An Overview of Global Marine Fisheries

by
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The sea provides an abundance and diversity of food, medicine and raw materials. From ancient times, fishing has been a major source of food and a provider of employment and economic benefits to those engaged in this activity. Income generated through marine fishing fuels only a small portion of the global economy, perhaps one per cent. But in coastal and island regions, the occupation assumes greater importance. In South-east Asia, more than five million people are engaged in fishing full time, contributing around $6.6 billion towards the region's national income. Around the world, some 2000 million people depend on fishing and fishery related industries for their livelihoods. Although annual increase in fish harvest has been low in recent years, the catch of finfish and shellfish is the world's largest single source of animal protein, exceeding the total production of beef, sheep, poultry or eggs. They are the major source of animal protein in the developing countries.

World fishery production form capture fisheries and aquaculture totaled almost 110 million tonnes in 1994 and of this over 90 million tonnes were produced in marine waters; 84 million tonnes from capture fisheries and 6 million tonnes from mariculture (FAO, 1996). Just over half of the marine fish catch consists of pelagic species (51% coastal pelagics such as sardine, anchovy, mackerel etc. and 4% oceanic pelagics such as tunas, whales and krill). Of the remainder, demersal fish make up 35%, invertebrates such as mollusks and crustaceans (squids, prawns, lobsters, crabs etc.) and marine plants provide 10%. Most of the marine resources are found on or above the continental self, usually well within the 200 mile coastline. Comparatively few oceanic living resources, mainly tunas and whales, are exploited and even a part of these stocks occur within the 200 mile zone.

Development Trends and Potential

The first estimates of world fish production were provided in 1945 by the Technical Committee for Fisheries of the United Nations Interim Commission on Food and Agriculture (FAO 1945) and these indicated that the total marine harvest was 39,000 million pounds (or 17.7 million tonnes), of which 37,000 million pounds were commercial landings and the balance subsistence and recreational landings. Even then, one third of the total landings were destined for reduction to fish meal and oil. At that time, only the North Pacific and North Atlantic fisheries were well developed and these areas accounted for 47% and 46% respectively of the total commercial harvest, with the southern parts of those oceans accounting for 1% each and the Indian Ocean for 5%.

Up to 1970s, landings were increasing at the rate of about 6% per year and the potential for traditionally exploited marine species was estimated to be around 100 million tonnes per year (Gulland, 1971). The growth in world fish catch slowed dramatically since early 1970's, particularly with the collapse of what was then the worlds world's largest fishery - the Peruvian anchovy fishery and the overall annual growth was only 2.3% during late 1980s. Despite fisheries development in non-traditional species, the marine fishery production has so far reached about 90 million tonnes (in 1994), with capture fisheries accounting for 84 million tonnes. The annual relative rate of increase of world landings has decreased significantly in recent years, indicating that the maximum production from the worlds conventional marine resources under current exploitation regimes is being reached and that the mean catch of the last few years was probably very close to that maximum (Fig. 1).

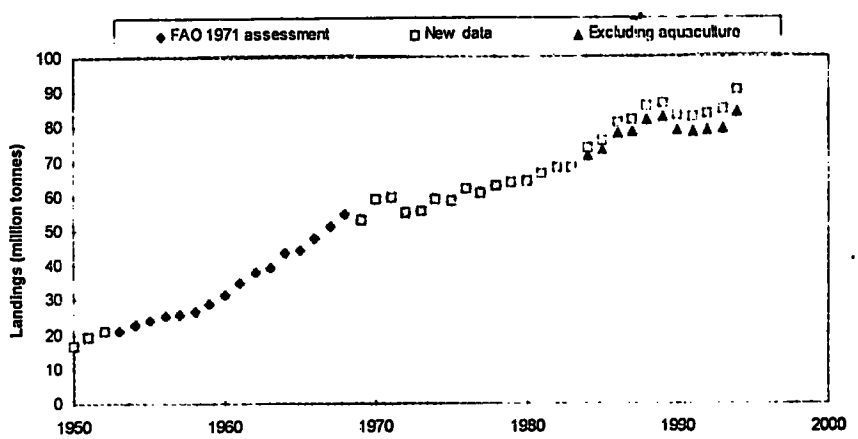

FIG. 1. GROWTH IN GLOBAL MARINE CATCH (MILLION TONNES) (SOURCE : FAO, 1997).

In quantity terms, the proportion of the total marine fish landings which is accounted for by pelagic fish has risen from about 50% in 1950 to over 60% in 1994. The production of pelagic fish has increased continuously, with large oscillations reflecting natural variations of resource productivity as well as boom and bust fishing strategies. In terms of value, pelagic production is much less important than demersal production, but its relative importance has been increasing and in 1993, pelagic production accounted for about 40% of the total value of the marine fish landings compared to 50% for demersal fish and 10% for unspecified marine fish. Demersal fish production had shown an increasing trend until the mid-1970s and has generally leveled off, with some oscillations since then.

In the Indian Ocean, pelagic fish account for less than half of all fish landings, indicating a relative deficiency of pelagic production compared to other oceans. Bakun et al (1996) related the lack of fisheries on small pelagic fish in the Western Indian Ocean to the extreme strength and turbulence of the Indian Ocean system of upwellings combined with extremely dynamic offshore advection, all factors very unfavourable to the survival of small pelagic resources.

High Migratory and Straddling Fish Resources

Highly migratory and straddling resources have received intense international attention at the UN Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks (New York, 1993-1995) which led to the adoption of a legally binding international instrument for their improved management. Highly migratory fish resources such as certain species of tunas and billfish have wide geographic distribution and are found within waters coming under the jurisdiction of coastal states as well as in international waters or high seas. They undertake extensive and sometimes trans-oceanic migrations and are fished throughout their range of distribution, by coastal states as well as being the target of many long distance fisheries. Straddling fish resources are located within waters belonging to coastal states or within Exclusive Economic Zones (EEZs) and adjacent high seas. The usual understanding seems to be that straddling stocks are mainly EEZ "residents" (their overall biomass largely within the EEZ) that straddle "out" a few miles into the high seas. Some stocks could be mainly "high seas residents" (overall biomass largely outside the EEZ) which straddle "in" the EEZ. A straddling fish stock could occur within EEZs of two or more states and the adjacent high seas (FAO, 1994).

Landings of highly migratory species have increased from 700,000 tonnes in 1950 to about 4.5 million tonnes in 1994; the increase being more rapid since 1970. In recent years, over half the total landings of highly migratory species is being accounted by just two species - skipjack and yellowfin tuna. Skipjack is considered under-exploited or moderately exploited in all three major oceans and increased catches are likely in the future. In contrast, yellowfin is fully exploited in some fishing areas in the Atlantic and Eastern Pacific. It is unlikely that much increased catches can be sustained in the long run.

Landings from straddling stocks have increased from less than 2 million tonnes in 1950 to nearly 14 million tonnes in 1989, and subsequently declined to about 12 million tonnes in 1991. Over 90 per cent of the landings are demersal finfish. Atlantic cod (in North-west Atlantic) and Alaska pollock (in North-west and North-east Pacific) are major straddling stocks.

Distant water fisheries were first developed for high valued demersal species such as Atlantic cod, Alaska pollock, Chilean jack mackerel and squid. Landings have increased from less than a million tonnes in 1950 to more than 8 million tonnes in 1972 and thereafter fluctuated around this value until 1990. While most of these stocks have collapsed, tunas continue to be a target of distant water fishing fleets. Tunas accounted for only 6 per cent of distant water landings in 1950, but increased to 46 per cent in 1994. Distant water fish landings increased rapidly during 1960s when oil was cheap and few countries had Exclusive Economic Zones or extended fisheries zones. Fleets from USSR, Europe and Japan expanded their range of activities beyond the heavily fished "domestic" waters in order to satisfy a growing demand. This growth was arrested by major increases in the price of oil and by extension of national jurisdictions in late 1970s and related increases in the cost of access to the newly "enclosed" resources. The sharp decrease of these landings from 1990 onwards is linked to the collapse of heavily subsidized state-sponsored fishing following the political changes in the republic of the former USSR and Eastern Europe.

World Trade in Food Fish and Fish Meal

The total quantity of fish traded has increased from about 13 million tonnes live weight equivalent in 1961 to about 43 million tonnes in 1994, always ranging between 30 and 40 per cent of the total landings. The increase in the value of world trade in fish and fishery products is in response to the demand in the developed countries for higher value species and, the ability of developing countries to provide them. In the 1960s, the quantities of fish traded for non-food use (following reduction into fish meal and oil) far exceeded the quantities traded for human consumption, accounting for about 80 per cent of the total fish traded (all expressed as live weight equivalent). The difference subsequently declined markedly as food fish trade grew and, since the 1980s, the quantities traded for human consumption and for non-food use have been fairly similar.

The most notable feature of the trade in fish is the highly variable species composition of landings destined for conversion to fish meal, which is determined mainly by the availability of the highly fluctuating small pelagic stocks which support opportunistic fisheries subject to "boom and bust" cycles. There has clearly been an overall increase in fishing effort directed towards fish for reduction, with the development of several new fisheries entirely for this purpose such as those for Chilean jack mackerel and sandeels.

By far the most important product of fish reduction is fish meal which is used in the production of animal feeds for livestock and aquaculture. Fish meal is usually considered as a substitute for soya bean meal but it fetches a higher price due mainly to its richer protein content (64 per cent protein

compared to 44 per cent for soya bean meal) and its particular amino acid profiles; and hence it is now more a complement to soya bean meal.

In 1993, aquaculture feeds used 16 per cent and 29 per cent of the world production of fish meal and fish oil respectively. It is estimated that aquaculture will use 25 - 30 per cent of the world's fish meal supply by the year 2000. With the rapid growth in aquaculture production of valuable carnivorous species which at present are totally dependent on the use of fish meal and fish oil as the major source of dietary protein and lipids, the demand for fish meal may increase. However, other sectors of the fish meal market such as poultry, pig growing and finishing diets, which account for a much greater share of the market, are still very elastic and could move away from fish meal.

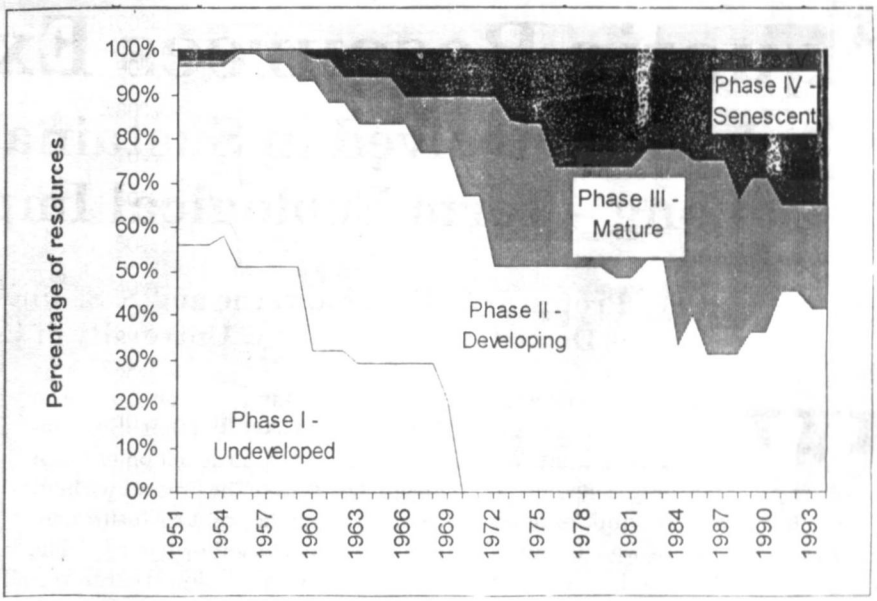

FIG. 2. PERCENTAGE OF MAJOR MARINE FISH RESOURCES IN VARIOUS PHASES OF DEVELOPMENT. (SOURCE : FAO, 1997).

Potential for Future

Since 1950, world food production from fish has increased faster than the world's population, with the result that per capita food supply from fish has almost doubled, increasing from about 7 kg. per year in 1950 to about 13 kg. in 1993. While fish supplies have stagnated, world population continues to grow approximately 1.6 per cent a year. At this rate, the total supply of fish would have to rise to 120 million tonnes by year 2010 in order to maintain today's per capita fish supply. Although the long-term prospects are limited, marine fisheries can still continue to contribute to the growth in the world fish supply if they are better managed.

Based on the analysis of total marine landings, the predicted maximum production of world marine fisheries with the present overall fishing regime corresponds to about 82 million tonnes, a value close to the average landings of 1990-1994 of about 83 million tonnes. This is a composite, aggregate result, which hides the increasing occurrence of over-fishing on a multitude of stocks in many different areas.

Although no commercially fished marine species is known to have become extinct in modern times, fishing has profoundly reduced population sizes and productivity in many targeted fisheries. An analysis of time series of landings of the worlds top 200 marine fisheries or resources which account for 77% of the worlds marine fish catch indicates that about 35% are senescent (i.e. showing declining yields), about 25% are mature (i.e. plateauing at a high exploitation level), 40% are still "developing" and 0% remain at low exploitation (undeveloped) level (Fig 2). This implies that around 60% of the major world fish resources are either mature or senescent and, given that few countries have established effective control of fishing capacity, these resources are in urgent need of management action to arrest the increase in fishing capacity or to rehabilitate damaged resources. An increase of 10 million tonnes from recent landings of about 80 million tonnes is considered possible (leading to a possible total potential world marine production of 93 million tonnes), with 4 million tonnes each coming from improved management of over-fished stocks in the Atlantic and Pacific Oceans and 2 million tonnes from fisheries development in the Indian Ocean (FAO, 1997). It is widely believed that the full potential in the Indian Ocean has not been reached. Generally speaking, the Indian Ocean has an important biological potential but its coastal resources are under severe stress in many areas and require effective management, even though potential for expansion may exist further offshore.

Implications for Management and Development

In the case of fisheries of resources which are below their historical peak levels of production, it may be possible to return to these levels by reducing fishing effort and, in most cases, simultaneously improving on yield per recruit. This can be achieved by increasing significantly the age at first capture, prohibiting the exploitation of juveniles, increasing mesh sizes and temporarily or permanently closing the areas of concentration of young fish. Examples in Cyprus and Philippines have shown that increases of sustainable production of 100 per cent can be obtained in the tropics within 18 months. More recent experiences with the protection of juveniles in Morocco (closed season/area for cephalopods) and Norway (ad-hoc area closures for cod) have also produced improvements in catch rates which tend to show that short - term benefits can also be expected in more temperate waters. That effective management can lead to long - term increases in yields has been demonstrated in the Norwegian and Barents Seas where a major reduction in fishing mortality of cod in the late 1980s has resulted in the recovery of the spawning biomass to a level not seen since the 1950s.

An important opportunity as well as a problem is in the potential im-

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provement from the reduction of unwanted by-catch. On an average, 27 million tonnes, comprising species of low commercial value but also of a large proportion of juveniles are discarded every year. The benefits resulting from a reduction of unwanted by-catch through increased survival of juvenile fish can be very significant.

An important question is whether improvements in yield from both demersal predators and pelagic prey can be expected. The pelagic group contains a number of significant predators, among which are the large pelagic tunas and tuna-like species. The eggs and larvae of many demersal species, and the adults of some small demersal fish are prey for the large pelagic species. Similarly, small pelagics are often major dietary components of larger demersal fish. The implications of these interactions are not easy to foresee and it is therefore impossible to establish how much of the present balance in the abundance (and potential) of pelagics and demersals results from the relative overfishing of the demersals and the resultant reduced pressure on the pelagics. Neither is it possible to determine to what extent the rehabilitation of the over-fished demersals will affect the survival and potential of pelagics. The issue of resource rehabilitation on a large regional scale has never been tackled and remains, with the issue of the medium-term variations of the small pelagics, one of the key issues of the management of fisheries of the 21st century.

With the lack of possibility of production from traditional capture fisheries increasing substantially, a large part of the future growth in fish production for food will depend on aquaculture. Any consideration of future fishery supplies for food security or for the market must take account of the aquaculture and caputre fishery production components separately, although this is becoming increasingly difficult as the distinction becomes blurred with the development of practices such as wild stock enhancement, ranching and culture-based fisheries. Whereas aquaculture production will undoubtedly continue to develop in the foreseeable future, despite increasing limitations by environmental factors and availability of sites, capture fisheries production seem to have almost reached saturation level in terms of the number of species and areas that can be exploited and it is generally agreed that it can only be increased by improved fisheries management. The potential offered by an increased exploitation of non-conventional species such as krill, meso-pelagic fish, and oceanic squid, is theoretically large but the economic and ecological implications raise questions as to its viability.

Open Access and Excessive Fishing Capacity

Of the worlds 15-21 million fishermen, more than 90 per cent are small operators, using traditional equipment and small boats. The popular phrase "too many fishermen chasing too few fish" is an over simplification of the situation. It is not just the number of fishermen that counts, but also the size of their nets, the number of their hooks, the size of their boats etc. In short, their capacity to fish.

The fundamental problem is fishermen's own expanded ability to catch fish and counterproductive government policies that have attracted more fishermen and boats into the industry even after the point of diminishing returns. Between 1970 and 1990, the FAO has recorded a doubling in the world fishing fleet, from 585,000 to 1.2 million large boats. It is contended that todays catch could easily be landed by the fleet that existed in 1970.

The over-capacity developed due to the open access nature of many fisheries. Under open access, boats will continue to enter the fishery, well after yields and profits begin to fall, As stocks decline, fishermen acquire larger, faster boats with more advanced equipment and gear. This sustained and increased pressure on the stocks will cause further decline in profits until people start to go out of business. Political pressure could then trigger subsidies that would keep overextended individuals in business, maintaining over-capacity and speeding up total collapse of the fishery. It is estimated that countries have provided subsidies amounting to around US $ 54 billion annually to the fishing industry in recent years.

The Advent of the Law of the Sea

A fundamental challenge to managing marine fisheries is determining who has jurisdiction and where. In the seventies, as conflicts mounted, the world community took the first major step towards curtailing freedom of the high seas. As part of the Third U.N. Conference on Law of the Sea, governments agreed to establish a zone no more than 200 nautical miles wide within which a coastal state has sole rights to natural resources. The Exclusive Economic Zones thus established include the most productive fishing grounds in the oceans and embrace some 90 per cent of the world's marine fisheries. To-day, nearly all of the coastal states numbering over 130 have declared or claimed EEZs.

Within the EEZ, the coastal state has sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the sea bed and sub-soil and adjacent waters. The coastal state is responsible for determining the allowable catch within its EEZ. Where a state can not harvest the entire catch, other nations are to be given access to the surplus by agreement. The treaty also provided provisions for the sharing of stocks which occur within zones of two or more states (straddling stocks), highly migratory species and the management of species that migrate between inland waters and the sea.

Two decades after the nations of the world convened for the Third Conference on the Law of the Sea, coastal countries control the prime fishing grounds, but the number of fish population that have collapsed or are at risk is higher than ever. Coastal countries have replaced over-fishing by foreign fleets with over-fishing by their own. After years of increasing catches, global fish landings have stagnated since late 1980s despite continued increase in fishing pressure. The enclosure has provided a potentially powerful tool for conservation. At the same time, the end of growth in world fish catch has created the need for fishery managers to devise ways to harvest food sustainably from the oceans.

The Law of the Sea itself officially came into force in November 1994, but

its provisions are vague on the matter of high seas fishing. Freedom of the seas in reckoned to be outside the EEZ. Regional agreements cover various high seas fisheries, but these lack teeth beyond the Jurisdiction of diplomacy. If a country does not wish to comply with restrictions imposed by an agreement, it can refuse to participate, as Norway did with the whaling moratorium; or it can simply quit, as Icelend did with the International Whaling Commission. When the home nation of a vessel enters into a regional agreement that might restrict fishing, the vessels's owners can avoid the restrictions by adopting a flag of convenience - the flag of a nation that has not signed the agreement. Unconfirmed reports suggest that there are over 1000 fishing vessels, or approximately 20 per cent of the fishing vessels over 500 GRT, operating under flags of convenience.

The most dramatic failure of high-seas diplomacy centres on bluefin tuna, the world's most valuable fish which fetch up to $ 260 per kilogram in restaurants in Japan. In principle, the International Commission for the Conservation of Atlantic Tuna (ICCAT), an organization of nations whose fishermen hunt tuna in the Atlantic Ocean manages this industry. However, despite ICCAT oversight, bluefin tuna population had dropped precipitously. The population that spawns in the Gulf of Mexico have dropped by 90 per cent since 1975, and the one that spawns in the Mediterranean has declined by half. ICCAT chose a phased cut of 50 per cent by 1995, but the prospects for bluefin tuna recovery remain dim. ICCAT members claim that up to 80 per cent of the catch may be harvested by non-ICCAT fishing vessels flying flags of convenience; some 500 of which are thought to be hunting bluefin in the Atlantic.

Management of Highly Migratory and Straddling Resources

By late 1980s, it became clear that extended national jurisdictions, as provided by the Law of the Sea, was insufficient for efficient management and sustainable development of fisheries. The situation was aggravated by the realization that unregulated fisheries on the high seas, in some cases involving straddling and highly migratory species were becoming a matter of increasing concern. Conflicts over high seas stocks precipitated international negotiations at the United Nations, beginning in July 1993. The U. N. Conference on straddling Fish Stocks and Highly Migratory Fish Stocks during 1993 - 1995 led to the adoption of a legally binding international instrument for their improved management.

All states fishing for these resources are required to establish bilateral or multilateral, and sub-regional or regional fisheries organizations, or strengthen already existing ones and, adopt conservation and management measures on the basis of the best scientific evidence available. Where a state does not participate in the work of a sub-regional or regional fisheries management organization, the State is not discharged from the obligation to cooperate in the conservation and management of the regulated stocks.

Code of Conduct for Responsible Fisheries

The adoption of the Code of Conduct for Responsible Fisheries is the latest attempt by the international community, mediated by the FAO, to establish a framework for national and international efforts to ensure sustainable exploitation of living aquatic resources in harmony with the environment. It was adopted by FAO member countries in October 1995.

The Code is global in scope and is directed towards all member countries as well as non-member countries of FAO, regional and sub-regional organizations (whether governmental or non-governmental), and all those who are concerned with conservation, management and utilization of fisheries resources and trade in fish and fishery products. It is voluntary and is to be interpreted and applied in conformity with international law, in particular as reflected in the U. N. Convention on the Law of the Sea.

The Code sets out principles and standards of behaviour for responsible practices with a view to ensuring the effective conservation, management and development of living aquatic resources, with respect for ecosystem and biodiversity. It covers the capture, processing and trade of fish and fishery products, fishing operations, aquaculture, fisheries research and the integration of fisheries into coastal area management.

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