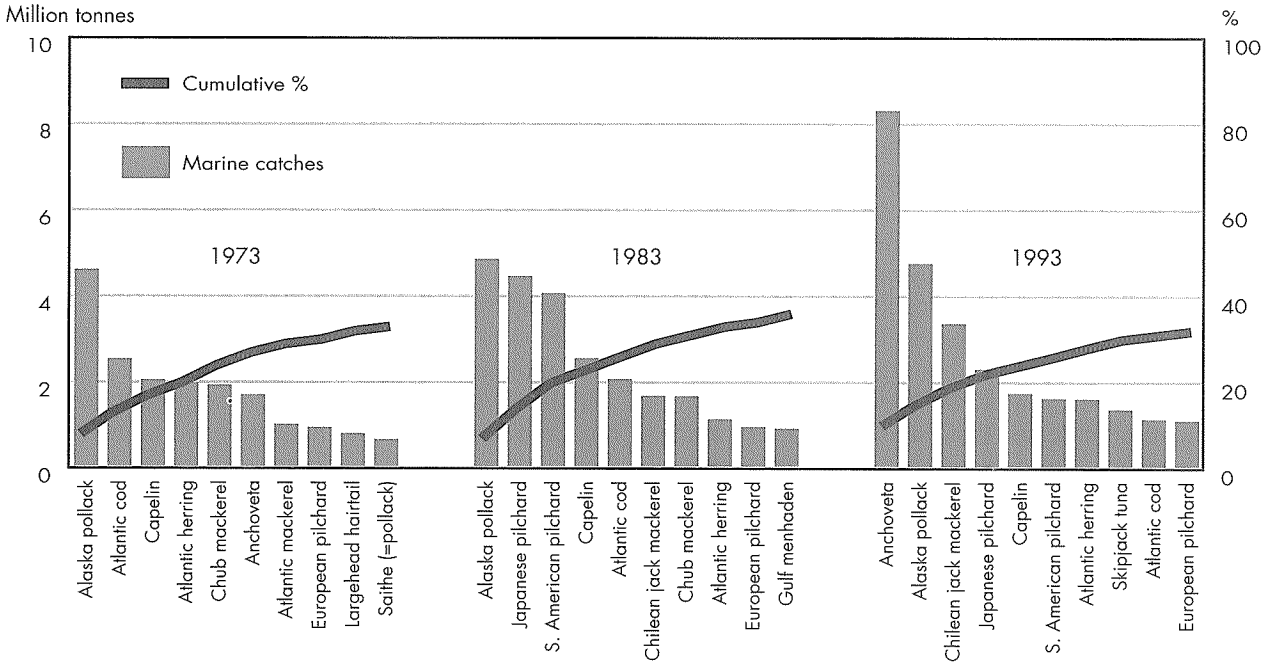
Eighty percent of world marine catches are taken by 20 states. This has been the pattern since 1970 although some of these states have changed, primarily as a result of national extensions in fisheries jurisdictions. These 20 states are indicated in Figure 5. Additional information on catches by states producing 150 000 tonnes or more in 1992-93 is given in Annex table 8.

FAO has previously highlighted[4] the decline in the landings and stock conditions of high-

[4] See **FAO.** 1993. *World fisheries ten years after the adoption of the 1982 United Nations Convention on the Law of the Sea.* Document COFI/93/4; **FAO.** 1994. *Review of the state of world marine fishery resources.* FAO Fisheries Technical Paper No. 335. Rome. 136 pp; and **FAO.** 1995. *Review of the state of world fishery resources: marine fisheries.* FAO Fisheries Circular No. 884. Rome. 103 pp.

*Figure 4*

MARINE CATCH BY PRINCIPAL TEN SPECIES AND CUMULATIVE CATCH
AS A PERCENTAGE OF THE MARINE WORLD TOTAL, 1973, 1983 AND 1993

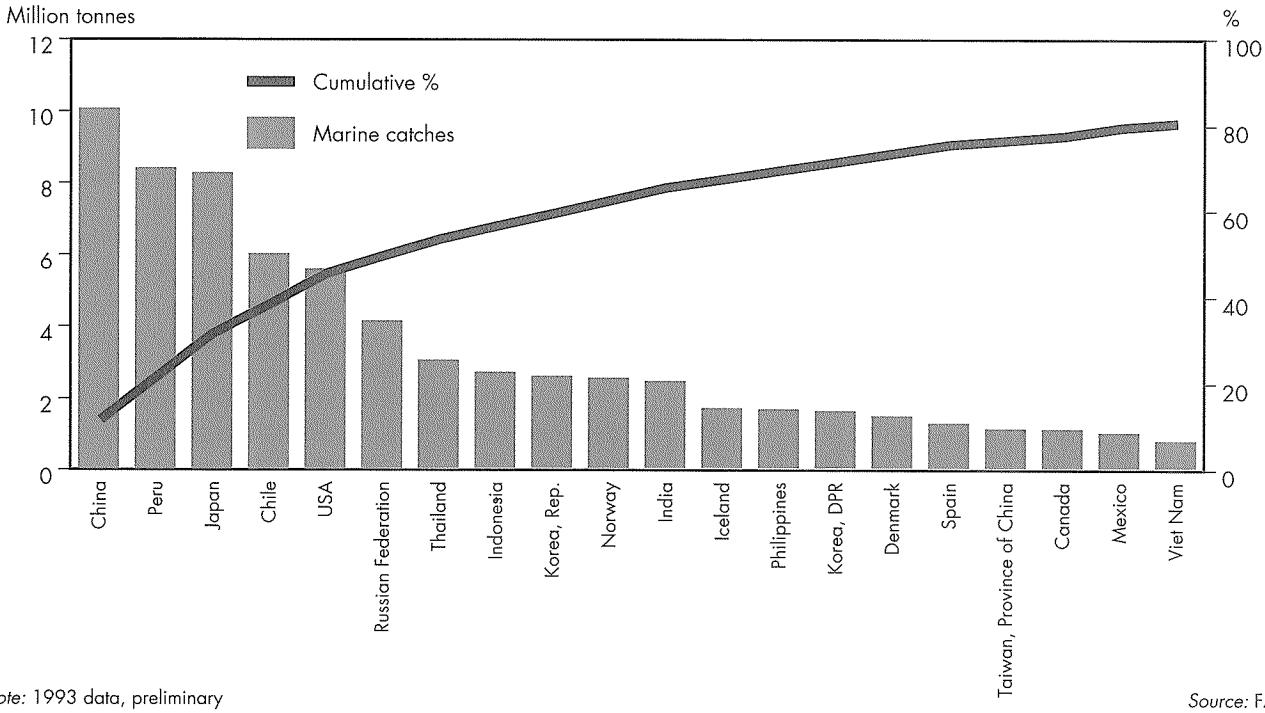



*Note:* 1993 data, preliminary

*Source:* FAO

*Figure 5*

WORLD MARINE CATCH BY PRINCIPAL PRODUCERS AND CUMULATIVE CATCH
AS A PERCENTAGE OF THE WORLD MARINE CATCH, 1993




*Note:* 1993 data, preliminary

*Source:* FAO

value demersal and shellfish species, and the frequent substitution of these species by other species of a lower economic value. Particular concern focused on the considerable excess in fishing capacity as a primary cause for the overexploitation of resources, and the need to ameliorate the imbalance between fishing effort and the productive capacity of stocks.

In 1993 at the Twentieth Session of the Committee on Fisheries it was reported that 69 percent of the world's marine stocks, for which data are available, were either fully to heavily exploited (44 percent),[5] overexploited (16 percent), depleted (6 percent), or very slowly recovering from overfishing (3 percent), and therefore were in need of urgent corrective conservation and management measures. This situation indicated that the main concern, at the global level, was to control fishing effort and to reduce it where necessary.

Figure 6, which is based on data presented in the *Review of the state of world fishery resources: marine fisheries*, indicates that more than 69 percent of the stocks of demersal fish, pelagic fish, crustaceans and molluscs located in various areas of the world's oceans are in need of urgent corrective conservation and management measures. Figure 6 also shows the number of stocks and areas for which no assessment is available and for which precautionary management measures are required (see Box 2).

## STATUS OF SOME MAJOR FISH STOCKS AND FISHING AREAS

Many of the world's major and commercially important species of fish and/or fishing areas are subject to overexploitation. The status of some of these stocks and areas is summarized in Figures 7 and 8.

Conservation and management action has been undertaken by some states in some areas of the world as a means of rebuilding stocks. Highly restrictive conservation and management action has been taken in the *northwest Atlantic* by both Canada and the United States, as a result of a sharp decline in a number of commercially important stocks.

Most of the major demersal groundfish stocks in the *northeast Atlantic* remain at a low level and some stocks continue to show long-term downward trends. If the current levels of fishing mortality of these stocks in the North Sea continue, these levels are expected to remain close to, or beyond, safe biological limits, and effective conservation and management action is overdue.

Arctic cod in the area of the northeast Atlantic has, however, responded well to the effective conservation and management measures imposed in the late 1980s. Nonetheless, the Icelandic cod stock is in serious difficulty at a dangerously low level. The history of all Atlantic cod landings is shown in Figure 9.

In the *Baltic Sea*, cod has been exposed to high and steadily increasing fishing mortality which, combined with adverse environmental conditions causing poor recruitment, has led the International Council for the Exploration of the Sea (ICES) to recommend a total ban on cod fishing in the central part of the sea.

Total landings in the *Mediterranean* and *Black Sea* combined are in decline from earlier production levels. This decline is primarily a result of the very low levels of Black Sea landings of anchovy, caused by the accidental invasion of jellyfish (ctenophore). Work has been initiated to identify possible control measures to restore the Black Sea's ecosystem to productive levels.

In the *southeast Atlantic*, the conservation and management regime imposed by Namibia has resulted in increasing stock recovery, while in the *southwest Atlantic* improvements have been made in the joint management of squid in the offshore area of the Falkland Islands (Malvinas).

The *Indian Ocean* continues to be one of the few fishing areas with increasing catches, primarily of skipjack and yellowfin tunas. In the southern area, Australia continues to adjust its conservation and management regimes over a number of fisheries, and attention is now being given to the shark fishery.

Catches from the *northwest Pacific* have declined since 1990, mostly as a result of variations in the abundance of Japanese pilchard. These decreases, however, have been offset by increased mariculture production of invertebrates by China. The overfishing of the Alaska pollack fishery in the Sea of Okhotsk and Nemuro Strait areas has necessitated international action. The increasing proportion of landings taken from the area consisting of

[5] The determination of the level of exploitation of stocks "fully or heavily exploited" is based on the position and value of the maximum sustainable yield (MSY) and, given the uncertainty over the exact position, the level of effort is considered to be close to, or slightly beyond, that required to produce the MSY.

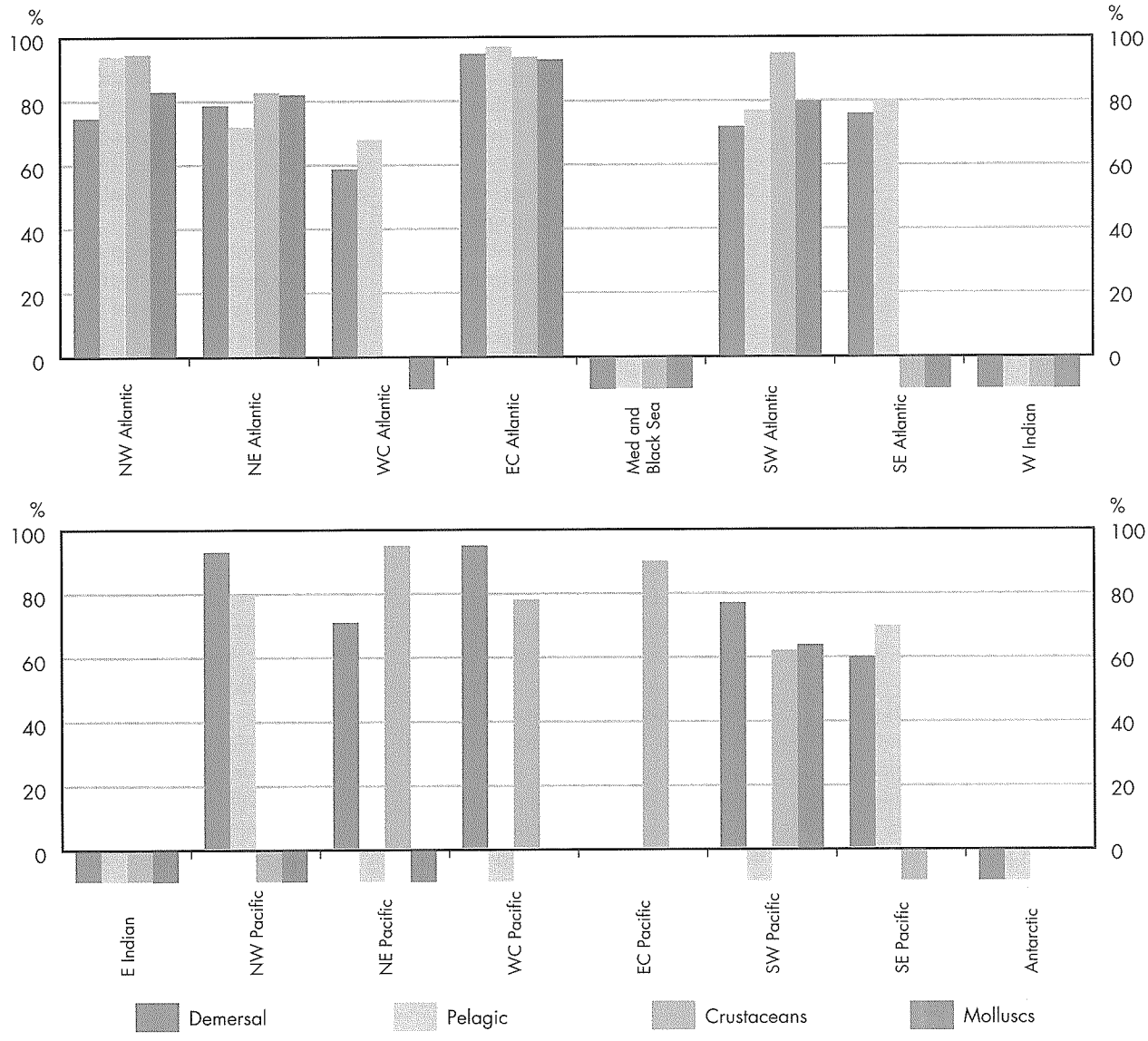
low-value, undifferentiated fish continues, and is now over 20 percent of total landings.

The large shelf area of the *western central Pacific*, stretching from Malaysia to the Arafura Sea, is rich in demersal resources, but declining catches are occurring overall. This reflects overfishing of certain stocks in several areas, although the magnitude in the decline of these stocks is offset by increased catches from new fishing grounds. In order to sustain increased overall production from these new grounds, conservation and management are required for overexploited stocks to prevent further declines. The tuna fishery in this area experienced reduced landings in 1992, primarily because of a contraction in distant-water fishing operations, although increases in tuna catches are considered possible.

The *southeast Pacific* is the second largest producing area in the world, after the northwest Pacific. Total production has recovered to the levels preceding the 1972 collapse of the anchoveta fisheries, but the species composition of production is now very different, consisting mainly of anchoveta, sardine and Chilean horse mackerel.

*Figure 6*

PERCENTAGE OF FULLY FISHED, OVERFISHED, DEPLETED AND RECOVERING STOCKS, 1992




*Notes:* bars below zero indicate stocks with unknown status

*Source:* FAO

*BOX 2*

## Precautionary fisheries management

The present status of many fishery resources around the world indicates that conservation and management practices need to be improved and particular attention is required for high seas fisheries. The uncertainty and related risk resulting from intrinsic inefficiencies in fisheries management, insufficient scientific information and natural variability (including climate change) are progressively being recognized and taken into account. An accelerated evolution of fisheries management, and a broadening of its scope are required to take fully into account both the explicit requirements of the 1982 United Nations Convention on the Law of the Sea and those of Agenda 21 of the United Nations Conference on Environment and Development. A global trend is developing in favour of the concept of precaution, which should now also be considered for implementation in fisheries management.

The concept of precaution requires management authorities to take pre-emptive action where there is a risk of severe and irreversible damage to human beings and, by extension, to the resources and the environment, even in the absence of certainty about the impact or the causal relationships. When there is doubt about the effect of a technology or fishing practice on the marine environment and resources, preventive or remedial action would have to be taken, erring on the safe side, with due consideration for social and economic consequences.

The need for precaution in management is reflected in two main concepts: the precautionary principle and the precautionary approach. The precautionary principle has suffered from a lack of definition and slack usage leading to extreme interpretations regardless of economic and social costs. It has therefore developed a strong negative overtone. The precautionary approach, which implicitly recognizes that there is a diversity of ecological as well as socio-economic situations requiring different strategies, has a more acceptable "image" and is more readily applicable to fisheries management systems.

Precautionary management measures have often been advocated in the past but they have rarely been implemented because of their potential short-term costs. On the one hand, they are needed to improve fisheries management and ensure more sustainable fisheries development, reducing risks for the resources and for fishing communities. For this purpose the use of more precautionary management reference points than in the past is highly recommended. On the other hand, overly stringent measures could lead to economic and social chaos in the fishing industry.

The requirement laid down in the 1982 UN Convention on the Law of the Sea for the "best scientific evidence available" remains the first condition for effective and equitable management, and the concept of precaution does not exempt fishing states and management authorities from their responsibilities to build up the necessary scientific information and cooperation. The best scientific evidence could be viewed as the most statistically sound evidence.

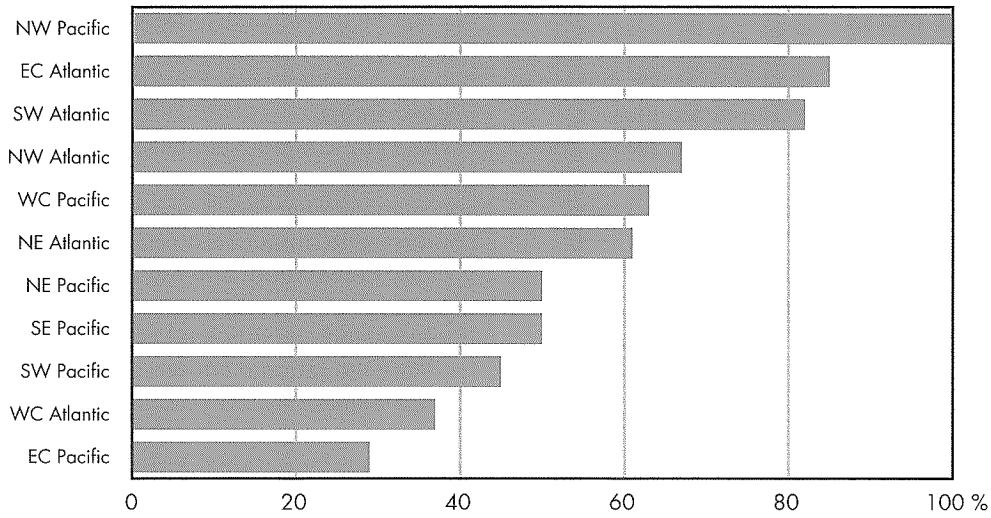
In a situation of high potential risk and lack or inadequacy of information, the concept of precaution requires that the onus of scientific proof (e.g. in the form of an environmental impact assessment) be on those who intend to draw benefits from the resource and contend that there is no risk (i.e. reversal of the burden of proof).

The precautionary approach propounds caution in all aspects of fishery activities: in applied fishery research, in management and in development. It can easily be translated into a "tool-box" of precautionary measures among which appropriate measures can be selected for different situations. It would be consistent with the internationally agreed principles of sustainable development and those of responsible fisheries and would, *inter alia*:

- promote the collection and use of the best scientific evidence
- adopt a broad range of reference points
- agree on a set of rules and guidelines
- adopt action-triggering thresholds
- agree on acceptable (tolerable) levels of impact and risk
- improve participation of non-fishery users
- improve decision-making procedures
- promote the use of more responsible technology
- introduce prior consent or prior consultation procedures
- strengthen monitoring, control and surveillance
- adopt experimental management and development strategies
- institutionalize transparency and accountability
- re-establish natural feedback controls.

*Figure 7*

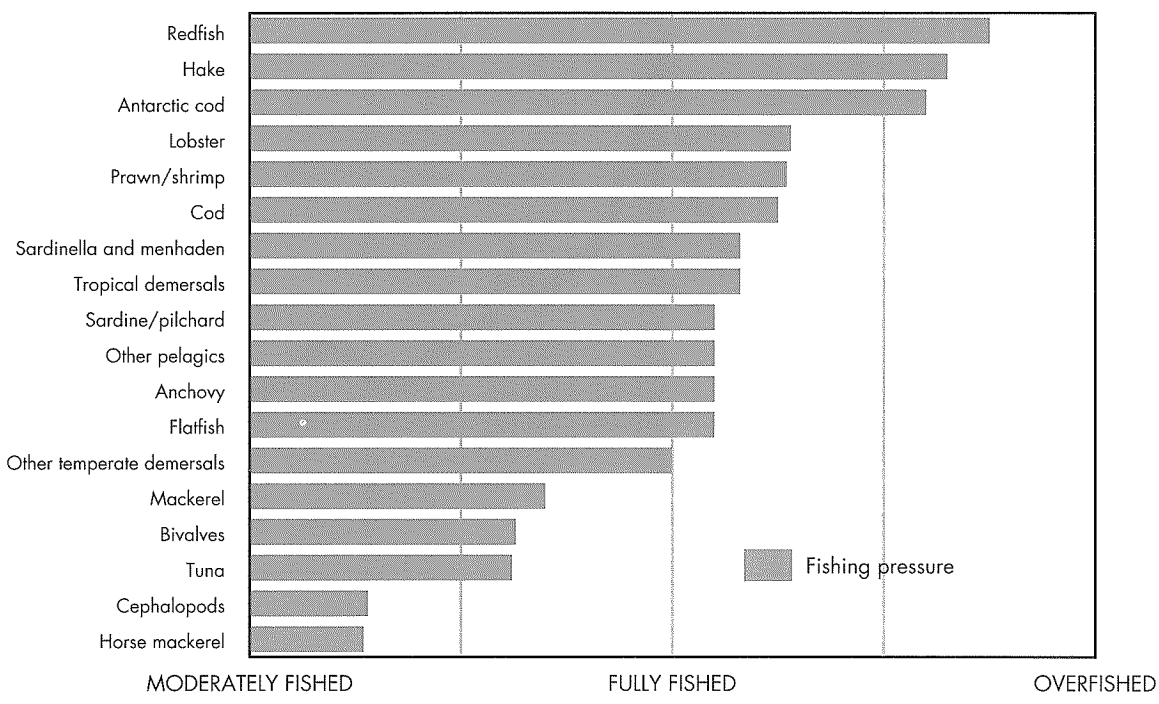
PERCENTAGE OF ASSESSED STOCKS FULLY FISHED, OVERFISHED, DEPLETED OR RECOVERING, BY AREA, 1992




*Source:* FAO

*Figure 8*

DEGREE OF EXPLOITATION BY SELECTED SPECIES, 1992




*Source:* FAO

## CONSERVATION AND MANAGEMENT

Many heavily fished stocks require urgent rehabilitation and action towards this end will require sharp reductions in fishing effort which, for long-lived species, will need to be monitored for at least a decade.

The overcapacity in fishing fleets is already being addressed by a number of states that have initiated scrapping or decommissioning programmes. To rebuild stocks effectively, and to increase yields in the longer term, reductions in fishing effort will mean reductions in total world landings in the short to medium term.

The implementation and enforcement of fisheries conservation and management measures in exclusive economic zones (EEZs) and on the high seas are not straightforward technical exercises. On the contrary, the implementation of these measures requires controversial and complicated policy decisions concerning resource allocation, as well as political will and capability to enforce them.

At the national level, conservation and management decisions focus on the allocation of resources between fishing gears operating within a fishery while, at the international level, the focus is on allocation decisions between fleets of different flag states. In implementing allocation decisions, certain fishermen and fleets may gain or lose financially, depending on their status *vis-à-vis* criteria adopted for the implementation of the conservation and management decisions. These decisions are inherently political in nature and are decisions that most governments have difficulty in implementing.

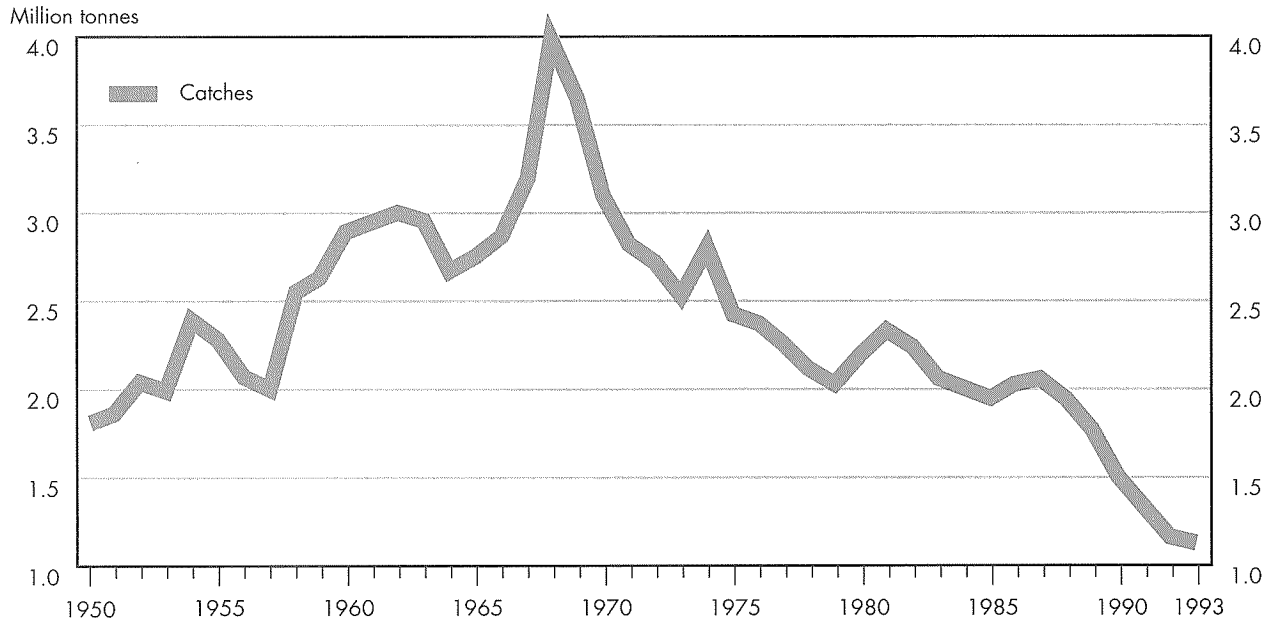
The 1982 United Nations Convention on the Law of the Sea specifies separate conservation and management provisions for fisheries conducted in areas of national jurisdiction (Part V of the convention) and the high seas (Part VII of the convention). These provisions, if implemented and enforced effectively, should facilitate the rational conservation and management of fishery resources.

### Fisheries under national jurisdiction

In the 1970s, during the proceedings of the United Nations Conference on the Law of the Sea, there was a widely held international assumption that the introduction of extended jurisdiction would, in itself, largely solve many of the conservation and management problems facing world fisheries.

*Figure 9*

NOMINAL CATCH OF ATLANTIC COD, 1950-93




*Note:* 1993 data, preliminary

*Source:* FAO

Over the 1980s many developing and developed states failed to implement effective fisheries conservation and management within their EEZs. The reasons for this situation can be traced to a number of complex factors, including:

- a reluctance by governments to commit themselves politically to the industry restrictions necessary to achieve rationalization;
- a reluctance by developed states to take conservation and management advice from scientific assessments;
- decreased attention given to local area managers and the fishing communities they served;
- industry resistance to the introduction of limited entry and restricted output measures, particularly where fishermen are well organized and where there is uncertainty about fisheries policy and the impact of structural adjustment. This resistance often subsides after the benefits of rationalization are demonstrated. In some instances fishermen have taken it upon themselves to arrange compensation schemes to restrict, or further reduce, the number of fishing units in a fishery; and
- a lack of technical capacity and financial means to implement and monitor fisheries conservation and management measures that would lead to a reduction of fishing effort and/or output.

Over the 1970s and 1980s some developing states (e.g. Argentina, Chile, Malaysia and Namibia) and some industrialized states (e.g. Australia, Canada, Iceland, Japan, New Zealand, Norway and the United States) introduced conservation and management measures that limit fisheries inputs and outputs. The fishing industry in some of these states has started to benefit from the measures introduced, which have generally made it more cost-competitive. Some states (e.g. Australia, Iceland and New Zealand) have introduced conservation and management systems based on individual transferable quotas (ITQs). This system affects the nature of resource ownership by converting, in effect, from a public resource to quasi-private ownership. Institutions such as the World Bank are promoting ITQ management in some developing states (e.g. Peru).

Many developing states have not succeeded in implementing and enforcing conservation and management measures within their EEZs because of technical and financial constraints. Many difficulties are faced by developing states with respect to the conservation and management of artisanal (subsistence) and small-scale (commercial) fisheries. The overriding problem in these fisheries is the relocation and redeployment of fishermen who would be displaced as a consequence of limited entry policies. Nonetheless, it must be recognized that failure to limit entry in overexploited artisanal and small-scale fisheries will only contribute further to the destruction of these fisheries and the long-term impoverishment of fishing communities dependent upon them for their livelihoods. Moreover, the continued non-sustainable use of these fisheries resources will erode the contribution they are capable of making to national food security.

Some developing states are addressing the need to relocate and/or retrain fishermen as part of their efforts to introduce input controls in artisanal and small-scale fisheries. However, if programmes of this type are to be successful, alternative employment opportunities outside the harvesting sector must be found. The use of compensation schemes to assist fishermen to leave the industry might be a means of reinforcing natural attrition.

Fisheries conservation and management are high-cost activities and with the movement towards greater privatization in many developing and developed states, industry is assuming greater financial responsibility for, and increased participation in, essential conservation and management decisions. In some developed states (e.g. Australia and Japan) industry is closely involved in setting research priorities in support of fisheries conservation and management and in cost-sharing for research undertaken. This approach to industry involvement, and the funding of fisheries research, is gaining wider acceptance in other developed states as government deregulation is emphasized and as a result of declining budget levels for government spending.

While recognizing the need that fisheries resources are to be conserved and managed in a sustainable manner, most states have yet to come to terms fully with the need to limit inputs (fishing effort) and outputs (catch). It must be said that few states, whether developed or developing, have achieved any reasonable success with fisheries conservation and management in their respective EEZs. This can be attributed to complex political, legal, technical and financial reasons; FAO

assessments have shown that the extent to which effective conservation and management have been implemented in the EEZs has fallen short of the expectations of the 1970s, when the 1982 convention was being negotiated.

### High seas fisheries

The proportion of total marine catches coming from the high seas increased between the 1970s and 1990s because of extended jurisdiction and resulted in more fishing effort being transferred to fishery resources in the high seas. As a consequence, high seas catches rose from an estimated 5 percent of total marine catches in the 1970s to more than 10 percent in the 1980s.

As indicated in Figure 10, catches of all species by distant-water fishing nation (DWFN) fleets in non-adjacent fishing areas have declined significantly from their peak in 1989.[6] DWFN catches reached 9.1 million tonnes, or 10.5 percent of total marine catches in 1989.

[6] Some of the catches taken by DWFN fleets in non-adjacent fishing areas are those from the EEZs of states that license DWFN vessels to operate within their EEZs.

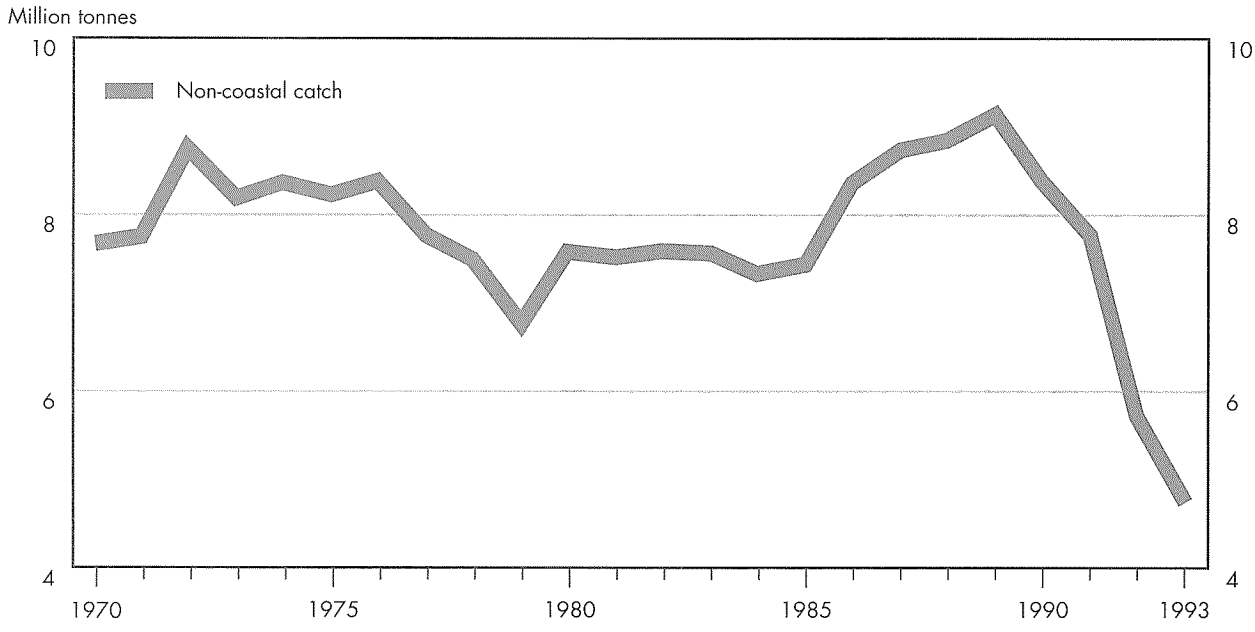
However, by 1992 the DWFN catch level had fallen to 5.7 million tonnes or 6.9 percent of total marine catches. A further drop in DWFN catches was recorded in 1993, when they declined to 4.7 million tonnes. On the basis of provisional total marine catch data for 1993, DWFN catches accounted for 5.6 percent of total world catches. A substantial proportion of these DWFN catches are now high-value species, such as tuna, and a declining proportion of lower-value species.

The marked downward trend in marine catches by DWFNs since 1989 can be attributed principally to decreased catches by fleets of the republics of the former USSR as they progress towards market economies. Catches by Japanese distant-water fleets have also decreased.

Since 1989 there have been some small increases in distant-water catches by other states, including the Republic of Korea, Taiwan (Province of China) and Spain, as shown in Figure 11. However, further decline in total DWFN catches was expected in 1994, since preliminary indications were that distant-water catches by the republics of the former USSR have again decreased.

*Figure 10*

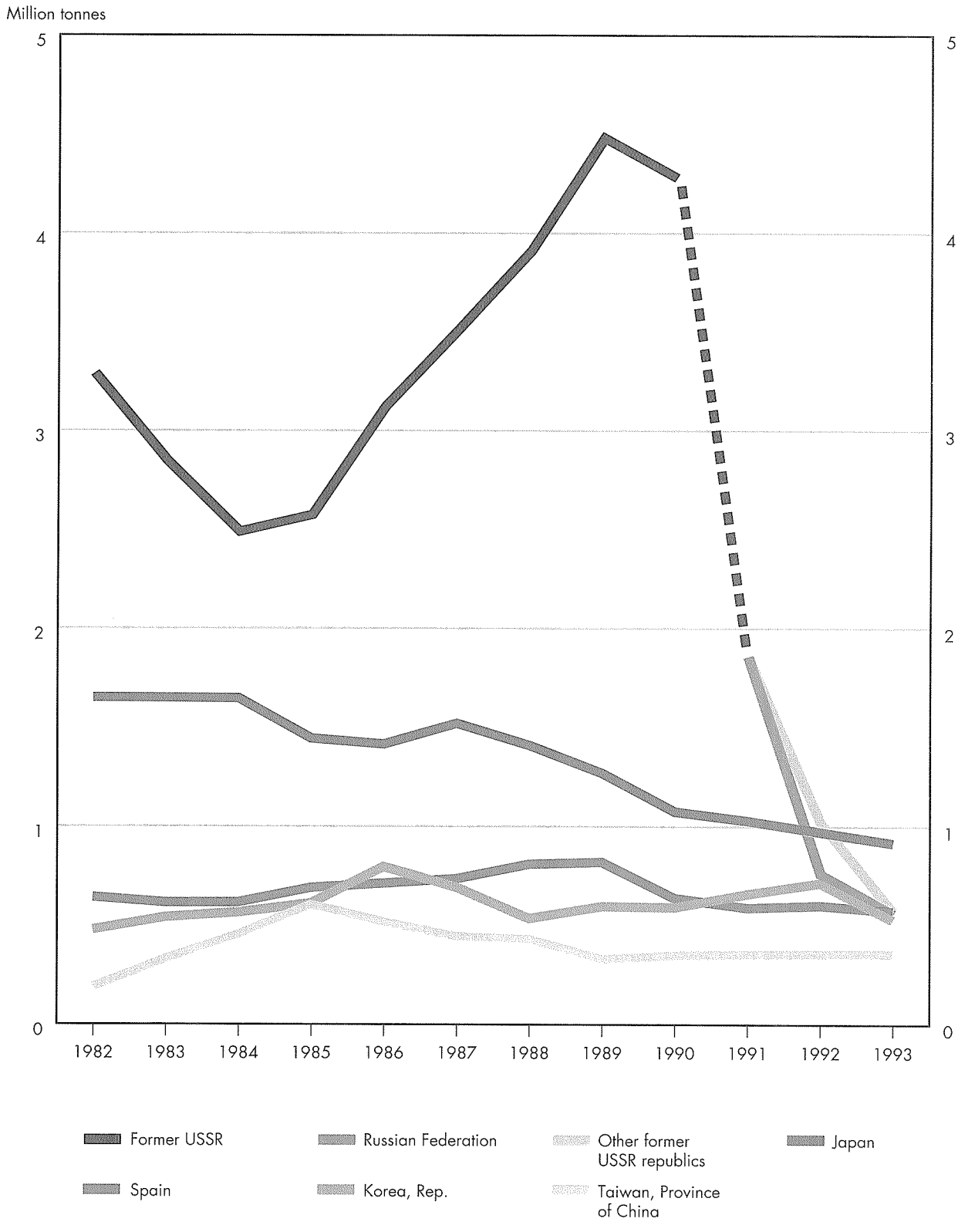
MARINE CATCH IN NON-ADJACENT FISHING AREAS, 1970-93




*Notes:* non-adjacent fishing areas are those FAO major fishing areas that are not adjacent to the producing countries;1993 data, preliminary *Source:* FAO

*Figure 11*

NON-LOCAL CATCHES BY MAJOR DISTANT-WATER STATES, 1982-93




*Note:* 1993 data, preliminary

*Source:* FAO

Despite the decline in total DWFN catches, there has been strong international concern about the proper conservation and management of straddling fish stocks and highly migratory fish stocks. This concern has been the subject of the United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks. Good progress has been made in elaborating internationally agreed measures to ensure the rational exploitation of these two types of stocks in the four sessions that have been held since 1993. The Forty-ninth Session of UNGA agreed that the conference should meet for a further two sessions in 1995 with a view to completing its work before the Fiftieth Session of UNGA.

Recognizing the difficulties being posed by fishing vessels operating under "flags of convenience", the 1992 FAO Technical Consultation on High Seas Fishing requested that, *inter alia*, the Organization address the issue of vessel "reflagging" as a means of avoiding compliance with applicable conservation and management measures for fishing activities on the high seas.

With the endorsement of the FAO Governing Bodies that the Organization should develop a "flagging" agreement using a "fast track" approach, a series of formal and informal consultations and negotiations were initiated by FAO during 1993 with members and interested non-member countries and representatives of regional fishery bodies. As a result of these consultations and negotiations an agreement was developed and the Twenty-seventh Session of the FAO Conference in November 1993 approved the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (Compliance Agreement). It is now open for signature and will come into force on the deposit with the Director-General of FAO of the twenty-fifth instrument of acceptance.

Under the terms of the Compliance Agreement, contracting parties are required to take measures to ensure that vessels flying their flags do not engage in any activity that undermines the effectiveness of international conservation and management measures. They are required not to allow any of their flag vessels to be used for fishing on the high seas unless they have been authorized by the appropriate national authorities to be so used. Authorized fishing vessels must fish in accordance with conditions of the authorization. Parties are required not to grant authorizations to fish on the high seas unless they are satisfied that they are able, taking into account the links existing between them and the vessels concerned, to exercise effectively their responsibilities under the Agreement in respect of those fishing vessels.

The importance of the Compliance Agreement (which will be an integral part of the Code of Conduct for Responsible Fisheries) as it relates to the conservation and management of high seas fisheries is that it represents a first, but critical, step towards deterring and preventing fishing vessels from "reflagging" in order to circumvent internationally agreed conservation and management measures. The importance of implementing such action is explicitly recognized in Programme Area C of Chapter 17 of Agenda 21 adopted by UNCED.

Equally important is the need for national fishery administrations to exercise greater control over their national fleets. Such fleets should be authorized to fish on the high seas and be obligated to maintain records to ensure that flag state control can be effective.

The development of the Code of Conduct for Responsible Fisheries (see Box 3), the implementation of the Compliance Agreement, and the deliberations at the UN Conference are mutually consistent and reinforcing. These international initiatives are aimed at securing enhanced fisheries conservation and management for high seas fisheries resources and to make those fleets and states exploiting them accountable for their actions. The development and implementation of these arrangements have been necessary because high seas fisheries resources in the past have not been exploited in a rational and sustainable manner as envisaged in the 1982 United Nations Convention on the Law of the Sea.

## PROBLEMS OF FLEET CAPACITY

In 1992 the world's total fishing fleet continued to increase in terms of gross register tonnage (GRT) to 26 million gross register tons (GRT). The number of vessels in 1992 increased to 3.5 million, an increase of 136 000 since 1989. The rate of increase has, however, moderated since the 1980s (Figure 12).

Asia has the largest fleet, 42 percent of the world's total register tonnage, while the republics of the former USSR have 30 percent. Europe has 11.6 percent and North America 9.85 percent. South America's fleet is small in proportion (3.1 percent) while Africa's fleet is even smaller at 2.7 percent. Oceania's fleet is less than 0.5 percent (Figure 13). It should be

*BOX 3*

**Code of conduct for responsible fisheries**

According to instructions from FAO Governing Bodies, a draft Code has been formulated to be consistent with the 1982 UN Convention on the Law of the Sea. It takes into account the 1992 Declaration of Cancún, the 1992 Rio Declaration and the provisions of Agenda 21 of UNCED, the conclusions and recommendations of the 1992 FAO Technical Consultation on High Seas Fishing, the Strategy endorsed by the 1984 FAO World Conference on Fisheries Management and Development, and other relevant instruments. It will also take into account the outcome of the UN Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks.

The purpose of the code is to ensure that fishing and aquaculture are developed in a comprehensive and balanced manner under the concept of "responsible fisheries". This concept encompasses the sustainable utilization of fishery resources in harmony with the environment and the use of capture and aquaculture practices that are not harmful to ecosystems, resources or their quality.

The code consists of five introductory articles: Nature and scope; Objectives; Relationship with other international instruments; Implementation, monitoring and updating; and Application of the code to developing states. These introductory articles are followed by an article on General principles that precedes the six thematic articles on: Fisheries management, Fishing operations, Aquaculture development, Integration of fisheries into coastal area management, Postharvest practices and Trade and fisheries research.

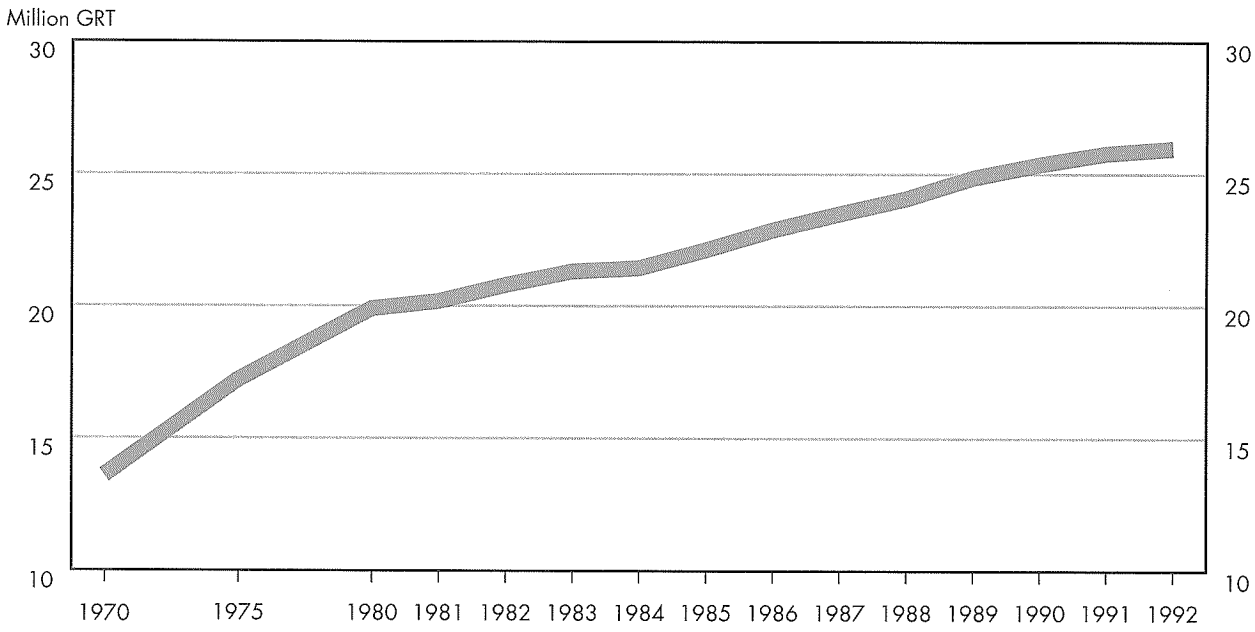
The Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas forms an integral part of the code.

The draft text of the code will be reconciled with the language agreed upon at the UN Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks, which is expected to conclude its work in August 1995. The complete code will be presented for adoption to the Twenty-eighth Session of the FAO Conference in November 1995.

The code will apply to all fisheries and may be adopted on a voluntary basis by any state. In addition to the principles that constitute the code of conduct, FAO is also preparing guidelines for each of the articles as a means of assisting members in implementing the code of conduct. A technical assistance programme is being prepared to support developing countries in this process.

*Figure 12*

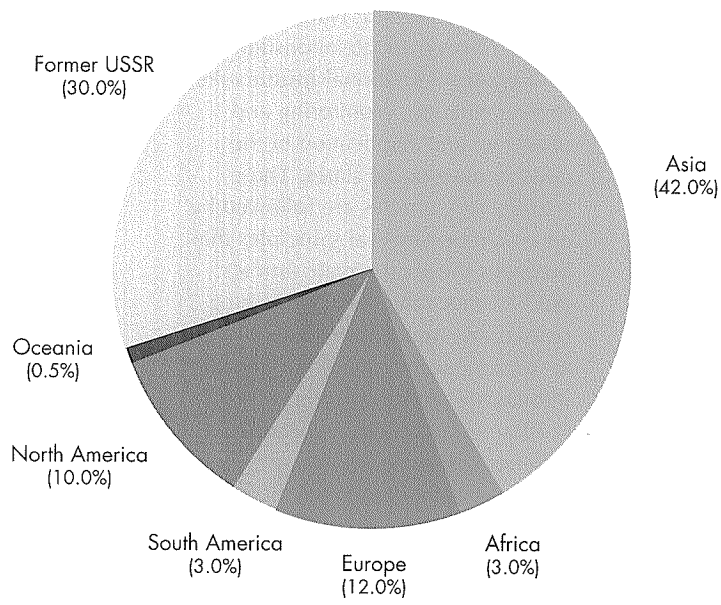
GROSS REGISTER TONNAGE (GRT) OF THE WORLD'S FISHING FLEETS, 1970-92




*Source:* FAO

*Figure 13*

DISTRIBUTION BY CONTINENT OF THE WORLD'S TOTAL FISHING FLEET, 1992 (GRT)




*Source:* FAO

noted that most of the millions of small, undecked vessels used by small-scale fishermen throughout the world are not measured in tonnage and are therefore not included.

In the special chapter of *The State of Food and Agriculture 1980*[7] entitled "Marine fisheries in the new era of national jurisdiction", it was anticipated that there would be a retrenchment in distant-water fishing fleets as a result of extension in national fisheries jurisdictions to 200 nautical miles. As the 1992 special chapter noted, this retrenchment did not occur and in fact many of these distant-water vessels continue to operate. Figure 14 shows that almost half (46.1 percent) the world's industrial fishing fleet (over 100 gross tons/GT) was still operating in 1992, and 31.4 percent entered fishing in the period from 1974 to 1984. Fifteen percent of the fleet became operational between 1984 and 1989. Within the last five years, new vessels represented 7.6 percent of the total fleet. Today the industrial fishing fleet represents 30 percent of the world's total shipping over 100 GT. Figure 15 gives the proportion of the industrial fishing fleet by category of ship, from Lloyds' Register.

This disproportionate share of the world's shipping by numbers of industrial fishing vessels is even more striking when compared with vessel replacement values. In this connection, the replacement value of all industrial fishing vessels is almost equal to the value of all other ships. Table 1 gives the actual comparison.

There are two aspects of the age composition of industrial fishing vessels to consider: *i)* new constructions have decreased since 1990, presumably as a result of the poor economic performance of fishing, which the 1992 special chapter identified as incurring losses in excess of US$50 000 million per year; and *ii)* a large proportion of the fleet is old and inefficient and should be scrapped.

In this connection, the fisheries economic situation would have to improve in order to stimulate new ship construction, and this improvement cannot be expected until a large number of older vessels are scrapped. Otherwise catch rates per GRT will continue to fall as they have done since 1970 and the losses incurred will continue. There are simply too many vessels sharing a limited resource yield.

*TABLE 1*

**Estimated replacement costs of world merchant fleets, 1992**

| Vessel type | Tonnage | Replacement costs |
|---|---|---|
| | *(Million GT)* | *(US$ million)* |
| **Bulk liquid cargo** | **162** | **40 500** |
| **Bulk dry cargo** | **139** | **37 530** |
| **General cargo** | **54** | **43 200** |
| **Specialized general cargo** | **66** | **79 200** |
| **Others** | **11** | **19 800** |
| ***Total merchant ships*** | | **220 230** |
| ***Fisheries***[1] | **13** | **173 290** |

[1] **Excluding China 7 000, Hong Kong 1 000 and the Republic of Korea 2 000. With these vessels, replacement costs are estimated at US$229 000 million**

***Sources:*** **FAO and *World Fleet Statistics*, December 1992. Lloyds' Register, London**

A number of states are reviewing their industrial fleet situation, appraising the costs of scrapping, refitting or rebuilding. Some of the republics of the former USSR have taken initiatives to rebuild fleets, but their policies towards displaced vessels remain unclear. Other states are attempting to transfer their fleets to other non-adjacent areas through joint-venture arrangements.

Of concern to fishery administrations is the need to allow for the construction of new vessels without further increasing fishing effort. New industrial vessels have a catching power ratio of 1.5:1, compared with older vessels of the same size. This ratio can increase to 3:1 when replacement is made by a larger vessel. Fishery administrations often adopt similar ratios by requiring new vessels to remove old vessels as a condition for being authorized to fish. In this way older vessels are removed (and compensated) from the fleet by the owners of new vessels. Other policies include scrapping and decommissioning programmes.

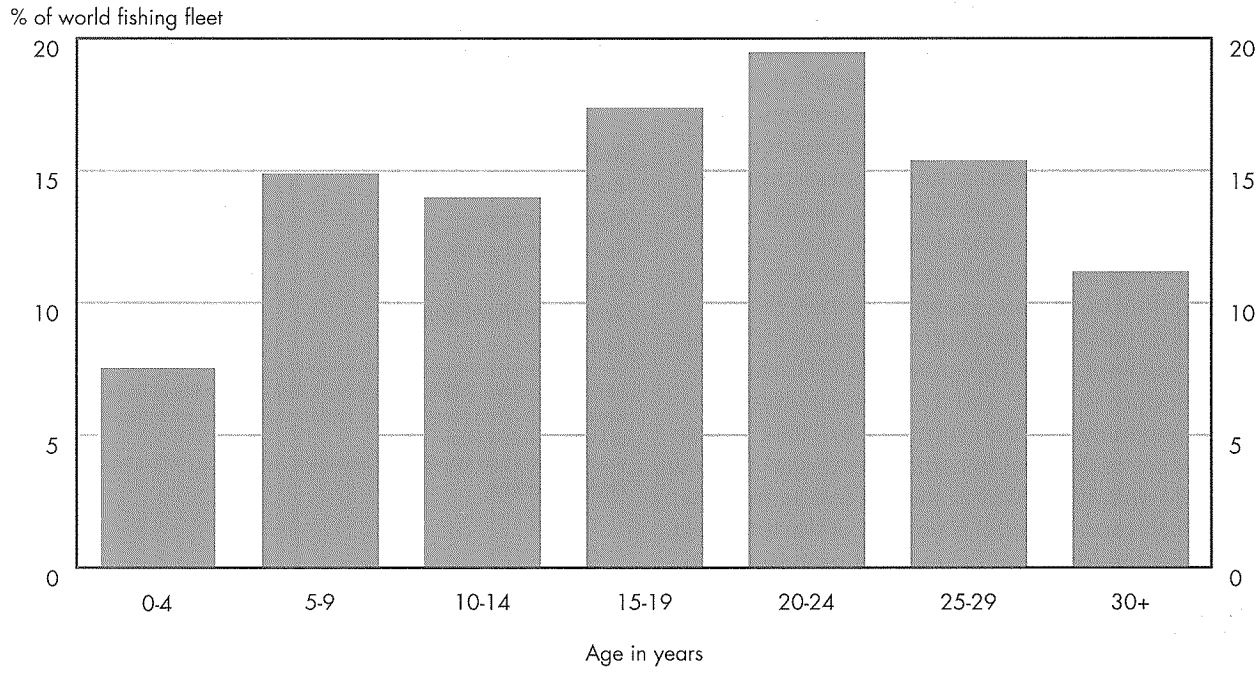
At issue is the realization that old industrial fishing vessels are the least efficient and generally need more crew, their machinery is not fuel-efficient, they incur higher maintenance costs and they experience more "down time". By definition, this means that such vessels must catch more fish in order to break even, let alone make a profit; they may often need to be subsidized to keep their operations viable.

Many boatyards have gone out of business which implies that new vessels below 100 GRT

[7] **FAO.** 1981. *The State of Food and Agriculture 1980*, p. 111-12. Rome.

*Figure 14*

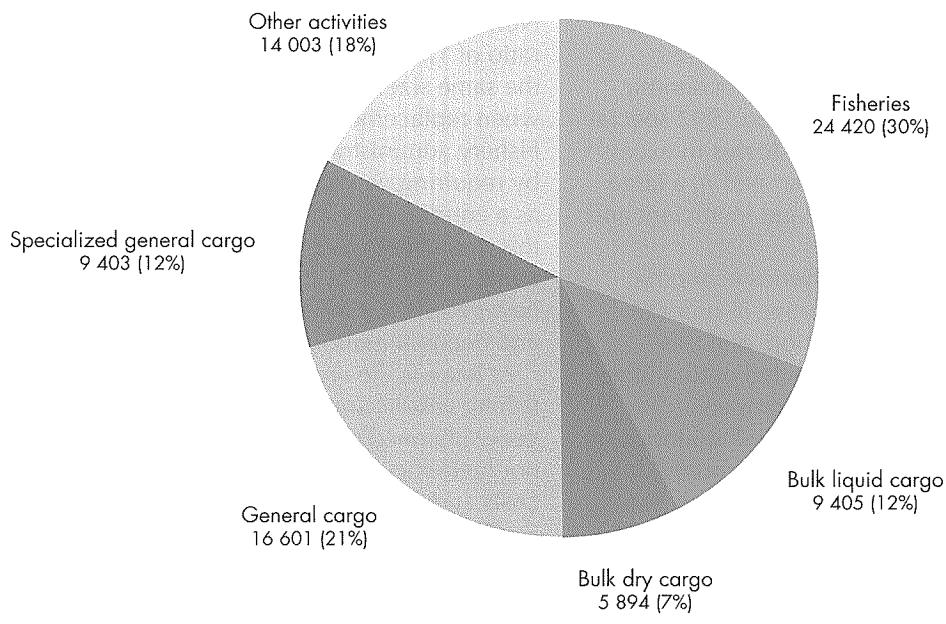
AGE OF THE WORLD'S INDUSTRIAL FISHING FLEET, 1994 (VESSELS OVER 100 GT)




*Source:* Lloyds' Maritime Information Services, 1994

*Figure 15*

WORLD FISHERY AND OTHER MERCHANT FLEETS BY NUMBERS, 1992 (VESSELS OVER 100 GT)




*Source: World Fleet Statistics Data,* December 1992. Lloyds' Register, London

may also be decreasing, but reliable data are not available. If the trend for smaller vessels is similar to the age composition of industrial vessels, the world's total fishing fleet must be declining in efficiency. This situation aggravates the competition for available fishery resources, resulting in increasing conflict between industrial fleets and the small-scale fishery sector.

Evidence of the increasing economic difficulties of the industrial fleets can also be viewed within the perspective of changes in flagging to "flags of convenience". Between 1991 and 1993, 1 682 vessels changed to open registers.

## BYCATCHES AND DISCARDS

The recent global assessment of fisheries bycatch and discards estimated a discard range of between 17.9 to 39.5 million tonnes per year, with a mean estimate of 27 million tonnes.[8] No estimate could be given, however, of the mortality level of "escapees" from fishing gear during operations. Although many of the discards include non-target or low-value species, undersized fish of target species are also discarded. The combined effect of this practice is to threaten the maintenance of biodiversity and the long-term sustainability of fisheries. Estimates of discards by major fishing areas are given in Figure 16.

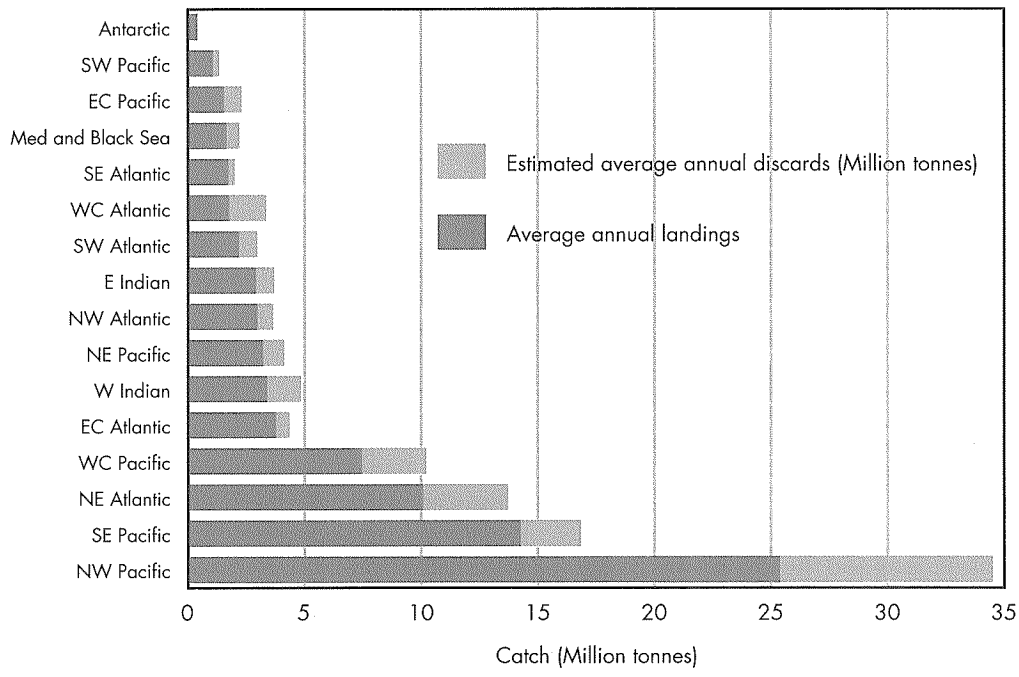
A major tactic to reduce the level of discards is improvement in the selectivity of fishing gear and fishing methods. While there has been an increase in activity to develop selective gears and techniques, much of the research has been carried out in the higher latitudes and is not readily transferable to multispecies tropical fisheries, where the tropical shrimp trawls still produce high rates of bycatch.

FAO estimates that a significant reduction in discards by the year 2000 of around 60 percent could be achieved by: a concentrated effort to improve the selectivity of fishing gear; the development of international standards for research; greater interaction between research staff, industry and fisheries managers; and the application of technology through fisheries regulations. To achieve this goal, FAO and

[8] **FAO.** 1994. *A global assessment of fisheries bycatch and discards.* FAO Fisheries Technical Paper No. 339. Rome. 233 pp.

*Figure 16*

AVERAGE ANNUAL MARINE CATCH AND ESTIMATES OF DISCARDS BY MAJOR FISHING AREAS, 1988-92




*Source:* FAO

national research institutes will need to strengthen and widen the scope of current programmes on gear selectivity.

## FISHERIES MONITORING, CONTROL AND SURVEILLANCE

An essential element of efficient fisheries conservation and management is the need to maintain appropriate monitoring, control and surveillance (MCS) systems. The purpose of these systems is to ensure that fisheries policy and management decisions are implemented and, where necessary, that appropriate enforcement measures are taken to ensure compliance with agreed measures. However, the emphasis of MCS should be on the monitoring (or shepherding) aspect of fleet activity as a means of facilitating a higher degree of voluntary compliance with conservation and management measures by vessel operators.

With changes in MCS technology (e.g. the increasing introduction of transponders) and efficient and inexpensive systems for maintaining and exchanging information on a real-time basis within and between states, the fishing industry is benefiting from the introduction of this technology. It has been demonstrated that the use of transponder technology has led to enhanced safety at sea for fishing vessels and their crews and that cost savings are possible since fleets are able to receive up-to-the-minute information on changes in time/area management, market conditions, port congestion, etc. As a result of such information, vessel owners are in a position to plan more efficiently in advance, and arrange fish deliveries to ports where turnaround time is minimal and prices are most favourable.

Concern is often expressed about MCS costs, but well-planned MCS systems can be kept within reasonable limits. There is also the possibility of transferring some or all MCS costs to the fishing industry, particularly in view of the benefits the industry receives from systems that improve safety and permit real-time transfer of information. This is already current practice in some states.

Two MCS-related issues were considered by the Forty-ninth Session of UNGA. These concerned *i)* unauthorized fishing in zones of national jurisdictions and the impact on the living marine resources of the world's oceans and seas; and *ii)* fisheries bycatch and discards and their impact on the sustainable use of the world's living marine resources.

Renewed international attention is focusing on unauthorized fishing and the role of MCS. Fisheries conservation and management are being undermined by such fishing and, together with the lack of effective MCS systems, this is threatening the sustainability of fisheries. The international community also acknowledges that the accurate collection and reporting of fisheries bycatch and discards data are important aspects of MCS, and issues that will attract increasing attention. The most realistic and effective means of collecting, verifying and reporting these data is through the use of increased "at-sea" monitoring of fishing activities.

## SMALL-SCALE FISHERIES

Almost 50 percent of total world landings are estimated to come from small-scale capture fisheries, and most of this production is used for direct human consumption. The small-scale sector employs many more people than the other fisheries sectors (although the catch per person employed is much less than for those employed in other fisheries) and many communities rely solely on fisheries for their existence. Against this background is the fact that coastal fisheries, most commonly exploited by the small-scale sector, are generally overfished in most parts of the world. The reasons for this include the lack of assured access to stocks, the inability to fish further offshore, and the interaction with industrial fishing fleets operating illegally too close to the shore. Small-scale fisheries are also under threat from other users in the coastal zones and they are perhaps the first to be affected by land-based pollution and other changes in the coastal area.

More recently the small-scale sector has come under threat through legislation enacted in favour of recreational users of the aquatic environment and this has had an adverse effect on small-scale fisheries in some small island developing states (SIDS).

FAO has advocated an integrated approach to small-scale fisheries conservation and management, not only within the fisheries sector itself, but also within coastal area management schemes. Better and safer craft for more advanced artisanal fisheries have been developed, appropriate fishing gear has been introduced and, in order to acquire new tools as well as to assist in marketing, institutional credit programmes have been promoted (with promising results in some parts of Africa and Asia).

Notwithstanding the progress made in enhancing fisheries conservation and management in coastal areas, competition for fisheries resources with industrial fleets and the lack of effective MCS mean that inshore fisheries will remain under threat. The situation is a matter of primary concern because of the impact that this unsustainable use of coastal fisheries resources has had on food security among highly vulnerable and very often impoverished communities.

Small-scale fisheries require the support of fishery managers, and they need assured access to areas that should be out-of-bounds to all other users. This requires strengthened MCS systems. Furthermore, in cases of coastal navigation practices and, where they exist, vessel traffic separations, as well as the avoidance of sensitive areas, there is an urgent need for close cooperation with other international agencies to ensure that the priorities for small-scale fisheries are given proper consideration.

## TRADITIONAL APPROACHES TO FISHERIES CONSERVATION AND MANAGEMENT

The difficulties associated with transplanting current fisheries conservation and management concepts and systems to developing states have encouraged renewed interest in some of these states to build on traditional (or community) fisheries conservation and management practices. Among many indigenous communities communal control over access to fisheries resources, as well as the use of a range of conservation-oriented measures in coastal fisheries, operate to ensure sustainability.

With the advent of rapid social change, population increases, urbanization, the rise of commercial opportunities for sales of fish and fisheries products, and the introduction of more effective mobile gears, these traditional management systems have come under extreme pressure and have, in some cases, started to disintegrate. However, the merits of fostering community control over vulnerable coastal fisheries are apparent and, given the mixed results that have been achieved with other conservation and management approaches, traditional management practices provide a viable alternative, in some cases, for regulating the use of coastal fisheries resources.

In some industrialized states community-based systems of fisheries conservation and management are institutionalized and effectively applied (e.g. Japan). Within these systems fishermen, often together with their cooperatives, play a central role in conservation and management decisions for fisheries resources. In general, fisheries managed in this manner tend to be both resource-sustainable and economically efficient.

# INLAND CAPTURE FISHERIES PRODUCTION

The steady increase in inland catches appeared to peak in 1990 at approximately 6.5 million tonnes and subsequently stabilized at a slightly lower level.[9] Figure 17 shows the relative importance in inland capture fisheries of Asia, which produced 54 percent of the world inland catch in 1992. Africa contributed 25 percent, the republics of the former USSR 7 percent, and North and South America about 4.5 percent each. With the possible exception of South America, North America and parts of Europe, nearly all inland resources show symptoms of excessive exploitation, although in poorer and isolated communities exploitation is usually at low levels of efficiency and catches seem to stay in balance with the available resource. In general, present yields probably cannot be substantially increased through traditional capture fisheries.

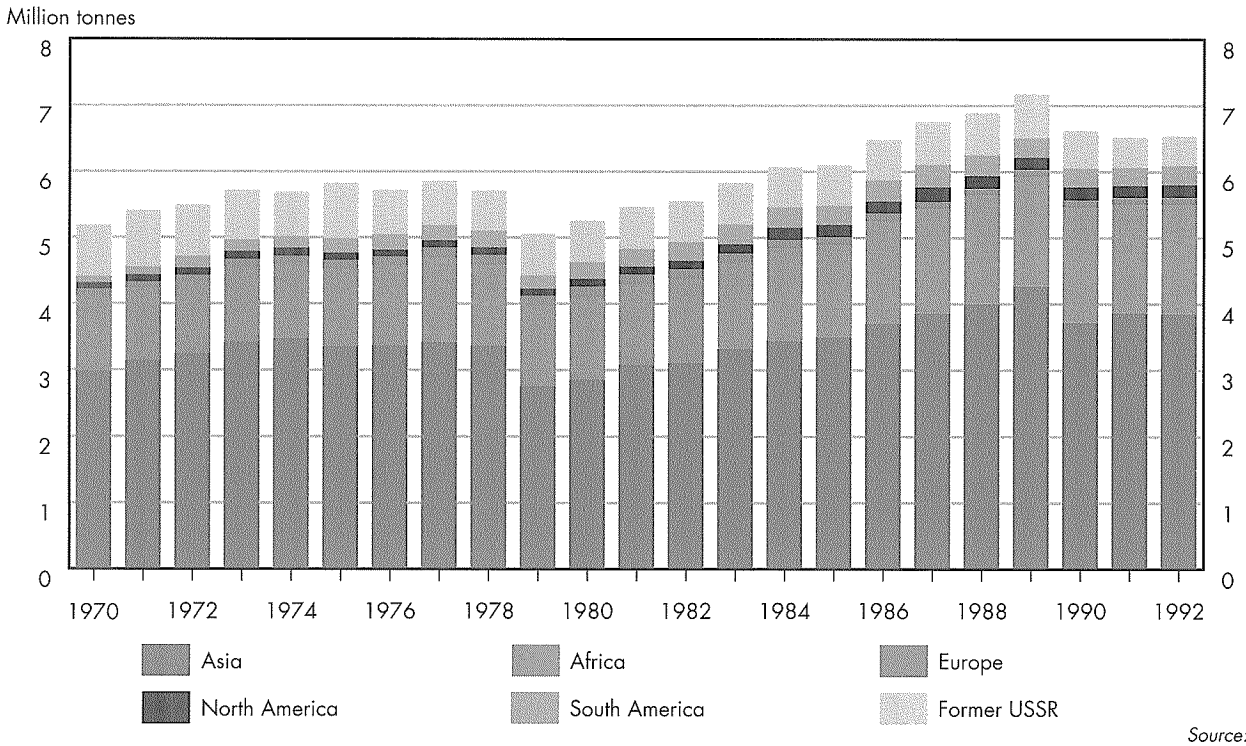
Virtually all inland fish are used for human consumption. Catches from inland waters are primarily most significant for rural areas, both commercially and for subsistence, although there are some export markets for high-value fish. Inland fish also provide the basis for valuable and widespread recreational fisheries and, locally, for fisheries for ornamental species. Freshwater fish are important for food and prices, depending on species and size, vary widely. On occasion inland fisheries serve as famine crops and are subject to heavy exploitation when other sources of protein are scarce. The widespread subsistence and recreational fisheries for domestic consumption do not generally appear in the statistics.

Because traditional capture fisheries are fully exploited it is evident that any increase in yields from inland waters will come from fisheries enhancement activities, either in the form of stocking or from improvements in the aquatic

[9] For a detailed analysis of inland fisheries, see **FAO.** 1995. *Review of the state of world fishery resources: inland capture fisheries.* FAO Fisheries Circular No. 885. Rome. 63 pp.

*Figure 17*

TOTAL INLAND CAPTURE FISHERY YIELDS BY CONTINENT, 1970-92




*Source:* FAO

environment. Stocking practices are widely applied in many areas of the world, often as a compensatory mechanism to environmental alteration, which has been degraded by human intervention. In many areas degradation has reached the point where the diversity and productivity of inland fisheries have been seriously reduced.

River fisheries show the largest loss in fish yields, primarily as a result of channelization and the removal of slow-flowing areas prone to flooding, as well as flood control, hydrodams and pollution. Historic levels of catches from rivers were significant but are now only marginal in many parts of the world. Some states, however, are achieving improvements through river rehabilitation programmes.

In addition to their use for food, freshwater fish are especially important as monitors of environmental alteration; for detecting introductions of toxic substances as well as changes in water quality.

# AQUACULTURE PRODUCTION

Aquaculture production expanded during the period 1984-92 at an average annual compounded rate of 9 percent. Total production in 1992, including plants, was 19.3 million tonnes (13.9 million tonnes excluding plants), while production in 1993 was tentatively estimated at 15.8 million tonnes (excluding plants), an increase of almost 2 million tonnes from production in 1992.[10]

The bulk of production is from developing states; Asia is by far the main contributor, with 84 percent of world aquaculture production in 1992. China contributes 60 percent of Asia's production, and this constitutes about half of the total world production. India is the second major Asian producer with 17.4 percent of the region's total, followed by Japan with 6 percent.

Aquaculture from other areas of the world is relatively minor in comparison with Asia: Europe produces 8.5 percent of the world's total, North America 3.7 percent and South America 2.3 percent. African production is 0.5 percent, while production in the republics of the former USSR is 0.9 percent.

It is remarkable that, as with the world marine catch where 80 percent of the total is taken by 20 states, 85 percent of world aquaculture production comes from only 11 states (Figure 18).

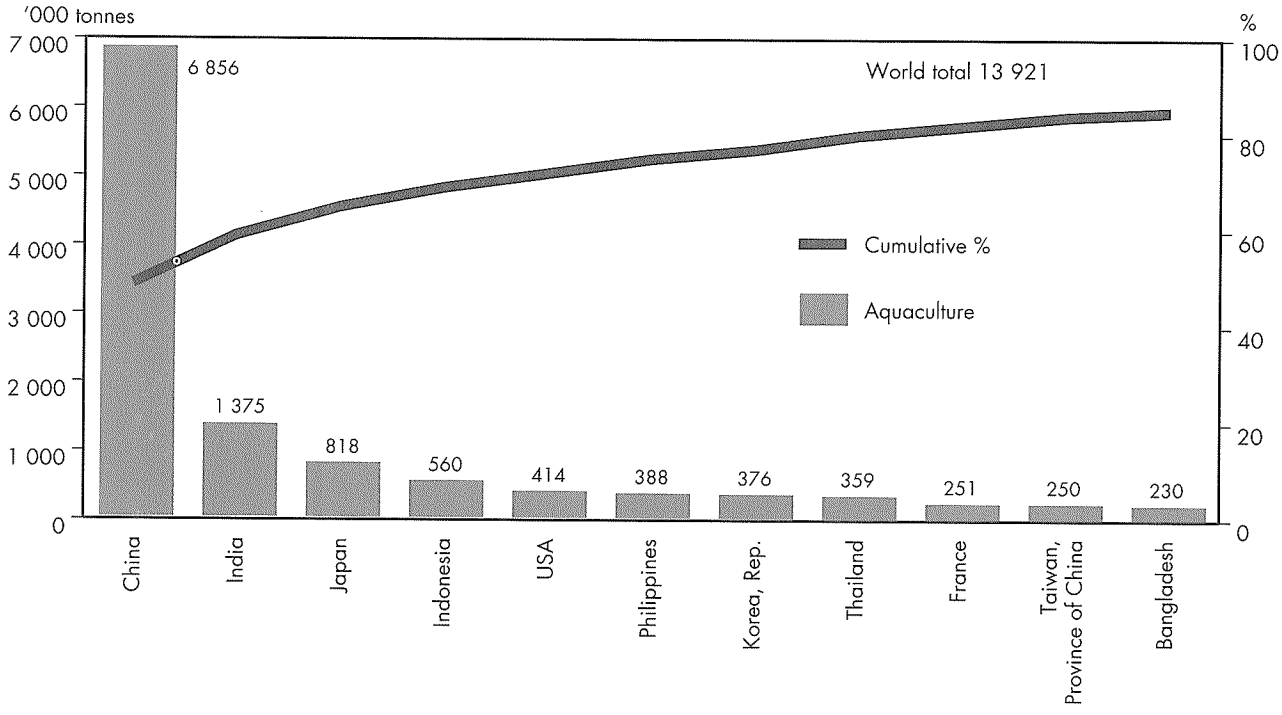
The rate of growth in aquaculture production by Asian states has outstripped other producing areas, with a result that both North America and Europe have a smaller relative share of the world total today than in 1984.

Aquaculture produces three commodities (excluding plants): finfish, crustaceans and molluscs. The finfish share of total aquaculture production between 1984 and 1992 has

[10] For a detailed evaluation of aquaculture, see **FAO.** 1995. *Review of the state of world fishery resources: aquaculture.* FAO Fisheries Circular No. 886. Rome. 127 pp.

*Figure 18*

TOTAL AQUACULTURE PRODUCTION BY PRINCIPAL PRODUCERS AND CUMULATIVE PRODUCTION AS A PERCENTAGE OF THE WORLD AQUACULTURE TOTAL, 1992




*Note:* excludes aquatic plants

*Source:* FAO

remained remarkably stable at around 68 percent. The proportion of molluscs decreased during the same period from 29 percent to 24 percent, whereas the share of crustaceans increased from less than 4 percent to 7 percent, because of substantial expansion in shrimp production. About 60 percent of all aquaculture production (excluding plants) continues to originate from inland areas. However, coastal aquaculture predominates in North Africa, Latin America, Europe and East and Southeast Asia.

Of the finfish produced by aquaculture in 1992, 85 percent of the volume was accounted for by non-carnivorous species, mostly carps (84 percent). Other cyprinid species (6 percent), tilapia (6 percent) and milkfish (4 percent) make up the balance (Figure 19). Production of these species has been mainly for domestic markets. In the carnivorous group, salmonids (44 percent by volume), catfish (26 percent) and yellowtail (10 percent) dominate. Salmonids are largely exported.

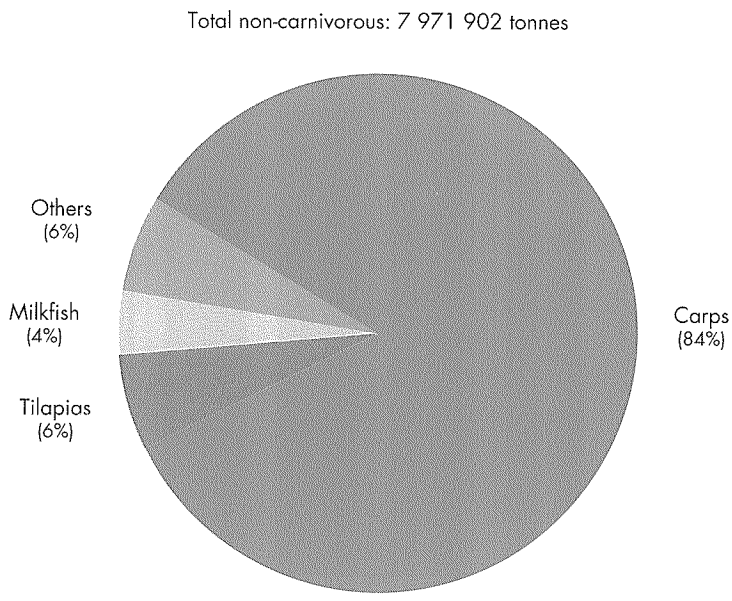
Although diversification of cultured species is occurring, it has not yet had a significant impact on production. Aquaculture continues to expand its production of "traditional" species and there is a global tendency for more rapid growth in the production of high-value species, although markets for these tend to saturate quickly.

Aquaculture increased its contribution to the world food fish supply from 12 percent in 1984 to 17 percent in 1992, representing an increase in average annual per caput fish supply from 1.5 to 2.5 kg, despite a 15 percent increase in global population. The contribution of the sector to animal protein supply increased by 50 percent, from 1.8 percent in 1984 to 2.7 percent in 1992.

However, there were wide differences among regions. In 1992 aquaculture contributed 24 percent of total fish production in Asia, 9 percent in Europe, 5-6 percent in North America, and less than 2 percent in Africa and Latin America. The contribution of some aquaculture commodities to total supply of these commodities has been substantial. In 1992, aquaculture accounted for 60 percent of the world supply of freshwater finfish, 40 percent of the supply of molluscs, 30 percent of marine shrimp supplies, and 43 percent of salmon supplies. By contrast, aquaculture produces only 5 percent of the world supply of marine fish. Figure 20 shows the composition of capture and aquaculture production by principal species between 1984 and 1992, while Figure 21 indicates the contribution made

*Figure 19*

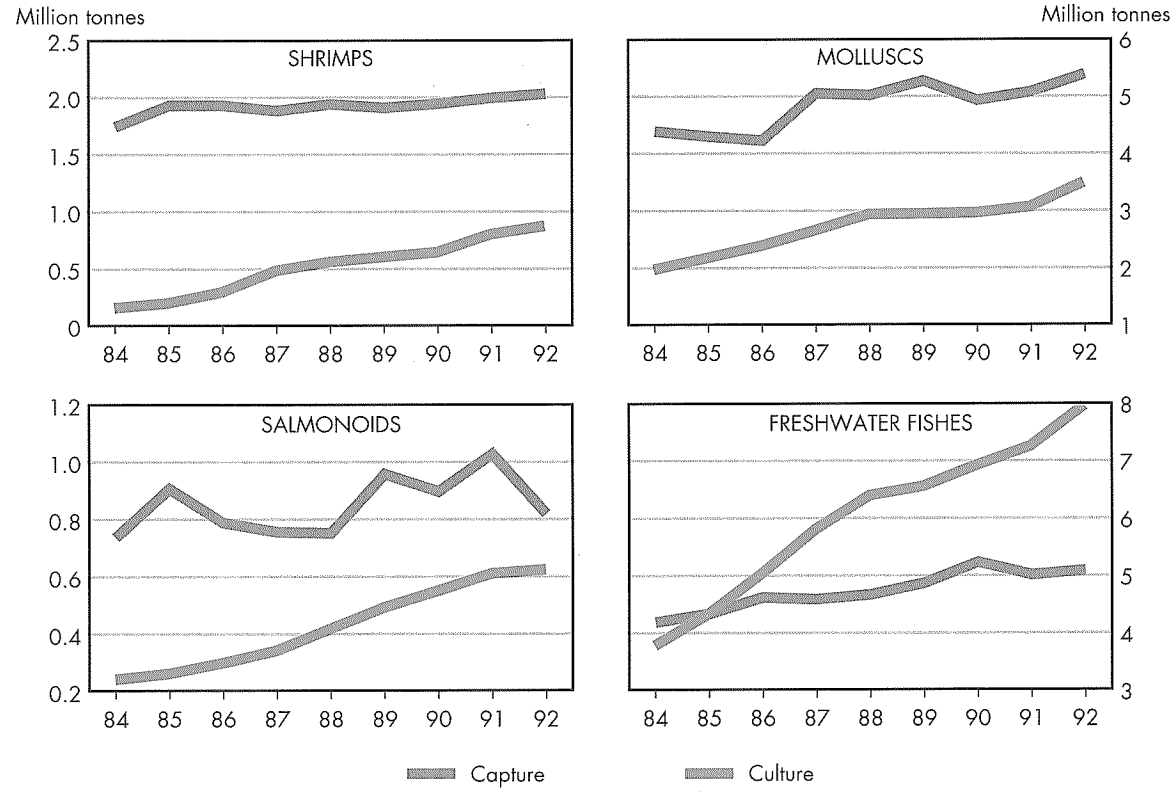
PERCENTAGE OF CULTURED NON-CARNIVOROUS FISH PRODUCTION BY MAJOR SPECIES/GROUPS, 1992




*Source:* FAO

*Figure 20*

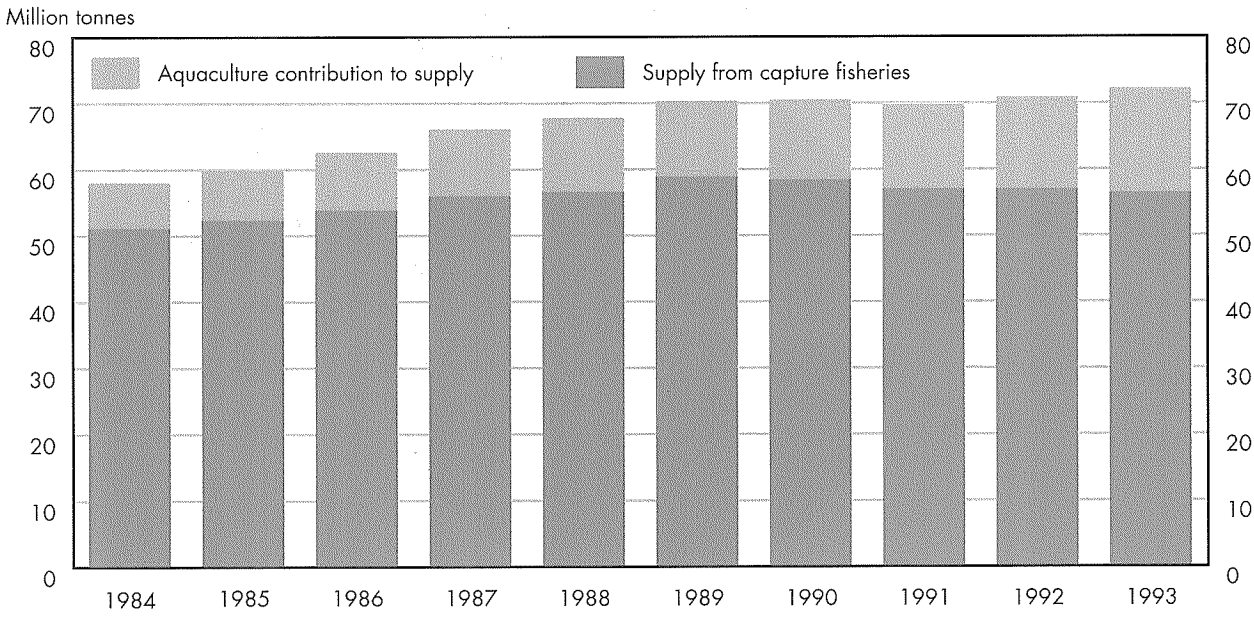
COMPOSITION OF CAPTURE AND AQUACULTURE PRODUCTION BY PRINCIPAL SPECIES/GROUPS, 1984-92




*Source:* FAO

*Figure 21*

AQUACULTURE CONTRIBUTION TO WORLD FOOD FISH SUPPLY, 1984-93




*Note:* 1993 data, preliminary

*Source:* FAO

by aquaculture to the world food fish supply between 1984 and 1993.

The major concerns observed in the 1990s indicate the following:

- For finfish, environmental concerns and diseases are emerging problems for domestic production as more intensive practices are progressively adopted. In the case of export-oriented high-value finfish, the progressive saturation of the markets and the associated reduction in prices are encouraging diversification and the development of new technologies to reduce production costs and to exploit new areas for production.
- In the case of the expanding, export-oriented, shrimp culture subsector, major economic constraints to development are being posed by diseases, environmental mismanagement, the more demanding quality standards of international markets, and price fluctuations.
- Mollusc production through aquaculture is rather static in the 1990s because of the limitations imposed by deteriorating environmental conditions in the coastal areas and stricter regulations for imports.

Aquaculture was a remarkable economic growth sector in some regions during the 1980s and early 1990s. In many states, it has become commercially organized and therefore recognized as a sector in its own right. Its growth is expected to continue and its contribution to fish food supplies to increase, as the gap between supply and demand for fish products widens.

Without significant improvement in the contribution to fish supplies from capture fisheries, aquaculture production would need to produce approximately 31 million tonnes by the year 2010 in order to maintain present levels in per caput fish consumption for the world's increased population.

It is difficult to assess the absolute growth potential of the aquaculture sector, as it is more similar to agriculture than to fisheries. To attain 31 million tonnes of aquaculture production by 2010 will require a doubling of the estimated 1993 production in a period of 17 years. This seems feasible considering recent annual rates of expansion, the available technical knowledge, and the interest of the private sector, governments and financing institutions. Nevertheless, the challenge is formidable. Proper planning, environmental considerations, proper system management and disease control will have to play a more important role than at present if crashes in production are to be avoided.

# FISH UTILIZATION

Figure 22 shows world fish utilization between 1982 and 1993. Over this period there has been a high degree of stability in the relative proportions of fish production going to the various end uses.

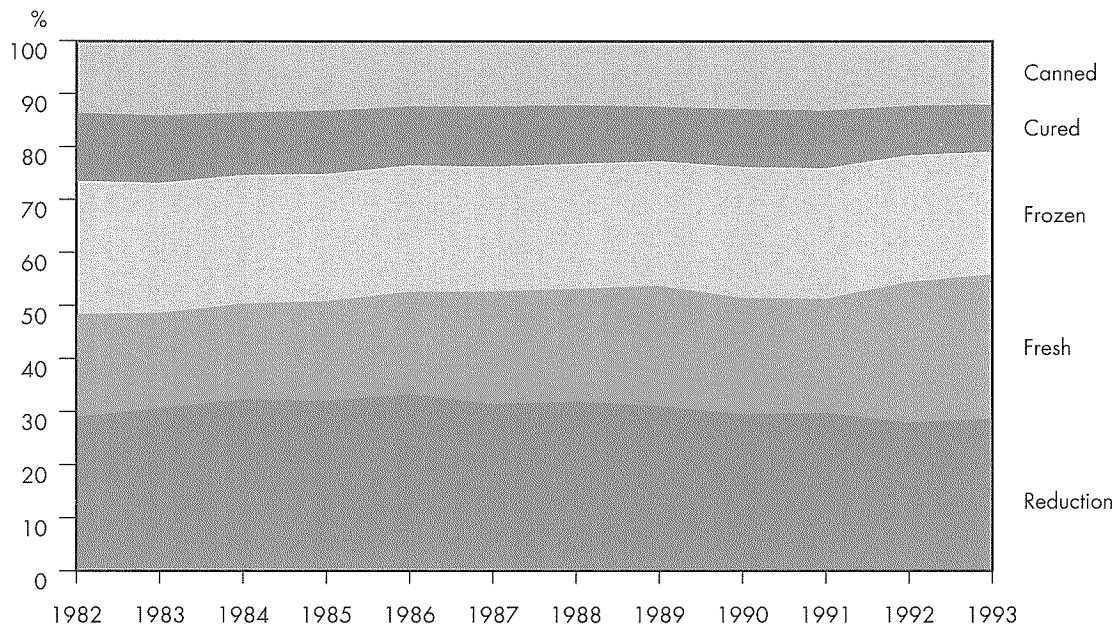
Increased demand for fish and fishery products, together with high pressure on exploited resources, calls for improved utilization of present catch and reduction of waste. As noted above, an estimated 27 million tonnes of bycatch are discarded and wasted annually. Although the problem can be partially resolved by improved selectivity of fishing gears, further progress in reduction of waste can be achieved through utilization of bycatch, preferably for human consumption. This can only be done by the introduction of proper handling systems and processing methods, together with suitable market promotion, since a large part of bycatch consists of fish species of low market value.

In many fisheries, particularly in developing states, significant postharvest losses occur. Although an accurate assessment of the quantity is difficult, losses certainly amount to more than 5 million tonnes per year. Most significant are physical losses of cured fish caused by insect infestation and the loss of fresh fish through spoilage. Lack of infrastructure, technology and price incentives for quality fish, together with poor distribution and marketing systems for fish and fishery products, are among the main contributory factors.

Important changes took place in recent years in the area of quality requirements as well as that of health and sanitary regulations related to fish and fishery products. Adoption by most developed states of quality assurance systems, based on hazard analysis of critical control points (HACCP), has had significant impact on international trade, since developing states have to comply with the new regulations. A lack of adequate infrastructure and technical expertise in these states results in losses of millions of dollars of foreign exchange earnings every year because of rejections and low prices for exported fish and fishery products. The economic values at risk are enormous, bearing in mind that developing states export more than US$19 000 million worth of fishery products

*Figure 22*

UTILIZATION OF WORLD FISH PRODUCTION, 1982-93




*Note:* 1993 data, preliminary

*Source:* FAO

and their net receipts of foreign exchange from the fishing sector are more than US$11 000 million.

To cope with new quality assurance requirements the governments of developing states should be prepared to make the necessary improvements in in-plant quality control and hygienic conditions in processing establishments, as well as to establish appropriate institutional systems for inspection and quality control of fish and fishery products. These measures are required not only for export but also to safeguard food quality for national consumers and meet their growing expectations regarding the quality of fish and fishery products. Technical assistance to meet this new challenge is a priority.

There are substantial quantities of underutilized resources that have not yet attracted commercial fisheries. The largest of these, in terms of possible sustainable harvest, are the shrimp-like Antarctic krill of the Southern Ocean and the mesopelagic species found in tropical waters. In both cases, advanced technology is required for their capture and processing. In the case of krill, the technology has been developed but the cost of the final product still appears too high for it to make a significant contribution to food supplies. The technology for capturing the mesopelagic species is also available and this large resource is potentially suitable for animal or fish feed. However, its exploitation has not proved economically viable to date.

# FISH TRADE

The volume of international fish trade has grown substantially over the last few decades. While the quantity of fish and fishery products entering international trade continued to grow in 1993, the value of fish exports declined to some extent, because of lower prices for most commodities. The total value of fish trade was around US$40 000 million in 1993.

The importance of developing countries in international trade of fish and fishery products continued to rise, reaching 48 percent of world trade in 1993, up from 45 percent in 1992 and 43 percent in 1983. Underlining the importance of developing countries as fish exporters, Thailand became the main fish exporter in the world, overtaking the United States. Total Thai exports were US$3 400 million in 1993, an 11 percent increase over 1992.

Compared with other agricultural commodities, fish plays an important role as an earner of foreign exchange: net exports of fishery products by developing countries were more than US$11 000 million in 1993, much higher than coffee, banana, rubber, tea, meat, rice or other typical commodities (Figure 23).

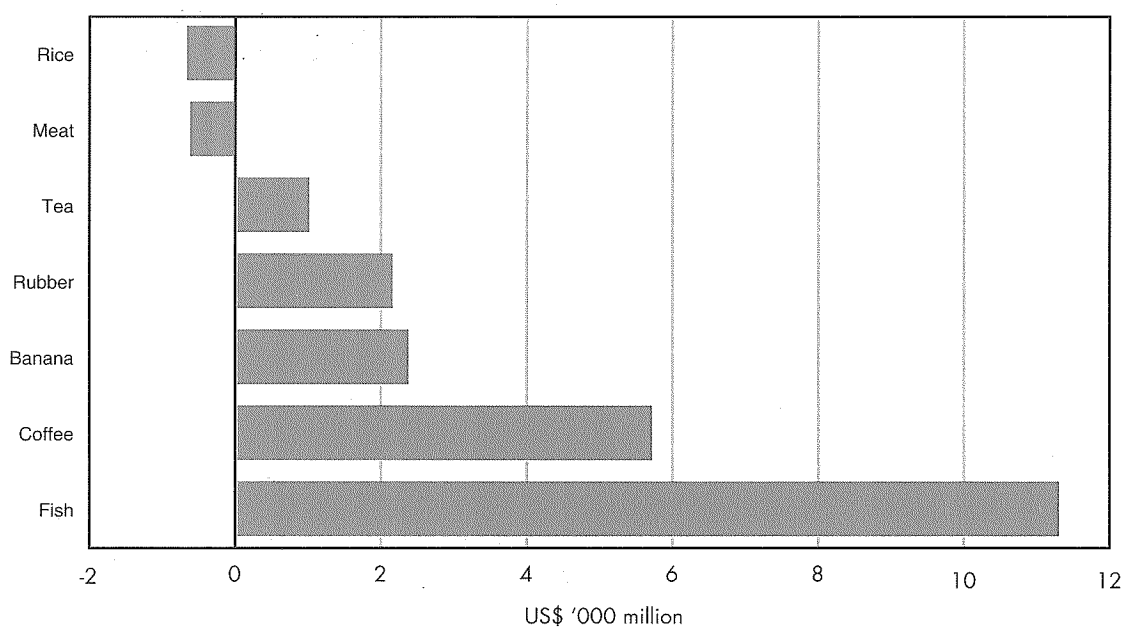
Developed countries continue to attract a substantial share of fish trade, accounting for 85 percent of world fish imports. Japan maintained its position as top importer: in 1993 it imported some US$14 200 million, alone accounting for 32 percent of world fish imports in value terms. The United States, the second major market for fishery products, reported a 5 percent increase in fish imports in 1993. In the European Community, recession and currency devaluations influenced fish imports, and growth slowed in many countries.

Trade patterns of fishery products have been influenced by the introduction of extended jurisdiction and by the culture of high-value species normally destined for export markets. Two fish commodities that have experienced a substantial increase in trade because of aquaculture have been salmon and shrimp (Figures 24 and 25).

Major increases in aquaculture production have generally created market disturbance leading to sudden declines in prices. In 1989,

*Figure 23*

NET EXPORTS BY DEVELOPING COUNTRIES, 1993

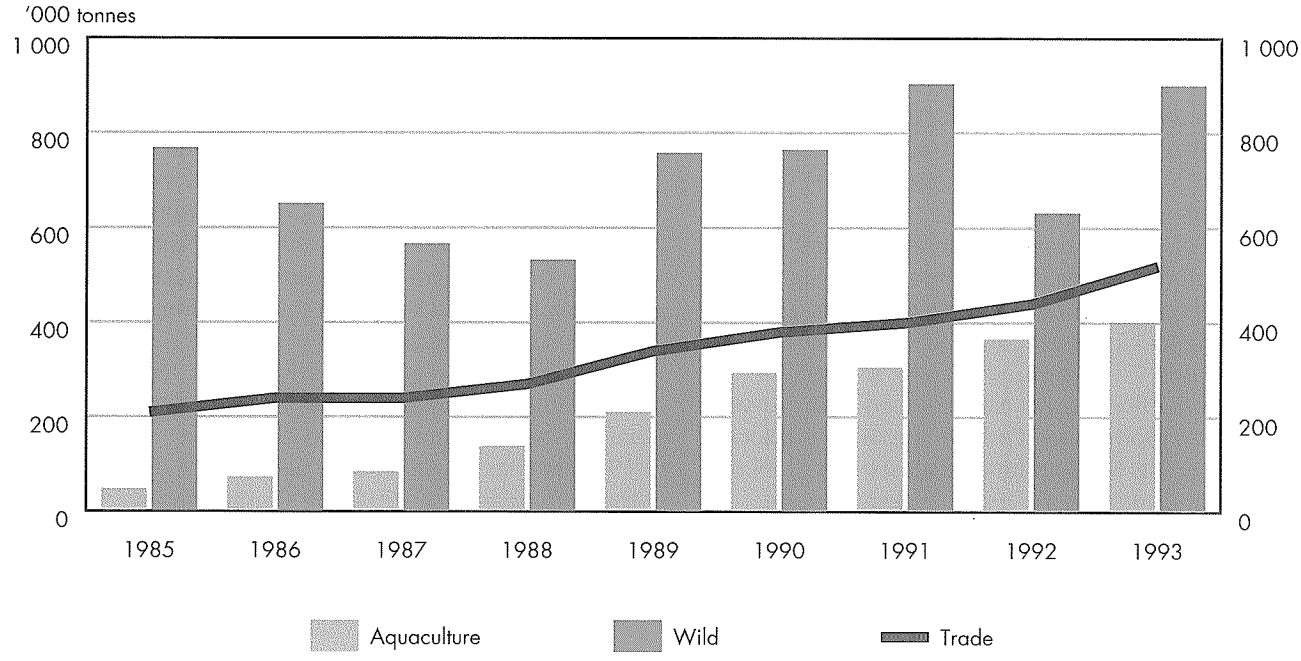



*Note:* 1993 data, preliminary

*Source:* FAO

*Figure 24*

SALMON PRODUCTION AND TRADE, 1985-93

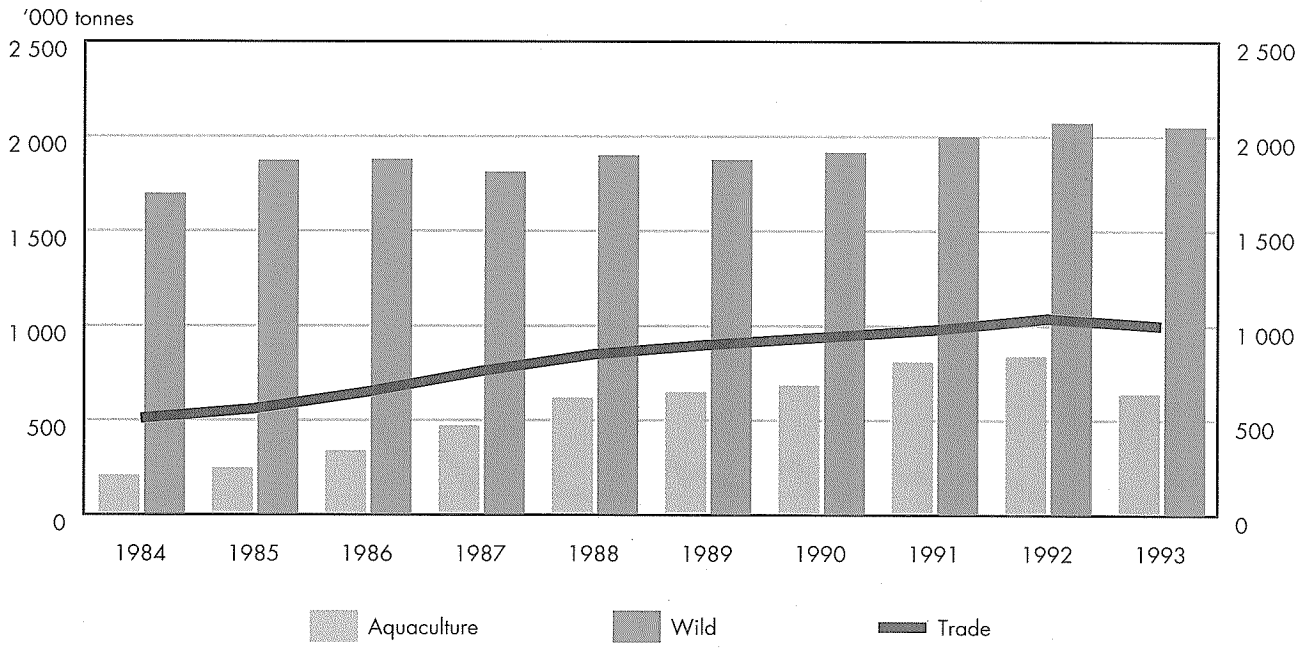



*Note:* 1993 data, preliminary

*Source:* FAO

*Figure 25*

SHRIMP PRODUCTION AND TRADE, 1984-93




*Note:* 1993 data, preliminary

*Source:* FAO

prices of shrimp declined by some 40 percent as Chinese cultured shrimp came on the market. Similarly, in 1991, prices collapsed as Thai shrimp flooded the market (Figure 26).

Salmon prices declined sharply in 1989 and 1991 when huge Norwegian salmon production hit the market. The stabilization process by Norwegian salmon producers was initially successful, but further production increases in 1993 and 1994 also resulted in some weakening of the market (Figure 27).

Sea bass and sea bream are species where culturing is just coming into full swing. In 1994, the combined aquaculture production of these two species is estimated at 18 000 tonnes, as against 7 000 tonnes in 1990. In 1995, production figures are expected to increase even more, since Greece, the main producer, forecasts production of both species at 35 000 tonnes. Italy is the main market for these species, but prices have declined sharply as additional supplies entered the market (Figure 28).

The shrimp trade expanded in absolute terms and in comparison with other commodities. Ten years ago it used to account for 15 percent of total trade in fishery products (value terms). At present this share has increased to 18 percent. Groundfish and tuna also experienced sizeable growth in percentage terms with regard to other fishery commodities (Figures 29 and 30).

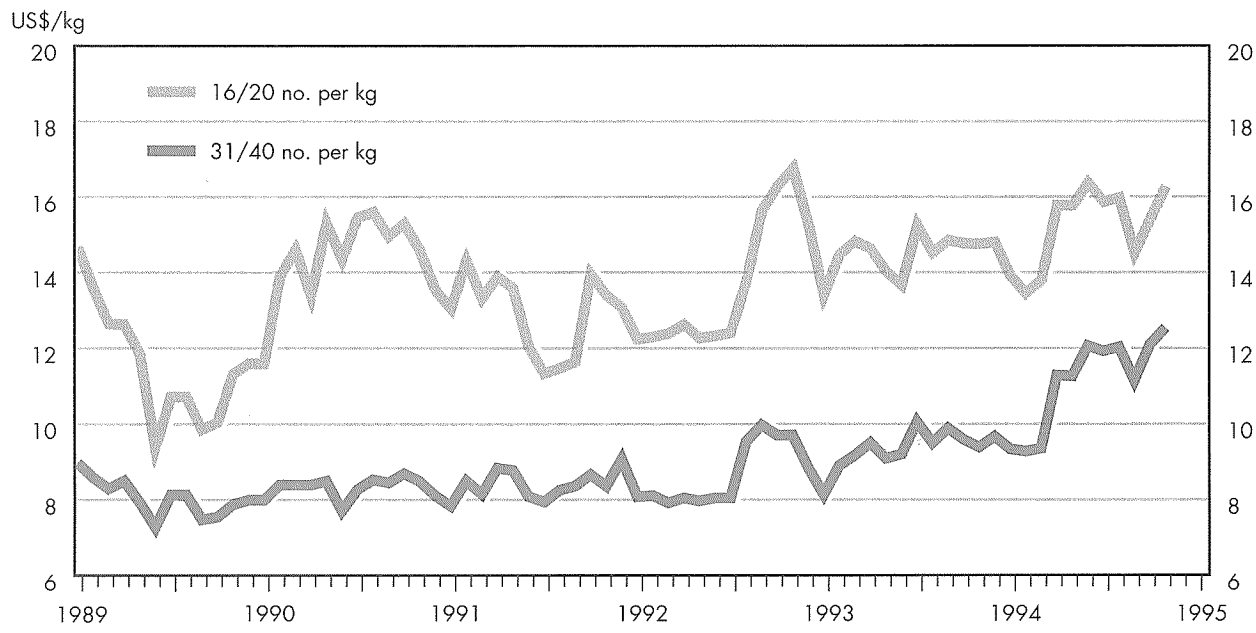
*Shrimp* production in 1994 is estimated to have exceeded the 1993 low, although staying below the 1992 figure. Countries reporting lower shrimp output in 1994 than in 1993 were: Ecuador, Indonesia (problems with pollution in shrimp farms), Norway (lower catch) and the United States. Countries on the positive side were Thailand (now the top shrimp farming country), Mexico (recovery of the wild shrimp catch combined with expansion in aquaculture output), India and Viet Nam (boom in the shrimp culture industry).

Shrimp prices were generally high in 1994, reflecting the shortage in supply created by the failure of the Chinese shrimp crop in the 1993/94 season. After some disturbance during the third quarter of 1994, the shrimp market recovered strongly in the closing months. The Japanese and European market reported good sales, especially for larger sizes. The United States market was somewhat slower, since the low dollar was making life difficult for most traders.

*Tuna* catches were very disappointing in 1994, with the western Pacific the only

*Figure 26*

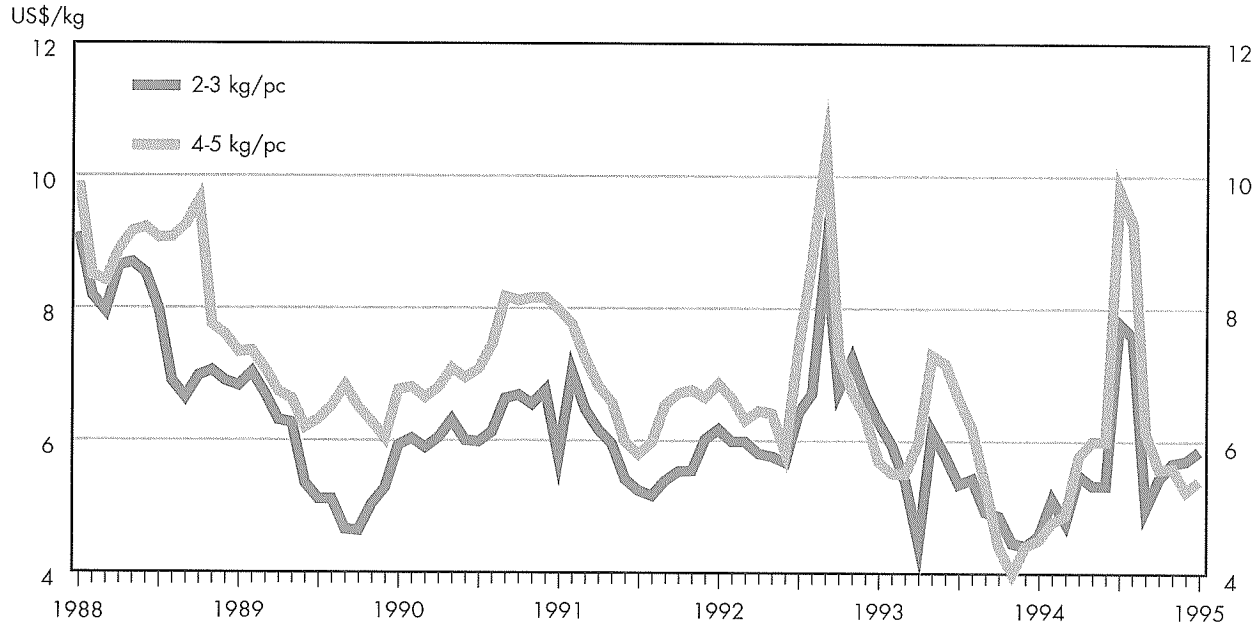
WHOLESALE PRICES OF BLACK TIGER PRAWNS IN JAPAN, 1989-95




*Source:* FAO

*Figure 27*

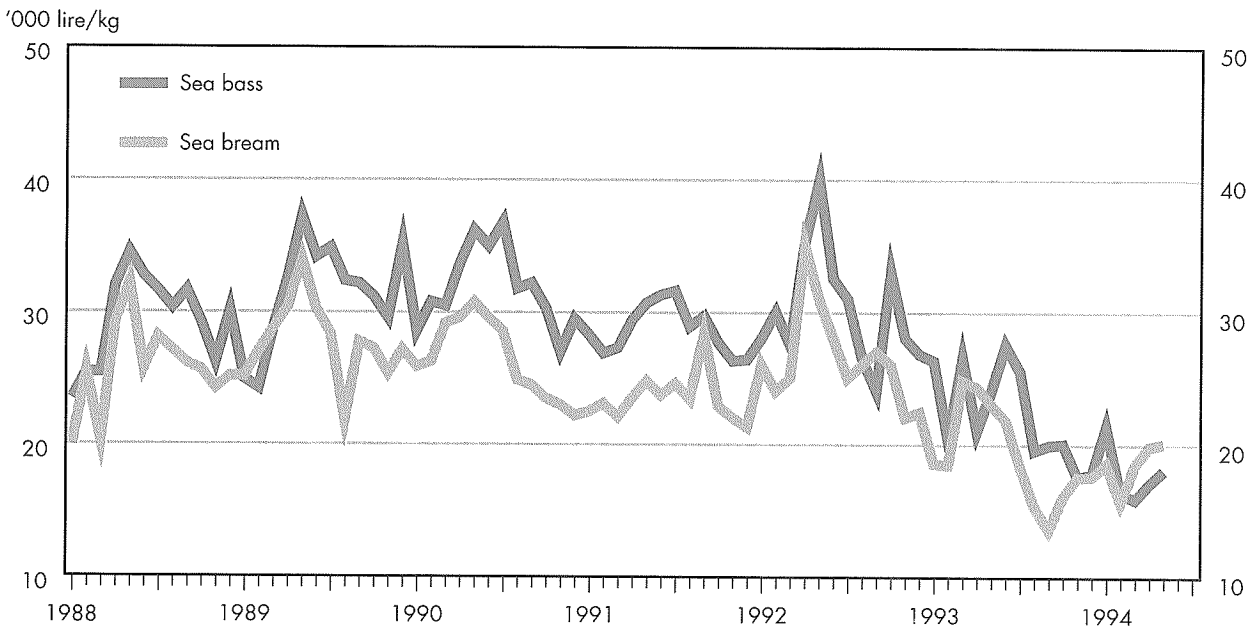
FRESH ATLANTIC SALMON, ORIGIN NORWAY, C.I.F. GERMANY, 1988-95




*Source:* FAO

*Figure 28*

ITALIAN WHOLESALE PRICES, 1988-94




*Source:* FAO

exception. A shortage of tuna raw material continued to overshadow the market and prices went up strongly. The only exception to the general trend of higher prices was the United States market, where cannery owners are more and more involved also in catching activities, and can thus control the price of the raw material.

The *groundfish* market in Europe experienced major problems in the spring of 1994, when prices collapsed as a result of excessive imports and domestic catches. In the closing months of 1994, the supply situation normalized leading to price increases for all major products. Consumer resistance was felt in the United States and, to a lesser extent, in Europe. Further price increases are likely since Alaska pollack will be in short supply in the coming months. Cod prices in Europe went up in the closing months of the year, because of lower supplies.

Surimi prices on the European market experienced a strong increase in December 1994, going up to US$3.00/kg from the low of US$2.40/kg touched in mid-1994. Demand is extremely good at present, and supply is less than usual.

The traditional exporters of *squid* reported lower catches in 1994, while some newcomers influenced the market. Squid prices stayed high. In the last quarter of 1994, trade was depressed on the Italian market as a result of the cholera scare.

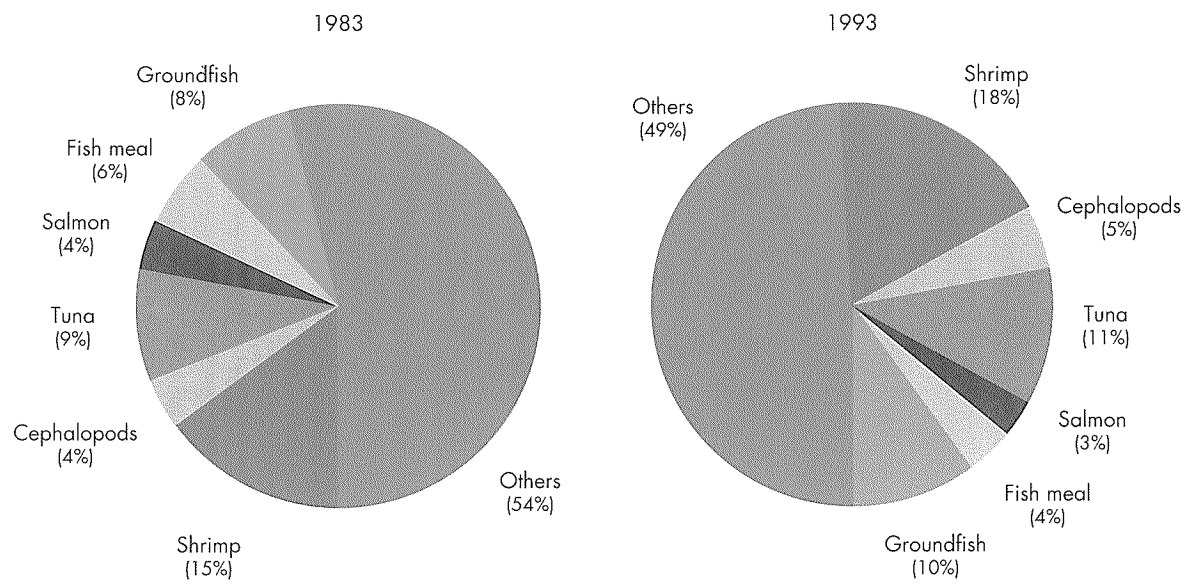
Octopus prices went up during the closed season in the Las Palmas area. Cuttlefish prices also moved upward in the last quarter of the year. This is the first time in recent years that prices of all three species of the cephalopod family have gone up at the same time.

The major *fish meal* exporting countries reported a 3.4 million tonne production in 1994, well ahead of the five-year average. Very high catches by Peruvian vessels led to a substantial increase in the country's fish meal output. Chile also reported higher fish meal production in 1994. Competitive fish meal prices prompted higher consumption especially in North America and in Europe.

In 1994, *fish oil* production was high in all major producing countries with the exception of Japan and Iceland. Prices moved upwards in the closing months of the year in response to large price increases in vegetable oils. Peru and Chile were dominating fish oil production and exports. In both countries production increased by more than 50 percent. Fish oil production by Scandinavian countries was stable in 1994, since a decline in Icelandic output was balanced by higher production in Denmark.

*Figures 29/30*

SHARE OF COMMODITIES IN TOTAL TRADE, 1983 AND 1993




*Source:* FAO

# SUPPLY AND DEMAND PROSPECTS: REGIONAL CONSIDERATIONS

The present report on the global developments of fisheries and aquaculture must by necessity mask many important differences existing between regions and states as to the current situation and future prospects in respect of demand for/and supply of fishery products. The following therefore provides a brief analysis by region.

## AFRICA

Fish plays an important part in the diet of many African communities, and a large number of families earn a living from capture fisheries, fish processing and marketing. In fact, it is not unlikely that the numbers of these families have grown more rapidly than the population since entry into fisheries has been easy, pressure on available land has increased and economies have otherwise stagnated. Available estimates of the growth in the number of canoes, both in marine and freshwater fisheries, support this hypothesis. Consumption is approximately 8 kg per caput and has fluctuated at this level during the two last decades. As meat consumption has been growing at a slower rate, the share of fish protein in the total animal protein supply has increased. Compared with artisanal canoes, the numbers of industrial vessels operated by African enterprises are relatively few. Aquaculture – which basically means pond farming of tilapia – is still insignificant in the food supply context, but has grown since the mid-1980s. Earnings from exports of fishery products exceed expenditures on imports which, however, in volume terms are larger than fish exports.

As free access is the rule rather than the exception in African capture fisheries, the problems of its fisheries are very similar to those of other regions, with one exception: an excess number of fishers together with underutilized vessels and gear. Overfishing is a problem mainly in trawl fisheries for shrimps, and in industrial fisheries for cephalopods off northwestern Africa. Past efforts, usually promoted by development aid agencies, to establish a viable rural aquaculture, mostly of tilapia in ponds, have frequently failed. Efforts by export-oriented aquaculture enterprises to start culture of marine shrimps have also met with difficulties.

Most African economies have undergone structural adjustment and are gradually converting into open market economies. In late 1994 the prospects – partly in view of improving export prices for traditional export crops – are for economic growth at least until the end of the decade. Thus, it seems likely that fishers will be encouraged by increased demand, reflected in increased prices, not only in foreign, non-African markets but also in local markets. In export-oriented demersal fisheries pressure will build for the fleet of trawlers to be replaced by more efficient vessels.

Given the likelihood of rapid growth in demand (3 percent population growth and 5-7 percent urbanization growth), fish prices, and not only high-priced products, will increase in real terms, as marine capture fisheries (with the exception of those for small pelagics off the West Coast of Africa) are unlikely to increase landings significantly. Aquaculture, although expanding rapidly, is starting from too low a level of production to have an impact before the end of the century.

It seems essential that an effort be made to introduce effective management of African marine capture fisheries. If improvements are not made in management, both artisanal and industrial fisheries will suffer. Industrial fisheries for demersal species will be plagued by overfishing to a much larger extent than up to now.

In view of their social and economic importance, governments have not normally placed restraints on the operation and expansion of canoe fisheries. However, this must change. Economic growth will intensify efforts in artisanal fisheries. The skilled, full-time fisheries will increase productivity through improved technology. As they introduce improved technology, the capital intensity of fisheries will increase, and so will demands for legally recognized long-term use rights of resources.

## ASIA AND THE PACIFIC

The status of fisheries in Asia and the Pacific varies. However, with the exception of some communities, fish is a valued and frequent ingredient in people's diets.

In the fisheries sector, Asia will be a promoter of increased interregional contacts. Increased demand for fish in the region will be rapid. In response, local aquaculture production will grow as will interregional trade.

During the remainder of this decade the absolute gap between the average salary of people in Africa and those in Asia will continue to grow. As a partial result, Asian aquaculture entrepreneurs will find it increasingly commercially attractive to develop aquaculture production units in Africa, using a favourable physical environment, African labour, Asian technology and capital from Asia or elsewhere.

The need to generate more wealth in processing and trade, coupled with the present international mobility of capital, makes it plausible that fish processing industries producing primarily for export markets will be established – in economies with cheap labour and surplus fish – using capital and expertise from importing states (i.e. members of the Organization for Economic Cooperation and Development, and also the newly industrializing Asian countries).

The fundamental problems of the fishery sector in Asia are similar to those recorded elsewhere. The problems of free access have been dealt with in Australia and New Zealand, and are being confronted in other countries (the Philippines and Sri Lanka).

The prospects for the major fisheries and aquaculture in Asia are somewhat different from those of the rest of the world.

In *South Asia*,[11] fish consumption varies from about the world's highest per caput consumption in the Maldives, to among the lowest in Pakistan and parts of northern India. For the region as a whole, however, consumption has been static during the last decade. In Bangladesh, per caput supplies dropped by about 30 percent during the last two decades. For the region as a whole the share of fish in animal protein supplies decreased over the same period. Aquaculture has a comparatively important role as supplier of freshwater fish and, increasingly, as generator of foreign exchange. In India and Bangladesh export-oriented culture of marine shrimps is expanding rapidly. With the exception of Sri Lanka, the region does not import fish. The industrial fisheries for shrimps in many parts have been out-competed by small mechanized boats.

In addition to overemployment and overcapitalization, artisanal and industrial sectors are competing for access to the same fishing grounds.

Since the mid- and late 1980s large devaluations of currencies have provoked a continued expansion of fishing capacities in export-oriented shrimp trawling, in spite of stable or declining overall landings. Inshore resources have suffered and in all those areas where intensive trawl fisheries for shrimp occur, significant shifts in species composition towards short-lived small species have taken place.

Several states in South Asia have enacted legislations that provide for the regulation of fisheries. These regulations, however, are largely confined to biological management measures such as closed seasons, mesh size regulations and zonation of inshore fishing grounds to protect the interests of artisanal fisheries. Limitations on numbers of vessels, gear, tonnage and horsepower are not yet common in the region but are urgently required.

In South Asia fish is tending to lose its character as a food for the poor, since it is becoming less affordable by the poorer sectors of the population. This issue is not serious as yet but needs careful monitoring.

The expected economic growth in South Asia is likely to stimulate demand for fish considerably, almost irrespective of developments for red meats, consumption of which is low but increasing. Given that wild stocks are exploited or overexploited with few exceptions (the Andaman Sea), aquaculturists will have considerable incentives to expand their production. Reduction of postharvest losses, which are substantial, will come about gradually with economic growth. Discards are less of a problem given that bycatch, obtained in shrimp trawling with small mechanized boats in most areas, is disposed of to local consumers.

The prospects for expanding marine catches of conventional species in inshore and offshore waters are believed to be very limited. Some potentials may exist to expand tuna catches further and commence the exploitation of unconventional species (mesopelagics) in the Arabian Sea.

In *Southeast Asia*[12] fisheries including

[11] Pakistan, Bangladesh, India, Nepal, the Maldives and Sri Lanka.

[12] Cambodia, Indonesia, Malaysia, Myanmar, the Philippines, Thailand and Viet Nam.

aquaculture have expanded along with other sectors in the rapidly expanding economies, and the per caput fish consumption has grown during the last decades. Fish processing industries have developed and Thailand is now the world leader in exports of fish and fish products.

The fundamental problems are similar to those recorded elsewhere: excessive effort – both in the expanding industrial fisheries and in inshore small-scale fisheries – and very limited capabilities to enforce access and effort limitations. However, there are promising attempts (in the Philippines) to deal with the management issue because they refer not only to the user rights of industrial fisheries, but primarily to those of artisanal fishing. Neither postharvest losses nor discards are problems as prominent as elsewhere. Modification of aquatic environments (urban waste, industrial waste, deforestation and mangrove clearing) causes problems both for inland fisheries and nearshore marine fisheries. Climate change and sea-level rise (e.g. "reef bleaching") are affecting reef-based fisheries in Indonesia and in the Philippines.

In terms of areas suitable for shrimp culture, good prospects for expansion continue to exist in the region. The extent to which this potential can be beneficially and sustainably utilized will depend mainly on the governments' ability to guide and plan the development process, largely driven by private investors, in a rational manner. This entails strengthening of legislation, regional and local level coastal area planning, monitoring and enforcement.

Economic growth is projected to continue in Southeast Asia. Local demand will grow, although possibly not so rapidly as in South Asia, since per caput consumption is already above world average. Mechanization and industrialization of fisheries will continue, as will development and growth of aquaculture. Although marine wild stocks are close to being fully exploited there are some exceptions. It is likely that output will rise rapidly in Myanmar, both from capture fisheries and from aquaculture.

*East Asia*[13] accounted in 1990 for almost one-third of the world's total fish consumption. In China per caput supply of fish for human consumption doubled during the last decade, while its share of fish in animal protein intake (around one-fifth) remained fairly steady. Consumption in Japan remained high – about 70 kg (live-weight equivalent) per caput. In the Democratic People's Republic of Korea and the Republic of Korea, fish has a very important nutritional role reflected in the high average level of consumption, as well as in the high shares of total animal protein supply.

Production in China expanded rapidly, from 4.9 to 15 million tonnes between 1982 and 1992. In 1992 some 40 percent came from inland fisheries and freshwater aquaculture. Most of the increased Chinese production has been consumed in China. Under pressure from a strong currency, imports and reduced access to overseas fishing grounds, landings by Japanese capture fisheries are declining. Consumption is being maintained through imports.

The fisheries of East Asia have varying problems. In China the unbridled expansion of aquaculture has led to problems not only for aquaculture but also for coastal fisheries. In Japan the strength of the yen is placing the fishing industry under strong and continuous pressure to modernize and improve productivity. In view of the state of exploitation of stocks fished by Japan this is becoming an extremely difficult task, implying a continuous reduction in the number of sea-going fishermen. The Democratic People's Republic of Korea and the Republic of Korea have different problems. However, both they and Japan are atypical in the sense that they have a relatively well-developed system for managing inshore, artisanal fisheries.

For the fisheries of East Asia it would seem that there are two ways forward, i.e. the modernization of fisheries and continued development of aquaculture. In Japan and on the Korean peninsula the modernization of capture fisheries and stimulation of aquaculture – and its integration with fisheries – would seem to have better prospects than elsewhere. In part, this results from an established and functioning system for community-based management of coastal fisheries.

Potential for expanding marine capture fishery production in the East Asian region is very limited and mainly related to the restoration of depleted resources through management measures. Many of the high-value resources are fully or overexploited and catches per unit of effort have declined substantially in these fisheries. The share of low-value species and

[13] China, Japan, Democratic People's Republic of Korea, Republic of Korea and Mongolia.

small-sized individuals in landings has increased over the years.

Expansion of freshwater fish production is likely to continue. It would seem that the growth of culture of marine shrimps is now slowing down. However, given the aquaculture expertise in the East Asia region it is to be expected that other species will be identified, developed and put through the same development cycle.

In the *South Pacific*[14] tuna fisheries are important to the majority of the small island developing states (SIDS). The South Pacific has the world's richest tuna fishing grounds, with about 60 percent of world tuna catches coming from the region. For some of the states (e.g. Kiribati and the Federated States of Micronesia) revenue earned from the exploitation of their highly migratory fish stocks accounts for more than 50 percent of annual national government revenue. Fish consumption is high in SIDS. Aquaculture does not contribute significantly to production.

On the whole the problems of fisheries in the South Pacific differ from those elsewhere since management of fisheries is relatively advanced. Australia and New Zealand in the 1980s introduced major changes in their fisheries legislation and in the manner in which their fisheries were administrated, and individual transferable quotas (ITQs) have been adopted as a principal mechanism for pursuing fisheries conservation and management. Australia and New Zealand are moving to a full ecosystems approach to conservation and management of fisheries.

Small island developing states in the South Pacific are focusing on traditional conservation and management arrangements for coastal fisheries in an effort to come to terms with excessive fishing efforts on inshore resources. Reef-based fisheries in SIDS are greatly affected by climate change and sea-level rise.

The economic prospects for commercial fisheries for tuna in the South Pacific are good. Tuna is not subject to aquaculture[15] on any scale and the exploitation of wild stocks will soon reach its maximum. It would not be unreasonable to expect a continued increase in the real price of tuna on the world market. Under the aegis of the Forum Fisheries Agency, tuna fishing management is making good progress. Thus, it would appear that for this fishery – as opposed to many others – it will become possible for participating states to realize some economic rent.

## EUROPE AND THE FORMER USSR

In the European Community[16] consumption increased from just over 8 million tonnes in 1984 to nearly 9.5 million tonnes in 1992. Average per caput consumption of fish increased from 15 kg in 1983 to 22 kg in 1990. Total production of fish and shellfish (excluding aquaculture) was around 6 million tonnes in 1992 and has been more or less static since 1983. Most of the commercially important fish stocks in the waters of the European Community are either fully or overexploited. There is little opportunity for an increase in total landings of fish from these waters for human consumption. Around a quarter of total production for human consumption comes from the EEZs of other countries under access agreements concluded by the European Community with those states.

European Community aquaculture production has increased gradually, rising to 974 000 tonnes in 1992. Production is concentrated on relatively high-value species of finfish (288 500 tonnes) and shellfish (685 500 tonnes). Since 1985, shellfish production has been static but finfish production has increased by 75 percent. Aquaculture may provide opportunities for increased supplies of fish for human consumption, depending on market conditions and physical constraints such as the availability of suitable sites.

The European Community is a net importer of fish. The fish trade gap has been increasing and stood at 2.6 million tonnes in 1992. Overall, imports represent 40 percent of European Community supplies by volume, although for

[14] The South Pacific includes 16 politically independent and/or self-governing states, 14 of which are developing states. They are Australia, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, New Zealand, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu. In addition there are seven French (French Polynesia, New Caledonia and Wallis and Futuna), United Kingdom (Pitcairn Island) and United States (American Samoa, Guam and the Northern Marianas) politically dependent territories in the region.

[15] Apart from a few establishments for the fattening of bluefin tuna.

[16] Data refer to membership prior to 1995: Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain and the United Kingdom.

the commercially important demersal species this figure amounts to 83 percent.

Overcapacity is regarded as the most serious management problem for the European Community, which has a fishing fleet two-thirds greater than that required to achieve landings commensurate with fishery management plans.

Given the expected increase in demand and the poor prospects for supply increases from within the European Community, real fish prices may increase and imports rise. The European Community will have strong incentives to continue to look for fishing opportunities in third country waters. These tendencies are not expected to be modified by the inclusion of three new European Community members.

Perhaps more than in any other region, the problems and prospects of the fishery sector in the former USSR and Central and Eastern Europe are determined by the economic and political changes of recent years. These have caused stagnation and contraction of most of the industrial fisheries, and it appears that small-scale fisheries have not yet significantly contributed to cover the shortfall of fish supplies that has arisen. Per caput supplies have fallen even more rapidly as companies have increased their sales of fish to foreign markets.

The fisheries of Iceland and Norway are modern, dynamic and export-oriented. Although management of their capture fisheries can still be improved, prospects are for continued high production in addition to growth and expansion in aquaculture. A strong effort to generate more wealth can be expected in the processing and marketing of fish and fish products from these countries.

## LATIN AMERICA AND THE CARIBBEAN

More than in any other region, the fishing industry in Latin America is oriented to supply external markets. Fish make notable contributions to the exports of Argentina, Chile, Ecuador, Peru and Uruguay. Exports of fish meal and oil have produced a large share of the export revenue; an average of 60 percent of yearly landings of marine capture fisheries are converted into these products. Fish to local consumers – the majority of whom much prefer red meats – generally originate from the artisanal fisheries. These are slowly transforming as fishermen establish means to supply their high-value species to export markets as well.

Caribbean fisheries are radically different. Per caput consumption is high, as are imports. There are almost no industrial fisheries. Local fisheries are artisanal in nature. Tourists consume a large share of the imported fish.

The main problems of the industry are similar to those experienced elsewhere: almost no access and effort limitations, too many vessels and vessels that are too old. Macro-economic reforms in some states, however, are forcing the older and more inefficient vessels to stop fishing although weak access control at the same time fosters demands to increase the number of vessels in profitable, but already fully exploited, fisheries. Artisanal fisheries are expanding, but not at the rate that would be possible if they were to be better linked to urban markets, since urbanization is higher in Latin America than elsewhere.

Industrial fisheries in Latin America are probably still more vulnerable to macro-economic policy shifts than fisheries in the majority of other regions. The economies of some of the major fishing nations are still undergoing structural reform and stabilization. The future well-being of the industry is dependent on the success of these reforms: open market economies must remain and the inflation must be kept in check.

Given the high dependence on foreign markets and the weak local demand for fish, prospects for Latin American fisheries are intimately tied to international developments. In the international context it seems likely that demand, and prices, for Latin American fish exports will increase until the end of the decade. It would seem plausible that an ever larger proportion of Latin American fish products will find markets in Asia.

As most commercially exploitable species are fully fished, Latin American consumers would have to be supplied at the expense of exports, or with the small pelagics that are at present turned into fish meal and oil. It is not evident what the outcome will be, but a decline in average fish consumption cannot be excluded for Latin America.

The artisanal fisheries of the Caribbean may generate more value added through increased channelling of production to tourist and export markets. Recreational fisheries are also likely to increase in importance.

## NORTH AMERICA[17]

Per caput consumption of seafood increased by roughly 30 percent between 1970 and 1990,

[17] United States and Canada.

reaching just below 22 kg per caput in 1990. In spite of this growth, seafood remains a minor component of average food consumption. Plausible explanations for the growth in seafood consumption are the increased prices of other meats, in relation to fish, and a growing awareness of the health properties of fish. In the United States, fish consumption has a particular characteristic – in comparison with the other regions considered – in that almost two-thirds of fish eaten is consumed outside the home.

Over the last two decades both the fish production in the region and fish imports have grown. In the last few years imports of cod caught in the Barents Sea have largely replaced declines in domestic cod production. Over the same period imports of canned tuna have contracted in the United States market, which normally accounts for about one-third of world consumption.

Aquaculture is growing, accounting in 1990 for 5.4 percent of fish production in the United States.

Since 1990 marine catches in Canada have declined and catches in the United States have stabilized. However, in the United States this has been achieved mainly through increased production of lower-value species (such as Alaskan pollack and menhaden).

Effective fisheries management is a major problem also in North America. In view of unregulated high seas fisheries in the north Atlantic, Canadian domestic management efforts did not prove sufficient to sustain the cod fisheries in the northwest Atlantic. Most United States fisheries are still open access and, as a result, overcapacity is considered a major problem. In particular the fisheries are under pressure by environmental and other interest groups to reduce levels of catch and discards.

Given the slow population growth, the prospects are that consumer demand for fish will expand rather slowly, and the past rising trends in demand and consumption will not continue.

Over one-quarter of all stocks in the United States are currently considered overexploited, and declines in production are likely to be experienced. Most of the remaining stocks are considered at or near their maximum exploitation levels. A few stocks, such as Canadian hake, are thought to be underutilized. Increase in production of hake, however, is not likely to offset the recent (and potential future) decline in catch from the other stocks. While there are likely to be some gains from improved management, these are largely economic- rather than production-based. Developments of new markets or processing techniques may create some incentives in the future.

# OUTLOOK: CAN FISHERIES AND AQUACULTURE SATISFY FUTURE DEMAND FOR FISH?

The demand for fish products in the aggregate depends on three factors: population, income and price, the latter incorporating a number of factors such as consumer preferences. Of these factors population is the most important since, with stable relative prices, it normally accounts for about two-thirds of change in total demand.

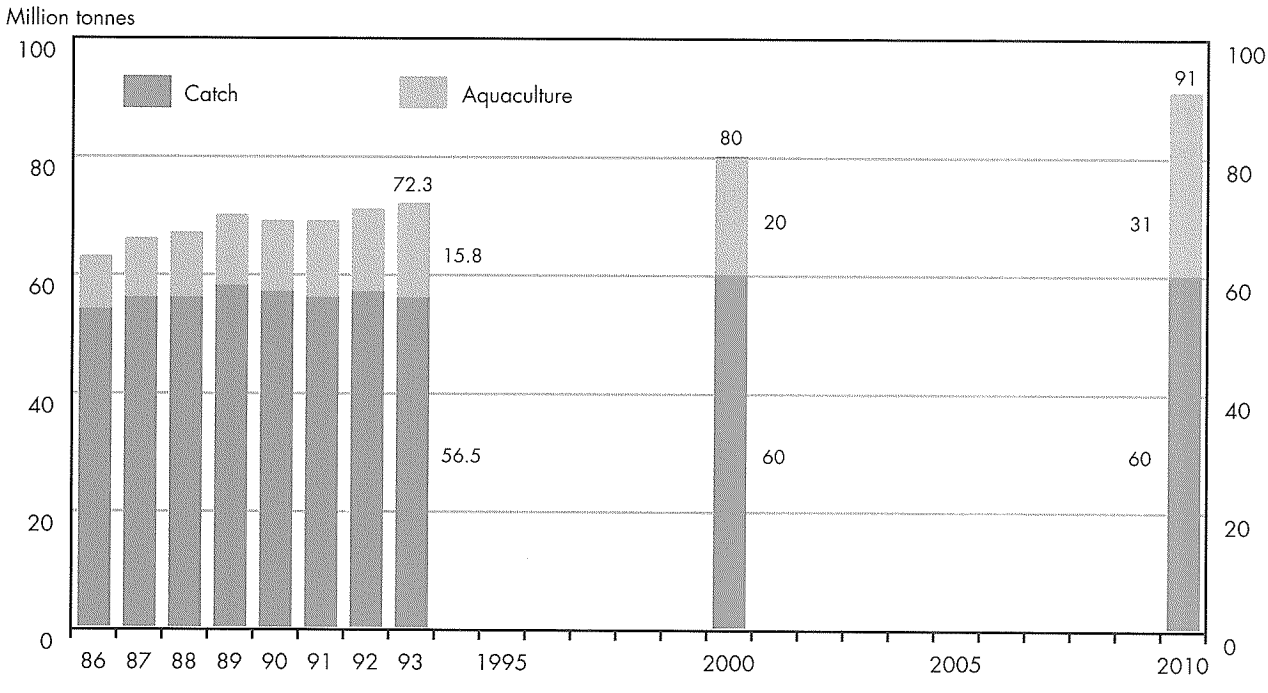
In 1993 world food fish supplies were 72.3 million tonnes. Of these, 56.5 million tonnes came from capture fisheries and 15.8 million tonnes from aquaculture. Using the 1993 estimated world level of per caput fish consumption of 13.0 kg/year (in live-weight equivalent), the increase in world population, forecasted to reach 7 032 million by the year 2010, would require total food fish supplies of 91 million tonnes. Figure 31 gives an illustration of possible trends.

Maintaining present per caput consumption levels in the year 2010 would therefore require an additional 19 million tonnes of food fish.

The contribution to food fish from marine and freshwater capture fisheries, in the longer term, is likely to oscillate around 60 million tonnes per year (about 53 million tonnes from marine and 7 million tonnes from freshwater sources). This would be an increase of 3.5 million tonnes above 1993 catches used for direct human consumption. Improved conservation and management measures will therefore not significantly change the overall contribution to food fish supplies from capture fisheries. The effect of fisheries conservation and management is stock rebuilding to ensure the contribution of the longer-lived demersal species to overall supplies as well as to improve the size of fish captured to meet consumer preferences. Management should also result in increased stability in stock yields, for both demersal and pelagic species. Reducing the present levels of

*Figure 31*

PROJECTED DEMAND TO THE YEAR 2010 FOR FISH FOR HUMAN CONSUMPTION




*Source:* FAO

*TABLE 2*

**Total fish production in 1990-93 with forecast of supply to 2010**

| Year | Capture fisheries | + Aquaculture | = Food | + Feed | = Total production |
|---|---|---|---|---|---|
| | (..... Million tonnes .....) | | | | |
| **1990** | **57.8** | **12.1** | **69.9** | **27.7** | **97.6** |
| **1993** | **56.5** | **15.8** | **72.3** | **29.0** | **101.3** |
| | ***(+3.5)*** | ***(+4.2)*** | ***(+7.7)*** | | |
| **2000** | **60.0** | **20.0** | **80.0** | **29.0** | **109.0** |
| | | ***(+11.0)*** | ***(+11.0)*** | | |
| **2010** | **60.0** | **31.0** | **91.0** | **29.0** | **120.0** |

bycatches, particularly in respect of juveniles, can be expected to increase the contribution to the potential yield from marine catches but an estimate of this contribution is not at present available.

The balance of 31 million tonnes in the supplies of food fish required by the year 2010 would have to come from aquaculture, which has been expanding at a rate of 1 million tonnes a year, increasing to almost 2 million tonnes in 1993. This growth should continue, recognizing the significant potential of increased farmed fish production in Africa and Latin America. To produce 31 million tonnes by the year 2010 would require an increase of just over 15 million tonnes above 1993 levels, an overall average annual increase of less than 1 million tonnes a year.

The significance of increased aquaculture production in satisfying projected demand to the year 2010 will depend on consumer acceptance of farmed products. Most of the production will continue to come from finfish and from freshwater species. Carps account for 70 percent of total farmed finfish, and China and India are the largest producers. These two states more than doubled their production between 1984 and 1992 while supporting an 8 percent increase in price. Cultured freshwater fish have the greatest potential for increased domestic supplies, where favourable farming conditions occur.

The production of molluscs is also considered to have great potential. The technology is available for different levels of sophistication and suitable growing areas are extensive. The major constraints are: *i)* the development of domestic markets; *ii)* quality control through depuration and certification of area of production; and *iii)* prevention of coastal pollution. These are initiatives requiring the attention of governments in order to allow for expansion by the private sector.

In addition to the potential contribution from aquaculture, it is also possible that additional food supplies could come from those catches that are at present used for the production of fish meal. In 1993, fish meal consumed some 29 million tonnes of fish, and part of this can be expected to be redirected to the market for human consumption, particularly some of the small pelagic fish, which in many parts of the world have a good degree of consumer acceptance. However, the large volumes caught over short periods will require technology to develop suitable new products for direct food consumption.

# ANNEX TABLES

*1*

## World total fish production by marine and inland waters, 1950-93

| Year | Catch | Marine | Inland |
|---|---|---|---|
| | (..... '000 tonnes .....) | | |
| 1950 | 20 750 | 18 557 | 2 193 |
| 1951 | 22 882 | 20 637 | 2 245 |
| 1952 | 24 416 | 22 118 | 2 298 |
| 1953 | 24 825 | 22 473 | 2 352 |
| 1954 | 26 495 | 24 088 | 2 407 |
| 1955 | 27 599 | 25 135 | 2 464 |
| 1956 | 28 958 | 26 436 | 2 522 |
| 1957 | 29 752 | 27 171 | 2 581 |
| 1958 | 31 013 | 28 371 | 2 642 |
| 1959 | 33 950 | 31 246 | 2 704 |
| 1960 | 36 869 | 34 101 | 2 768 |
| 1961 | 40 458 | 37 340 | 3 118 |
| 1962 | 43 515 | 40 577 | 2 938 |
| 1963 | 44 985 | 41 787 | 3 198 |
| 1964 | 48 411 | 45 013 | 3 398 |
| 1965 | 50 767 | 46 060 | 4 707 |
| 1966 | 54 716 | 49 378 | 5 338 |
| 1967 | 57 780 | 52 667 | 5 113 |
| 1968 | 61 311 | 55 886 | 5 425 |
| 1969 | 60 300 | 54 380 | 5 920 |
| 1970 | 65 211 | 59 156 | 6 055 |
| 1971 | 65 604 | 59 376 | 6 228 |
| 1972 | 61 581 | 55 211 | 6 370 |
| 1973 | 62 207 | 55 587 | 6 620 |
| 1974 | 65 562 | 58 883 | 6 679 |
| 1975 | 65 469 | 58 641 | 6 828 |
| 1976 | 68 988 | 62 187 | 6 801 |
| 1977 | 67 905 | 60 860 | 7 045 |
| 1978 | 69 998 | 63 031 | 6 967 |
| 1979 | 70 831 | 63 704 | 7 127 |
| 1980 | 72 028 | 64 492 | 7 536 |
| 1981 | 74 592 | 66 514 | 8 078 |
| 1982 | 76 768 | 68 310 | 8 458 |
| 1983 | 77 497 | 68 286 | 9 211 |
| 1984 | 83 932 | 73 914 | 10 018 |
| 1985 | 86 378 | 75 714 | 10 664 |
| 1986 | 92 845 | 81 100 | 11 745 |
| 1987 | 94 454 | 81 698 | 12 756 |
| 1988 | 99 132 | 85 671 | 13 461 |
| 1989 | 100 353 | 86 427 | 13 926 |
| 1990 | 97 593 | 82 850 | 14 743 |
| 1991 | 97 376 | 82 549 | 14 828 |
| 1992 | 98 729 | 83 039 | 15 690 |
| 1993 | 101 270 | 84 261 | 17 009 |

*Notes:* 1993 data, preliminary; includes aquaculture data

*2*

## World total fish production compared with aquaculture, 1984-93

| Year | Catch | Aquaculture |
|---|---|---|
| | (..... '000 tonnes .....) | |
| 1984 | 83 932 | 6 933 |
| 1985 | 86 378 | 7 729 |
| 1986 | 92 845 | 8 807 |
| 1987 | 94 402 | 10 151 |
| 1988 | 99 086 | 11 210 |
| 1989 | 100 311 | 11 497 |
| 1990 | 97 556 | 12 121 |
| 1991 | 97 052 | 12 781 |
| 1992 | 98 113 | 13 921 |
| 1993 | 101 270 | 15 921 |

*Note:* 1993 data, preliminary
*Source:* FAO

*3*

## Aquaculture production, 1984-93

| Year | Aquaculture |
|---|---|
| | (Million tonnes) |
| 1984 | 7 |
| 1985 | 8 |
| 1986 | 9 |
| 1987 | 10 |
| 1988 | 11 |
| 1989 | 11 |
| 1990 | 12 |
| 1991 | 13 |
| 1992 | 14 |
| 1993 | 16 |

*Note:* 1993 data, preliminary
*Source:* FAO

*4*

## Marine catch by principal ten species and cumulative catch as a percentage of the marine world total, 1973, 1983 and 1993

| 1973 | Marine catch | Cumulative |
|---|---|---|
| | *('000 tonnes)* | *%* |
| Alaska pollack | 4 617 | 8 |
| Atlantic cod | 2 539 | 13 |
| Capelin | 2 054 | 17 |
| Atlantic herring | 1 980 | 20 |
| Chub mackerel | 1 932 | 24 |
| Anchoveta | 1 705 | 27 |
| Atlantic mackerel | 1 021 | 29 |
| European pilchard | 949 | 30 |
| Largehead hairtail | 804 | 32 |
| Saithe (=Pollack) | 665 | 33 |
| *Total marine catches* | 55 585 | |

| 1983 | Marine catch | Cumulative |
|---|---|---|
| | *('000 tonnes)* | *%* |
| Alaska pollack | 4 858 | 7 |
| Japanese pilchard | 4 465 | 14 |
| South American pilchard | 4 066 | 20 |
| Capelin | 2 553 | 23 |
| Atlantic cod | 2 072 | 26 |
| Chilean jack mackerel | 1 679 | 29 |
| Chub mackerel | 1 675 | 31 |
| Atlantic herring | 1 141 | 33 |
| European pilchard | 961 | 34 |
| Gulf menhaden | 924 | 36 |
| *Total marine catches* | 68 279 | |

| 1993 | Marine catch | Cumulative |
|---|---|---|
| | *('000 tonnes)* | *%* |
| Anchoveta | 8 300 | 10 |
| Alaska pollack | 4 758 | 15 |
| Chilean jack mackerel | 3 364 | 19 |
| Japanese pilchard | 2 306 | 22 |
| Capelin | 1 742 | 24 |
| South American pilchard | 1 624 | 26 |
| Atlantic herring | 1 613 | 28 |
| Skipjack tuna | 1 365 | 30 |
| Atlantic cod | 1 139 | 31 |
| European pilchard | 1 110 | 32 |
| *Total marine catches* | 84 261 | |

*Note:* 1993 data, preliminary
*Source:* FAO

*5*

## World marine catch by principal producers and cumulative catch as a percentage of the world marine catch, 1993

| Country/region | Marine catch | Cumulative |
|---|---|---|
| | *('000 tonnes)* | *%* |
| China | 10 066 | 12 |
| Peru | 8 410 | 22 |
| Japan | 8 273 | 32 |
| Chile | 6 020 | 39 |
| USA | 5 595 | 46 |
| Russian Federation | 4 154 | 50 |
| Thailand | 3 065 | 54 |
| Indonesia | 2 731 | 57 |
| Korea, Rep. | 2 619 | 60 |
| Norway | 2 562 | 63 |
| India | 2 473 | 66 |
| Iceland | 1 718 | 68 |
| Philippines | 1 688 | 70 |
| Korea, DPR | 1 640 | 72 |
| Denmark | 1 499 | 74 |
| Spain | 1 300 | 76 |
| Taiwan, Province of China | 1 144 | 77 |
| Canada | 1 135 | 78 |
| Mexico | 1 036 | 80 |
| Viet Nam | 810 | 81 |
| *World total marine catches* | 84 262 | |

*Note:* 1993 data, preliminary
*Source:* FAO

*6*

## Percentage of fully fished, overfished, depleted and recovering stocks, 1992

| Area | Demersal | Pelagic | Crustaceans | Molluscs |
|---|---|---|---|---|
| | (..... % .....) | | | |
| NW Atlantic | 75 | 94 | 95 | 83 |
| NE Atlantic | 79 | 72 | 83 | 82 |
| WC Atlantic | 59 | 68 | 0 | ... |
| EC Atlantic | 95 | 97 | 94 | 93 |
| Med + Black Sea | ... | ... | ... | ... |
| SW Atlantic | 72 | 77 | 95 | 80 |
| SE Atlantic | 76 | 80 | ... | ... |
| W Indian | ... | ... | ... | ... |
| E Indian | ... | ... | ... | ... |
| NW Pacific | 93 | 80 | ... | ... |
| NE Pacific | 71 | ... | 95 | ... |
| WC Pacific | 95 | ... | 78 | 0 |
| EC Pacific | 0 | 0 | 90 | 0 |
| SW Pacific | 77 | ... | 62 | 64 |
| SE Pacific | 60 | 70 | ... | 0 |
| Antarctic | ... | ... | 0 | 0 |

*Note:* ... indicate status of stocks unknown

7A

## World total tonnage, numbers of decked and numbers of undecked vessels by region, 1970-82

| | 1970 | 1975 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|
| | (Tonnes) | | | | |
| **World total** | | | | | |
| Number decked vessels | 580 980 | 683 170 | 812 030 | 821 820 | 874 150 |
| GRT decked vessels | 13 615 900 | 17 229 600 | 19 927 300 | 20 204 100 | 20 821 600 |
| Number undecked vessels | 1 516 390 | 1 639 850 | 1 802 430 | 1 800 570 | 2 048 600 |
| **Africa** | | | | | |
| Number decked vessels | 4 150 | 4 520 | 5 580 | 5 850 | 5 530 |
| GRT decked vessels | 244 000 | 238 700 | 326 600 | 354 600 | 381 200 |
| Number undecked vessels | 186 930 | 340 080 | 370 950 | 365 430 | 371 140 |
| **North America** | | | | | |
| Number decked vessels | 19 840 | 23 740 | 28 220 | 28 660 | 46 550 |
| GRT decked vessels | 1 076 900 | 1 326 400 | 1 593 100 | 1 776 900 | 1 999 100 |
| Number undecked vessels | 155 720 | 170 850 | 195 210 | 190 250 | 189 340 |
| **South America** | | | | | |
| Number decked vessels | 8 310 | 7 570 | 9 280 | 9 490 | 9 700 |
| GRT decked vessels | 361 500 | 339 000 | 509 600 | 535 500 | 549 700 |
| Number undecked vessels | 70 760 | 68 910 | 74 060 | 72 870 | 76 830 |
| **Asia** | | | | | |
| Number decked vessels | 467 690 | 539 230 | 657 640 | 669 980 | 720 210 |
| GRT decked vessels | 4 802 300 | 5 929 600 | 7 292 700 | 7 423 700 | 7 819 700 |
| Number undecked vessels | 993 200 | 937 680 | 1 031 360 | 1 041 630 | 1 261 930 |
| **Europe** | | | | | |
| Number decked vessels | 106 060 | 101 670 | 104 850 | 101 630 | 85 300 |
| GRT decked vessels | 3 097 400 | 3 404 000 | 3 625 700 | 3 566 000 | 3 479 500 |
| Number undecked vessels | 60 300 | 59 710 | 55 060 | 52 620 | 70 370 |
| **Oceania** | | | | | |
| Number decked vessels | 1 850 | 2 200 | 1 890 | 1 940 | 2 760 |
| GRT decked vessels | 37 100 | 54 700 | 70 700 | 77 300 | 92 400 |
| Number undecked vessels | 49 460 | 62 600 | 75 760 | 77 740 | 78 960 |
| **Former USSR** | | | | | |
| Number decked vessels | 3 050 | 4 210 | 4 550 | 4 250 | 4 060 |
| GRT decked vessels | 3 996 700 | 5 937 400 | 6 508 900 | 6 470 100 | 6 499 900 |
| Number undecked vessels | ... | ... | ... | ... | ... |

*Source:* FAO

*7B*

## World total tonnage, numbers of decked and numbers of undecked vessels by region, 1983-87

| | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|
| | (..... Tonnes .....) | | | | |
| **World total** | | | | | |
| Number decked vessels | 900 340 | 930 910 | 969 030 | 1 011 190 | 1 059 680 |
| GRT decked vessels | 21 338 900 | 21 467 900 | 22 156 500 | 22 906 500 | 23 522 000 |
| Number undecked vessels | 2 122 510 | 2 162 520 | 2 186 430 | 2 170 510 | 2 229 160 |
| **Africa** | | | | | |
| Number decked vessels | 5 520 | 6 270 | 6 500 | 6 820 | 7 110 |
| GRT decked vessels | 409 200 | 456 000 | 468 700 | 519 700 | 526 400 |
| Number undecked vessels | 405 860 | 396 970 | 385 360 | 392 190 | 396 820 |
| **North America** | | | | | |
| Number decked vessels | 46 920 | 49 780 | 47 890 | 52 710 | 51 740 |
| GRT decked vessels | 2 027 200 | 2 124 800 | 2 424 100 | 2 429 300 | 2 426 800 |
| Number undecked vessels | 196 640 | 199 890 | 207 280 | 205 540 | 207 380 |
| **South America** | | | | | |
| Number decked vessels | 9 630 | 9 830 | 9 400 | 10 200 | 10 380 |
| GRT decked vessels | 568 100 | 603 600 | 610 200 | 633 100 | 661 100 |
| Number undecked vessels | 80 470 | 81 880 | 83 400 | 86 500 | 87 400 |
| **Asia** | | | | | |
| Number decked vessels | 745 280 | 777 710 | 810 090 | 848 180 | 900 540 |
| GRT decked vessels | 8 121 600 | 8 464 200 | 8 654 700 | 9 050 000 | 9 608 600 |
| Number undecked vessels | 1 291 300 | 1 331 150 | 1 358 530 | 1 339 720 | 1 392 770 |
| **Europe** | | | | | |
| Number decked vessels | 87 230 | 81 990 | 89 980 | 88 370 | 84 870 |
| GRT decked vessels | 3 525 900 | 3 400 600 | 3 434 300 | 3 338 500 | 3 371 500 |
| Number undecked vessels | 68 520 | 70 480 | 67 770 | 64 520 | 64 290 |
| **Oceania** | | | | | |
| Number decked vessels | 1 680 | 1 700 | 1 510 | 1 540 | 1 690 |
| GRT decked vessels | 79 800 | 90 100 | 81 600 | 88 400 | 98 200 |
| Number undecked vessels | 79 690 | 82 130 | 84 080 | 82 010 | 80 920 |
| **Former USSR** | | | | | |
| Number decked vessels | 4 060 | 3 590 | 3 620 | 3 340 | 3 320 |
| GRT decked vessels | 6 607 100 | 6 328 600 | 6 483 000 | 6 847 400 | 6 829 400 |
| Number undecked vessels | ... | ... | ... | ... | ... |

*Source:* FAO

*7C*

## World total tonnage, numbers of decked and numbers of undecked vessels by region, 1988-92

| | 1988 | 1989 | 1990 | 1991 | 1992 |
|---|---|---|---|---|---|
| | (..... Tonnes .....) | | | | |
| **World total** | | | | | |
| Number decked vessels | 1 103 550 | 1 143 430 | 1 172 220 | 1 183 070 | 1 178 160 |
| GRT decked vessels | 24 095 900 | 24 887 400 | 25 394 100 | 25 806 800 | 25 994 300 |
| Number undecked vessels | 2 256 740 | 2 243 880 | 2 285 230 | 2 318 830 | 2 345 070 |
| **Africa** | | | | | |
| Number decked vessels | 7 360 | 7 640 | 7 760 | 8 200 | 8 370 |
| GRT decked vessels | 550 800 | 587 600 | 632 800 | 689 500 | 699 100 |
| Number undecked vessels | 405 730 | 410 830 | 426 210 | 431 090 | 443 650 |
| **North America** | | | | | |
| Number decked vessels | 49 970 | 48 830 | 53 000 | 52 680 | 51 520 |
| GRT decked vessels | 2 396 200 | 2 424 700 | 2 456 200 | 2 616 600 | 2 560 000 |
| Number undecked vessels | 209 720 | 199 530 | 208 650 | 207 970 | 207 730 |
| **South America** | | | | | |
| Number decked vessels | 10 560 | 11 030 | 12 230 | 12 590 | 12 520 |
| GRT decked vessels | 673 600 | 713 800 | 716 600 | 781 900 | 816 500 |
| Number undecked vessels | 89 410 | 90 330 | 90 360 | 92 650 | 93 250 |
| **Asia** | | | | | |
| Number decked vessels | 945 100 | 982 540 | 1 003 540 | 1 010 590 | 1 007 330 |
| GRT decked vessels | 10 119 400 | 10 724 800 | 10 822 300 | 10 922 800 | 11 012 500 |
| Number undecked vessels | 1 408 240 | 1 400 280 | 1 418 910 | 1 437 610 | 1 451 020 |
| **Europe** | | | | | |
| Number decked vessels | 85 720 | 88 370 | 90 120 | 93 340 | 92 340 |
| GRT decked vessels | 3 414 700 | 3 446 200 | 3 264 700 | 3 153 800 | 3 018 300 |
| Number undecked vessels | 64 020 | 60 920 | 58 600 | 61 810 | 61 930 |
| **Oceania** | | | | | |
| Number decked vessels | 1 490 | 1 800 | 1 930 | 1 990 | 2 060 |
| GRT decked vessels | 97 900 | 106 400 | 113 900 | 119 800 | 122 300 |
| Number undecked vessels | 79 600 | 81 960 | 82 470 | 87 680 | 86 710 |
| **Former USSR** | | | | | |
| Number decked vessels | 3 310 | 3 190 | 3 620 | 3 660 | 3 990 |
| GRT decked vessels | 6 843 300 | 6 883 900 | 7 387 500 | 7 522 500 | 7 765 500 |
| Number undecked vessels | ... | ... | 0 | 0 | 750 |

*Source:* FAO

*8*

## Catches by principal producers, 1992-93

| Country/region | 1992 | 1993 | Country/region | 1992 | 1993 |
|---|---|---|---|---|---|
| | (..... Tonnes .....) | | | (..... Tonnes .....) | |
| China | 15 007 450 | 17 567 907 | South Africa | 696 395 | 563 229 |
| Japan | 8 460 324 | 8 460 324 | Turkey | 454 345 | 550 641 |
| Peru | 6 871 200 | 8 450 600 | Italy | 556 839 | 546 607 |
| Chile | 6 501 767 | 6 037 985 | Netherlands | 439 291 | 486 894 |
| USA | 5 588 491 | 5 939 267 | Poland | 505 747 | 423 029 |
| Russian Federation | 5 611 164 | 4 461 375 | Venezuela | 329 860 | 390 333 |
| India | 4 175 112 | 4 175 112 | Ukraine | 525 801 | 371 343 |
| Indonesia | 3 441 570 | 3 637 700 | Ghana | 423 918 | 371 194 |
| Thailand | 3 240 160 | 3 348 149 | Sweden | 314 686 | 347 820 |
| Korea, Rep. | 2 695 630 | 2 648 977 | Ecuador | 347 066 | 347 066 |
| Norway | 2 549 655 | 2 561 991 | Iran, Islamic Rep. | 334 203 | 343 888 |
| Philippines | 2 271 917 | 2 263 775 | Tanzania | 331 585 | 331 585 |
| Korea, DPR | 1 750 100 | 1 750 100 | Namibia | 294 483 | 329 790 |
| Iceland | 1 577 206 | 1 718 495 | Senegal | 326 889 | 326 889 |
| Denmark | 1 995 500 | 1 534 058 | Germany | 307 239 | 309 725 |
| Spain | 1 330 000 | 1 330 000 | Ireland | 272 536 | 305 021 |
| Taiwan, Province of China | 1 314 233 | 1 319 904 | Egypt | 287 108 | 302 829 |
| Mexico | 1 247 622 | 1 200 686 | Portugal | 298 952 | 272 035 |
| Canada | 1 275 851 | 1 171 614 | Faeroe Islands | 270 806 | 261 635 |
| Viet Nam | 1 080 279 | 1 080 279 | Nigeria | 318 384 | 255 499 |
| Bangladesh | 966 727 | 1 047 170 | UK, England, Wales | 228 137 | 242 152 |
| Myanmar | 800 000 | 836 878 | Hong Kong | 229 514 | 226 843 |
| France | 800 000 | 800 000 | Uganda | 250 000 | 219 814 |
| Brazil | 790 000 | 790 000 | Australia | 233 900 | 218 339 |
| Argentina | 705 316 | 705 316 | Sri Lanka | 206 168 | 206 168 |
| Malaysia | 640 000 | 640 000 | Greece | 179 644 | 198 932 |
| UK, Scotland | 572 364 | 629 993 | Kenya | 163 227 | 185 438 |
| Morocco | 548 098 | 622 034 | Panama | 148 772 | 156 517 |
| Pakistan | 553 118 | 621 695 | Finland | 148 625 | 152 491 |
| New Zealand | 679 288 | 594 038 | Zaire | 150 000 | 150 000 |

*Note:* these 60 countries or regions are those with catches of 150 000 tonnes or more
*Source:* FAO. 1994. *Yearbook of fishery statistics 1992. Vol. 74: Catches and landings*

*9A*

## Nominal catch of Atlantic cod, 1950-93

| Year | Catch |
|---|---|
| | *('000 tonnes)* |
| 1950 | 1 820 |
| 1951 | 1 870 |
| 1952 | 2 050 |
| 1953 | 2 000 |
| 1954 | 2 400 |
| 1955 | 2 290 |
| 1956 | 2 080 |
| 1957 | 2 010 |
| 1958 | 2 560 |
| 1959 | 2 640 |
| 1960 | 2 900 |
| 1961 | 2 955 |
| 1962 | 3 010 |
| 1963 | 2 965 |
| 1964 | 2 678 |
| 1965 | 2 761 |
| 1966 | 2 876 |
| 1967 | 3 203 |
| 1968 | 3 993 |
| 1969 | 3 659 |
| 1970 | 3 106 |
| 1971 | 2 831 |
| 1972 | 2 728 |
| 1973 | 2 539 |
| 1974 | 2 811 |
| 1975 | 2 434 |
| 1976 | 2 382 |
| 1977 | 2 271 |
| 1978 | 2 127 |
| 1979 | 2 040 |
| 1980 | 2 206 |
| 1981 | 2 344 |
| 1982 | 2 251 |
| 1983 | 2 072 |
| 1984 | 2 016 |
| 1985 | 1 960 |
| 1986 | 2 038 |
| 1987 | 2 070 |
| 1988 | 1 956 |
| 1989 | 1 784 |
| 1990 | 1 516 |
| 1991 | 1 343 |
| 1992 | 1 173 |
| 1993 | 1 139 |

*Note:* 1993 data, preliminary
*Source:* FAO

*9B*

## World catch of selected major groundfish species, 1982-93

| Year | Cape hakes | Haddock | Silver hake |
|---|---|---|---|
| | *(..... '000 tonnes .....)* | | |
| 1982 | 439 230 | 423 103 | 80 364 |
| 1983 | 456 454 | 372 886 | 53 513 |
| 1984 | 493 204 | 306 792 | 95 728 |
| 1985 | 541 815 | 379 631 | 99 137 |
| 1986 | 541 002 | 418 611 | 102 665 |
| 1987 | 466 840 | 397 894 | 77 917 |
| 1988 | 501 359 | 338 687 | 90 727 |
| 1989 | 465 432 | 269 391 | 105 579 |
| 1990 | 268 244 | 207 084 | 90 818 |
| 1991 | 180 821 | 189 982 | 77 382 |
| 1992 | 205 904 | 204 790 | 45 302 |
| 1993 | 195 209 | 249 063 | 40 422 |

*Note:* 1993 data, preliminary
*Source:* FAO

*10*

## Marine catch in non-adjacent fishing areas, 1970-93

| Year | Non-coastal catch |
|---|---|
| | *('000 tonnes)* |
| 1970 | 7 673 |
| 1971 | 7 755 |
| 1972 | 8 755 |
| 1973 | 8 190 |
| 1974 | 8 363 |
| 1975 | 8 225 |
| 1976 | 8 377 |
| 1977 | 7 761 |
| 1978 | 7 488 |
| 1979 | 6 757 |
| 1980 | 7 569 |
| 1981 | 7 507 |
| 1982 | 7 575 |
| 1983 | 7 548 |
| 1984 | 7 314 |
| 1985 | 7 420 |
| 1986 | 8 339 |
| 1987 | 8 714 |
| 1988 | 8 822 |
| 1989 | 9 114 |
| 1990 | 8 361 |
| 1991 | 7 741 |
| 1992 | 5 701 |
| 1993 | 4 717 |

*Notes:* 1993 data, preliminary; non-adjacent fishing areas are those FAO major fishing areas that are not adjacent to the producing countries
*Source:* FAO

*11*

## Non-local catches by major distant-water states, 1982-93

| Country/region | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (..... '000 tonnes .....) | | | | | | | | | | | |
| Former USSR | 3 292 | 2 848 | 2 489 | 2 575 | 3 123 | 3 511 | 3 911 | 4 482 | 4 281 | | | |
| Russian Federation | | | | | | | | | | 1 858 | 1 021 | 572 |
| Other former USSR republics | | | | | | | | | | 1 859 | 762 | 561 |
| Japan | 1 650 | 1 648 | 1 646 | 1 443 | 1 414 | 1 519 | 1 408 | 1 268 | 1 074 | 1 028 | 971 | 915 |
| Spain | 641 | 614 | 615 | 689 | 711 | 734 | 808 | 818 | 636 | 587 | 599 | 570 |
| Korea, Rep. | 476 | 540 | 564 | 610 | 795 | 691 | 533 | 594 | 589 | 657 | 713 | 526 |
| Taiwan, Province of China | 185 | 328 | 451 | 602 | 514 | 440 | 425 | 325 | 345 | 349 | 352 | 352 |

*Note:* 1993 data, preliminary
*Source:* FAO

*12*

## Gross register tonnage (*GRT*) of the world's fishing fleets, 1970-92

| Year | ('000 GRT) |
|---|---|
| 1970 | 13 616 |
| 1975 | 17 230 |
| 1980 | 19 927 |
| 1981 | 20 204 |
| 1982 | 20 822 |
| 1983 | 21 339 |
| 1984 | 21 468 |
| 1985 | 22 157 |
| 1986 | 22 907 |
| 1987 | 23 522 |
| 1988 | 24 096 |
| 1989 | 24 887 |
| 1990 | 25 394 |
| 1991 | 25 807 |
| 1992 | 25 994 |

*Source:* FAO

*13*

## Distribution by continent of the world's total fishing fleet, 1992

| Continent | ('000 GRT) | % |
|---|---|---|
| Asia | 11 013 | 42.37 |
| Africa | 699 | 2.69 |
| Europe | 3 018 | 11.61 |
| South America | 817 | 3.14 |
| North America | 2 560 | 9.85 |
| Oceania | 122 | 0.47 |
| Former USSR | 7 766 | 29.87 |
| *World total* | 25 994 | |

*Source:* FAO

*14*

## Age of the world's industrial fishing fleet, 1994 (*vessels over 100 GT*)

| Years | World fishing fleet |
|---|---|
| | % |
| 0-4 | 7.6 |
| 5-9 | 14.9 |
| 10-14 | 14.0 |
| 15-19 | 17.4 |
| 20-24 | 19.5 |
| 25-29 | 15.4 |
| 30 + | 11.2 |

*Source:* Lloyds' Maritime Information Services, 1994

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## World fishery and other merchant fleets by numbers, 1992 (*vessels over 100 GT*)

| | Number | % |
|---|---|---|
| Fisheries | 24 420 | 30.63 |
| Bulk liquid cargo | 9 405 | 11.8 |
| Bulk dry cargo | 5 894 | 7.39 |
| General cargo | 16 601 | 20.82 |
| Specialized general cargo | 9 403 | 11.8 |
| Other activities | 14 003 | 17.56 |
| All fleets | 79 726 | 100.0 |

Source: *World Fleet Statistics Data*, December 1992. Lloyds' Register, London

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## Average annual marine catch and estimates of discards by major fishing areas, 1988-92

| Fishing area landing | Average annual landing | Estimated average annual discards |
|---|---|---|
| | ('000 tonnes) | |
| NW Pacific | 25 404 | 9 132 |
| SE Pacific | 14 269 | 2 602 |
| NE Atlantic | 10 080 | 3 671 |
| WC Pacific | 7 463 | 2 777 |
| EC Atlantic | 3 787 | 594 |
| W Indian | 3 402 | 1 471 |
| NE Pacific | 3 229 | 925 |
| NW Atlantic | 2 987 | 686 |
| E Indian | 2 923 | 802 |
| SW Atlantic | 2 192 | 803 |
| WC Atlantic | 1 772 | 1 601 |
| SE Atlantic | 1 747 | 278 |
| Med + Black Sea | 1 664 | 565 |
| EC Pacific | 1 558 | 767 |
| SW Pacific | 1 079 | 293 |
| Antarctic | 404 | 45 |

*Source:* FAO

17

## Total inland capture fishery yields by continent, 1970-92

| Year | Asia | Africa | Europe | North America | South America | Former USSR |
|---|---|---|---|---|---|---|
| | (Tonnes) | | | | | |
| 1970 | 2 982 600 | 1 127 600 | 110 300 | 94 300 | 94 300 | 783 900 |
| 1971 | 3 145 600 | 1 077 600 | 105 200 | 108 900 | 112 900 | 865 000 |
| 1972 | 3 244 000 | 1 087 400 | 97 100 | 111 700 | 172 800 | 786 300 |
| 1973 | 3 417 400 | 1 143 000 | 110 800 | 121 600 | 172 800 | 756 200 |
| 1974 | 3 474 376 | 1 130 724 | 110 829 | 126 173 | 173 500 | 681 400 |
| 1975 | 3 356 273 | 1 174 029 | 124 322 | 113 313 | 220 594 | 839 335 |
| 1976 | 3 371 032 | 1 213 441 | 125 148 | 103 761 | 232 163 | 678 692 |
| 1977 | 3 423 468 | 1 287 368 | 134 766 | 109 972 | 228 360 | 674 727 |
| 1978 | 3 367 771 | 1 229 907 | 134 169 | 119 149 | 249 561 | 616 209 |
| 1979 | 2 761 521 | 1 219 000 | 139 325 | 106 973 | 202 222 | 637 396 |
| 1980 | 2 859 114 | 1 249 180 | 151 132 | 117 093 | 253 194 | 633 512 |
| 1981 | 3 084 176 | 1 228 345 | 129 171 | 121 019 | 268 673 | 642 147 |
| 1982 | 3 114 851 | 1 284 056 | 122 976 | 126 414 | 286 764 | 627 324 |
| 1983 | 3 327 084 | 1 311 316 | 118 503 | 144 524 | 300 200 | 634 620 |
| 1984 | 3 449 351 | 1 409 277 | 107 307 | 187 744 | 309 741 | 615 118 |
| 1985 | 3 507 458 | 1 402 784 | 96 236 | 187 360 | 294 798 | 621 962 |
| 1986 | 3 710 882 | 1 550 202 | 106 733 | 182 639 | 324 150 | 619 010 |
| 1987 | 3 866 803 | 1 590 407 | 82 615 | 223 628 | 344 481 | 656 849 |
| 1988 | 4 010 825 | 1 659 001 | 81 281 | 193 860 | 318 179 | 642 724 |
| 1989 | 4 278 632 | 1 664 263 | 84 376 | 186 364 | 298 222 | 679 111 |
| 1990 | 3 729 597 | 1 749 355 | 88 271 | 200 001 | 289 583 | 571 759 |
| 1991 | 3 874 878 | 1 649 971 | 80 026 | 183 728 | 279 342 | 461 574 |
| 1992 | 3 861 516 | 1 657 726 | 88 913 | 192 879 | 295 592 | 452 417 |

*Source:* FAO

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## Total aquaculture production by principal producers and cumulative production as a percentage of the world aquaculture total, 1992

| Country | Aquaculture | Cumulative |
|---|---|---|
| | ('000 tonnes) | % |
| China | 6 856 | 49 |
| India | 1 375 | 59 |
| Japan | 818 | 65 |
| Indonesia | 560 | 69 |
| USA | 414 | 72 |
| Philippines | 388 | 75 |
| Korea, Rep. | 376 | 77 |
| Thailand | 359 | 80 |
| France | 251 | 82 |
| Taiwan, Province of China | 250 | 84 |
| Bangladesh | 230 | 85 |
| *World total* | 1 392 | |

*Note:* excludes aquatic plants
*Source:* FAO

19

## Percentage of cultured non-carnivorous fish production by principal species/groups, 1992

| Species/groups | Fish production | |
|---|---|---|
| | (Tonnes) | % |
| Carps | 6 652 305 | 84 |
| Tilapias | 473 477 | 6 |
| Milkfish | 339 289 | 4 |
| Others | 506 831 | 6 |
| Total | 7 971 902 | |

*Source:* FAO

20

## Composition of capture and aquaculture production by principal species/groups, 1984-92

| Year | Shrimps | | Molluscs | | Salmonoids | | Freshwater fishes | |
|---|---|---|---|---|---|---|---|---|
| | Capture | Culture | Capture | Culture | Capture | Culture | Capture | Culture |
| | ('000 tonnes) | | | | | | | |
| 1984 | 1 740 | 177 | 4 384 | 1 994 | 737 | 247 | 4 190 | 3 796 |
| 1985 | 1 927 | 218 | 4 294 | 2 197 | 907 | 267 | 4 335 | 4 347 |
| 1986 | 1 927 | 313 | 4 222 | 2 405 | 788 | 304 | 4 620 | 5 055 |
| 1987 | 1 880 | 500 | 5 046 | 2 672 | 756 | 347 | 4 588 | 5 828 |
| 1988 | 1 939 | 576 | 5 016 | 2 951 | 752 | 423 | 4 667 | 6 413 |
| 1989 | 1 907 | 619 | 5 267 | 2 958 | 958 | 497 | 4 867 | 6 572 |
| 1990 | 1 943 | 658 | 4 926 | 2 973 | 897 | 555 | 5 234 | 6 940 |
| 1991 | 1 993 | 815 | 5 075 | 3 075 | 1 028 | 615 | 5 014 | 7 271 |
| 1992 | 2 028 | 884 | 5 385 | 3 500 | 819 | 628 | 5 090 | 7 981 |

*Source:* FAO

*21*

## Aquaculture contribution to world food fish supply, 1984-93

| Year | Capture fisheries supply | Aquaculture contribution |
|---|---|---|
| | (..... '000 tonnes .....) | |
| 1984 | 51 105 | 6 933 |
| 1985 | 52 302 | 7 729 |
| 1986 | 53 824 | 8 807 |
| 1987 | 55 962 | 10 150 |
| 1988 | 56 603 | 11 210 |
| 1989 | 58 891 | 11 497 |
| 1990 | 58 424 | 12 121 |
| 1991 | 57 026 | 12 781 |
| 1992 | 57 008 | 13 921 |
| 1993 | 56 470 | 15 800 |

*Note:* 1993 data, preliminary
*Source:* FAO

*22A*

## Utilization of world fish production, 1982-87

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|
| | (..... '000 tonnes .....) | | | | | |
| Total catch | 76 768 | 77 497 | 83 932 | 86 378 | 92 845 | 94 402 |
| Human consumption | 54 606 | 53 851 | 56 875 | 58 784 | 62 046 | 64 795 |
| Canned | 10 476 | 10 969 | 11 382 | 11 441 | 11 527 | 11 698 |
| Cured | 9 842 | 9 846 | 9 878 | 10 265 | 10 315 | 10 710 |
| Frozen | 19 382 | 19 099 | 20 481 | 20 846 | 22 227 | 22 352 |
| Fresh | 14 906 | 13 937 | 15 134 | 16 232 | 17 977 | 20 035 |
| Reduction | 22 162 | 23 646 | 27 057 | 27 594 | 30 799 | 29 607 |

*Source:* FAO

*22B*

## Utilization of world fish production, 1988-93

| | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|---|---|
| | (..... '000 tonnes .....) | | | | | |
| Total catch | 99 086 | 100 311 | 97 556 | 97 052 | 98 729 | 101 270 |
| Human consumption | 67 560 | 69 236 | 68 813 | 68 211 | 71 179 | 72 270 |
| Canned | 12 065 | 12 502 | 12 625 | 12 809 | 12 161 | 12 200 |
| Cured | 10 914 | 10 293 | 10 624 | 10 536 | 9 151 | 9 000 |
| Frozen | 23 488 | 23 681 | 24 171 | 23 973 | 23 669 | 23 500 |
| Fresh | 21 093 | 22 760 | 21 393 | 20 893 | 26 198 | 27 570 |
| Reduction | 31 526 | 31 075 | 28 743 | 28 841 | 27 550 | 29 000 |

*Note:* 1993 data, preliminary
*Source:* FAO

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