GOVERNMENT OF JAPAN

INTERNATIONAL CONFERENCE ON SUSTAINABLE CONTRIBUTION OF FISHERIES TO FOOD SECURITY

Kyoto, Japan, 4-9 December 1995

organized by the

GOVERNMENT OF JAPAN

in collaboration with the

FOOD AND AGRICULTURE ORGANIZATION

OF THE UNITED NATIONS

DEMAND AND SUPPLY OF FISH AND FISH PRODUCTS IN SELECTED AREAS OF THE WORLD PERSPECTIVES AND IMPLICATIONS FOR FOOD SECURITY

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CONTENTS

Introduction

This document describes the expected supply and demand of fish and fish products in selected regions and countries. These expectations are interpreted in terms of the expected future role of fish in food security. An attempt has been made to group countries according to their economic situation and/or according to their characteristics as markets for fish and fish products.

Some of the reports have been written by FAO staff, others by consultants. The reports have not been reviewed by representatives of governments in the countries concerned. The views expressed and exploratory calculations made are those of the authors.

The reports have been produced in parallel and there has not been time to edit for internal technical consistency within the set of reports. Therefore, the information should be interpreted with caution. Projections for international trade in one report may be contradictory to those used in another.

Mr. A. Gumy, Senior Fishery Planning Officer, in the Development Planning Service, Fisheries Department, FAO, has managed the preparation of the reports. He has been assisted by Ms. P. Brennan, Ms M. Guyonnet, Ms. A. Hedayat-Pour, Mr. K. Leendertse and Ms E. Mercado.

AUSTRALIA AND NEW ZEALAND

Demand and Supply of Fish and Fishery Products in Australia and New Zealand Perspectives and Implications for Food Security

by

G.L. Preston
FAO Consultant

Contents

1. INTRODUCTION

1.1 Background

This document has been prepared to provide background information on food fish demand and supply in the Australasian (Australia and New Zealand) sub-region of Oceania, and their relation to food security. This information is for input into the Main Conference Document for the International Conference on Sustainable Contribution of Fish to Food Security, to be held in Kyoto, Japan, from 4 to 9 December 1995.

1.2 Regional characteristics and issues

The Australasian sub-region as defined here consists of the two large continental land masses of Australia and New Zealand, plus various dependent islands. For the purposes of this paper, the Australian Antarctic territory is not considered as part of the sub-region, since it does not form part of the Australian Fisheries Management Zone (AFMZ).

The two continental land masses are bordered by the Indian Ocean to the west, the Timor, Arafura and Coral Seas to the north, the Pacific Ocean to the east, and the Southern Ocean to the south, as well as the Tasman Sea which separates Australia from New Zealand. The total ocean area encompassed by the EEZs of the sub-region is over 11 million sq. km, compared to a total land area of about 8 million sq. km, as shown in table 1.

Table 1: Land, EEZ and fisheries management areas in the Australasian sub-region (in sq. km)

	Australia	New Zealand	Total
Land area	7,682,300	270,534	7,952,834
EEZ area*	8,900,000	2,222,400	11,122,400

* for Australia, the area given is actually that of the AFMZ, i.e. the total EEZ of Australia and its dependent islands and territories, less the ocean area of the Australian Antarctic territory)

The Australian Fisheries Management Zone of about 8.9 million sq. km is the third largest in the world (after France and the USA), and encompasses the waters that extend up to 200 nautical miles around the Australian continent as well as the Australian external territories of the Cocos, Keeling, Christmas, Macquarie, Heard and MacDonald Islands. The FMZ abuts the exclusive economic zones of Indonesia, France (New Caledonia and Kerguelen Island) and Papua New Guinea, as well as New Zealand. New Zealand's Exclusive Economic Zone of about 2.2 million sq. km. has only one neighbour, Australia.

The total EEZs of Australia and New Zealand together comprise about 11.6% of the world EEZ area. EEZs collectively cover less than 10% of the ocean's surface but contain most of the world's prime fishing grounds (Weber, 1994). Despite the large size of their zones, however, fisheries (including aquaculture) in the Australasian sub-region yield less than 1% of world production. The Australian commercial domestic catch in 1988-89 of about 0.2 million tonnes ranked only 55th in the world. New Zealand, with a catch of about 0.5 million tonnes, ranked 31st in the world (FAO, 1991).

In terms of fishery production, the two countries of the sub-region have several features in common. Fisheries in both countries are highly export-oriented, and promotion of increased export of fishery products is a feature of national fisheries policy in each case. Marine fishery production in both countries is likely to be constrained in future by resource limitations (since most fishery stocks are now thought to be at or close to full utilisation), and by competition for access to wild resources. Freshwater fisheries are insignificant, and aquaculture is in its infancy, but is expanding in both nations. Human populations are small relative to the available land area, and are affluent by world standards, with an average per capita income of US$ 11,816 in 1990 (FAO, 1995). Protein consumption is high (116.8 kg/ capita/ year), with fish comprising a relatively small, but steadily increasing, proportion of total protein intake.

Despite these similarities, there are also significant differences between the fisheries and fishery resources of the two countries. Australia's fisheries are characterised by their multi-species nature: commercial fish markets handle at least 200 commonly named species of fish, and the commercial and recreational catch includes more than 60 species of crustacean, 30 species of mollusc and a handful of echinoderms. About 100 species of fish, 26 species of crustacean, 18 species of mollusc and one echinoderm made up 85% of the total commercial catch for 1990 . Most Australian species may be taken by several types of fishing gear, and are thus caught (and managed) in association with other species. Fisheries such as the rock lobster, scallop, jack mackerel and southern bluefin fisheries, in which the catch is dominated by a single species, are the exception rather than the rule.

New Zealand, on the other hand, has fisheries that are often more typical of temperate-water zones, where catches are greater in volume and are dominated by smaller numbers of species. In 1993 about 41 species of fish and some 13 species of mollusc and crustacean made up almost all of New Zealand's commercial catch (Parker, 1994). New Zealand's waters are more productive than those of Australia, and despite the fact that New Zealand's EEZ is less than a quarter the size of Australia's, the 1992 marine catch of 677,836 tonnes from New Zealand's EEZ was well over twice the 229,551 tonnes caught in the Australian zone in the same year (FAO, 1994).

Australia's population was estimated in 1990 to be 17,052,000, or over five times that of New Zealand's estimated population of 3,392,000 in the same year (Laureti, 1992). The disparity in population size between the two countries will clearly have a major influence on all statistics or projections that are made on a per capita basis, since trends or characteristics prevalent in Australia will tend to mask those in New Zealand. In order to compensate for this problem, some effort has been made in the present paper to disaggregate sub-regional data wherever there appear to be significant differences between the two countries.

2. DEMAND AND CONSUMPTION

2.1 Consumption 1970 - 1990

Table 2 shows data on fish supply, population and per capita supply (i.e. apparent consumption) in Australia and New Zealand over the past 25 years. The derivation of the net supply data in this table is shown in table 5 (section 3.1).

Table 2: Fish consumption in Australia and New Zealand (Laureti, 1992)

	1965	1970	1975	1980	1985	1990
Australia						
Net supply of fishery products ('000 t)	145.7	167.3	187.2	204.4	271.8	323.0
Population (millions)	11.4	12.5	13.6	14.7	15.8	17.1
Fish supply/capita (kg live weight)	12.8	13.3	13.7	13.9	17.2	18.9
New Zealand						
Net supply of fishery products ('000 t)	47.9	45.0	45.4	65.3	81.1	100.3
Population (millions)	2.6	2.8	3.1	3.1	3.3	3.4
Fish supply/capita (kg live weight)	18.2	16.0	14.7	21.0	25.0	29.6
Sub-regional total						
Net supply of fishery products ('000 t)	193.6	212.4	232.6	269.6	352.9	423.3
Population (millions)	14.0	15.4	16.7	17.8	19.0	20.4
Fish supply/capita (kg live weight)	13.8	13.8	13.9	15.1	18.5	20.7

The table indicates that there has been a gradual increase in per capita fish consumption over the 25-year period. This is attributed to increased perceptions of fish as a healthy or desirable food, availability of a wider range of product forms, better presentation, packaging and marketing, and a growing per capita income among citizens of the sub-region. While still quite low by the standards of most of the developing countries in the Pacific region (according to Dalzell and Adams (1994) per capita fish consumption in Kiribati is as high as 181.6 kg/ capita/ year), fish consumption in the sub-region is now well above the world average of 13.2 kg/ capita/ year.

Contrary to expectations, the increase in consumption of seafoods has taken place in the face of increasing prices of fishery products. The Bureau of Agricultural Economics (1986) noted that, in Australia "Domestic consumption of fisheries products is unlikely to increase and may decline given the increase in fish prices relative to the prices of other products, the expected slowdown in economic growth, and the impact of the fringe benefits tax on the restaurant sector." However FAO statistics indicate that seafood consumption, and particularly the consumption of fresh fish, has increased each year since 1985. In 1992 the aggregate increase was about 10% over 1985 levels.

In New Zealand also, apparent consumption of seafoods has increased substantially during a period when seafood prices have been rising in real terms. Unlike Australia, however, the price of meat in New Zealand rose faster than that of seafoods in 1991-1993, while the price of poultry continued to decline.

Statistics in Laureti (1992) give some indication of trends in consumption of various types of seafood products in Australia and New Zealand over the past decade, as shown in table 3 below.

Table 3: Apparent consumption of fish and fishery products (kg product weight/capita/year) (Laureti, 1992)

	Av 1980-82	Av 1998-90	% change
Australia			
Fresh/frozen fish	5.4	8.0	+48.1
Fresh/frozen shellfish	1.2	1.2	0.0
Tinned fish/shellfish	1.8	2.0	+11.1
Other	0.8	0.6	-25.0
Total*	9.2	11.8	+28.3
New Zealand			
Fresh/frozen fish	13.6	13.6	0.0
Fresh/frozen shellfish	4.5	8.4	+86.7
Tinned fish/shellfish	1.5	2.6	+73.3
Other	<0.1	0.2	+260.0
Total*	19.6	24.8	+26.5
Sub-regional total			
Fresh/frozen fish	6.9	8.9	+30.3
Fresh/frozen shellfish	1.8	2.4	+36.1
Tinned fish/shellfish	1.8	2.1	+16.8
Other	<0.1	<0.1	-37.5
Total*	11.1	13.8	+24.9

* Because the data is presented as product weight, figures in this table do not agree with the per capita fish supply information (expressed as live weight) shown in table 2 above.

Broadly these data indicate that, on a regional basis, per capita consumption of most forms of fish and shellfish is remaining stable or increasing, in some cases substantially. The trends are somewhat different in the two countries concerned, however. Per capita consumption of fresh fish and seafood is stable in New Zealand but increasing rapidly in Australia, while consumption of tinned and frozen fish and seafood products is increasing rapidly in New Zealand and less rapidly, or not at all, in Australia. In both countries the consumption of "other" seafood products, which includes cured, pickled and miscellaneous forms, already low, appears to be stable or in decline. (While a very large percentage increase in this category is indicated for New Zealand, the actual product volumes involved are in fact minuscule).

The first direct measure of Australian seafood consumption habits was made in 1976-77, when a survey carried out in the 6 Australian state capitals indicated that urban Australians consumed 10.1 kg of fish per head annually, of which 7.8 kg (77%) was fin-fish and 2.3 kg (23%) other seafood (Fisheries Division, 1978). This estimate is lower than the FAO assessment of consumption (12.8 kg/ capita in 1976 and 14.4 kg/ capita in 1977) during the same period (Laureti, 1992). The disagreement may be due to several factors: the 1976-77 survey was based on a sample of the Australian population which did not include rural dwellers; the survey involved the assignment of a standard weight to take-away fish portions which may have introduced a bias; there were difficulties experienced during the survey in estimating the exact portion weights of certain product forms; and the FAO estimate is an apparent consumption figure based on dividing total fish supply by the total population of the country, rather than on any direct measure of consumption.

Both sets of figures include fresh, frozen, canned and cured seafoods, as well as some other product forms. The 1976-77 survey indicated that tinned fish was the most frequently consumed form of seafood (28 times per household per year) followed by fresh fish (18 times per year) and cooked fish from take-away outlets (8 times per year). In terms of quantity, however, fresh and frozen fish and seafood made up the largest component of consumption (36%), followed by tinned products (19%), and food served at take-away outlets (16%). Prawns were by far the most popular type of non-fish seafood consumed. While three quarters of all fish was prepared and cooked at home, only one third of non-fish seafood was prepared and cooked at home, the remainder being consumed in restaurants, clubs, bars, take-away outlets or the homes of friends and relatives.

A more recent Australian survey, carried out in 1992, confirms that seafood demand in Australia has continued to show strong growth since this time (P+A Consulting Group Ltd., 1992). The survey estimated that Australian consumption of all seafoods was about 175,600 tonnes (meat weight) in 1990-91, excluding institutional seafood use by non-household residents (prisons, etc.). If this rate of growth were to continue, the survey projects that domestic consumption would rise to around 220,000 tonnes total by the year 2001, after accounting for population growth. This represents an increase of nearly 25% on 1991 levels of consumption estimated by the survey. (Note that, while the projected future increase in consumption is consistent with the trends indicated by the FAO data, the actual figures do not agree with FAO estimates).

Detailed information on seafood consumption in New Zealand is less readily available. The annual Household Income and Expenditure Survey carried out by the New Zealand Statistics Department indicates that household expenditure on fish and seafoods declined slightly in 1992 and 1993 after peaking in 1991, but no data are given on the quantities or types of seafoods consumed.

Over the past three decades fish has increased in importance as a component of animal protein intake in the sub-region, as shown in table 4 below.

Table 4: Fish and seafood as a percentage of total animal protein consumption (from Laureti, 1992)

	1965	1970	1975	1980	1985	1990
Australia	4.2	4.7	4.4	5.1	5.8	6.5
New Zealand	5.6	4.6	3.3	6.7	8.0	10.6
Total	4.5	4.7	4.2	5.4	6.2	7.2

While increasing in importance, fish and seafoods still play a far less important role in satisfying protein demand in the sub-region than other forms of animal produce, in particular poultry and various forms of meat, average supply of which in 1990 averaged 116.8 kg/ capita/ year in the sub-region. In general, seafoods continue to be viewed as a desirable but sometimes expensive alternative form of protein which is eaten occasionally or irregularly as a flavour alternative, a luxury item, or because of a growing awareness of dietary health. As noted earlier, a substantial amount of seafood consumption is associated with restaurant or take-away dining rather than with home-prepared meals.

2.2 Factors influencing demand

Smith and Tran (1994) note that demographic factors (population growth, ethnic mix and changes in the population age structure), taste factors, the tourist market for seafoods, and relative prices are among the principal determinants of domestic demand for seafood in Australia. These considerations also apply in large part to New Zealand.

Demographic factors. Population growth in Australia and New Zealand is slow relative to other regions of the world, (1.4% p.a. between 1970 and 1990, with a slight decline in recent years) and is expected to decline to 1.1% between 1990 and 2010 (FAO, 1995). Based on these expected growth rates, the population of the region is expected to rise from 20.5 million in 1990 to 25.4 million in 1995, of which, as noted earlier, over 80% is resident in Australia.

Seafood consumption varies among people of different ethnic origin. Fisheries Division (1978) noted that country of origin had no discernible effect on the overall amount of fish and seafood consumed but had a marked influence on the types preferred. Families of Italian, Greek and other Mediterranean origins ate almost twice as much fresh fish as families of British origin, who ate more fish fingers, packaged frozen and tinned fish, and more cooked fish outside the home.

In recent years immigration into the region has continued to be a major component of population growth, especially in Australia, where it has been responsible for 40% of total growth over the past two years (Smith and Tran, 1994). The highest growth has been in the proportion of Asian-origin immigrants, which grew from 1.3% of the population in 1981 to 3.8% in 1991.

This continuing change is expected to result in increasing demand for seafoods, particularly non-traditional types.

The changing age structure of the population of the sub-region may also result in a strengthening of the demand for seafood because of the relationship between seafood consumption and age. The populations of both New Zealand and Australia are aging, with people over 20 years of age comprising 69.8% of the total Australian population in 1991, as opposed to 66.3% ten years earlier (Australian Bureau of Statistics, 1993). Australian consumer surveys have shown low seafood consumption among younger age groups, with increasing consumption among older age groups based on perceived health advantages of seafood products, higher levels of disposable income, and a higher proportion of meals eaten outside the home (P+A Consulting Group Ltd., 1992). In New Zealand, consumers aged over 40 are responsible for 68% of total expenditure on seafoods (Parker, 1994).

Taste factors. Australian and New Zealand consumers tend to have positive attitudes towards seafoods, based on the perceived healthiness of these products. However, they also have a range of concerns in relation to the products and their marketing, including the freshness of the product, misrepresentation by traders who sell lower grades of fish as more valuable species, and product safety issues. Many consumers are concerned at the impacts of marine pollution on seafoods, and the health aspects of seafoods may be further eroded by competitive promotion of the health advantages of other potential substitute products (Smith and Tran, 1994).

An example of the importance of health-related issues to seafood consumption occurred when a major outbreak of biotoxicity ("red tide") took place in New Zealand early in 1993 (the first such event in that country) and caused paralytic shellfish poisoning in consumers of mussels and other molluscs. As a result of the incident consumption of locally-harvested molluscan shellfish in New Zealand effectively ceased and over 1,000 jobs in the seafood processing industry were temporarily lost. Only at the end of 1993, after the fishing industry and the New Zealand Government had spent over NZ$ 1 million on a major seafood promotion campaign and a further NZ$ 4 million on a long-term research programme to investigate biotoxicity did consumer confidence return and seafood consumption reach the same levels as earlier in the year.

Tourism may also be a source of growth in demand for seafood, especially in Australia, which has one of the fastest growth rates in the number of short-term visitors of any OECD country, (an increase of 10% per year from 1981 to 1991), with the number of short-term visitors in 1991 estimated at 2.37 million (Bureau of Tourism Research, 1992). Tourists, and especially overseas visitors, have a high per capita expenditure and a high propensity to consume meals in restaurants. Smith and Tran (1994) estimate that tourists consumed about 3,000 tonnes of seafood in Australia during 1991, and that this demand will probably increase to at least 6,800 tonnes (edible weight) by the year 2001.

Prices and the availability of disposable income can clearly be expected to have an effect on demand for seafood. Referring to a survey of consumer attitudes towards seafoods, Kitson

(1992) states that "When respondents were asked what actions taken by the fishing industry would encourage greater consumption in their household, almost a third sought reasonable/ cheaper prices. Greater availability of fresh fish and seafood were also common responses. Smith and Tran (1994) note that "Prices of fisheries products on the Australian market appear likely to strengthen further in the medium term as a result of continued high export demand, a continued weak Australian dollar which boosts import prices and little prospect of significant increase in domestic supplies. This will be expected to reduce the quantity of fish and seafood demanded in comparison with other products, but the impact will vary between sectors depending on the substitutes available".

As noted earlier, however, the relationship between seafood price and demand may not be simple. In the past, seafood consumption in the sub-region has risen despite real price increases, a factor which is thought to be largely attributable to positive consumer perceptions of seafood products. The populations of both Australia and New Zealand are relatively affluent, with 1990 per capita gross domestic product (GDP) estimated to be US$ 11,816 at 1980 constant prices. The average annual GDP growth rate during the period 1970-1990 was estimated to be 1.4%, while for the period 1990-2010 GDP in the sub-region is projected to rise by an annual average of 1.9% (FAO, 1995). In view of the resultant increased affluence of the population, other factors, such as continued positive perceptions of seafood products, may prove more important than price increases in determining future demand for fish and fishery products.

2.3 Demand projections 2010

In order to project future demand for fishery products, some basic assumptions are needed. Here it is assumed that per capita seafood demand over the next 20 years will continue to grow as it has in the past 20, due to the range of demographic and economic factors outlined above which will, on the whole, tend to lead to increased demand for fishery products. A projected increase of this scale, which represents the maximum likely to be experienced, would lead to a per capita consumption of 27.6 kg/ annum, as shown in figure 1 below.

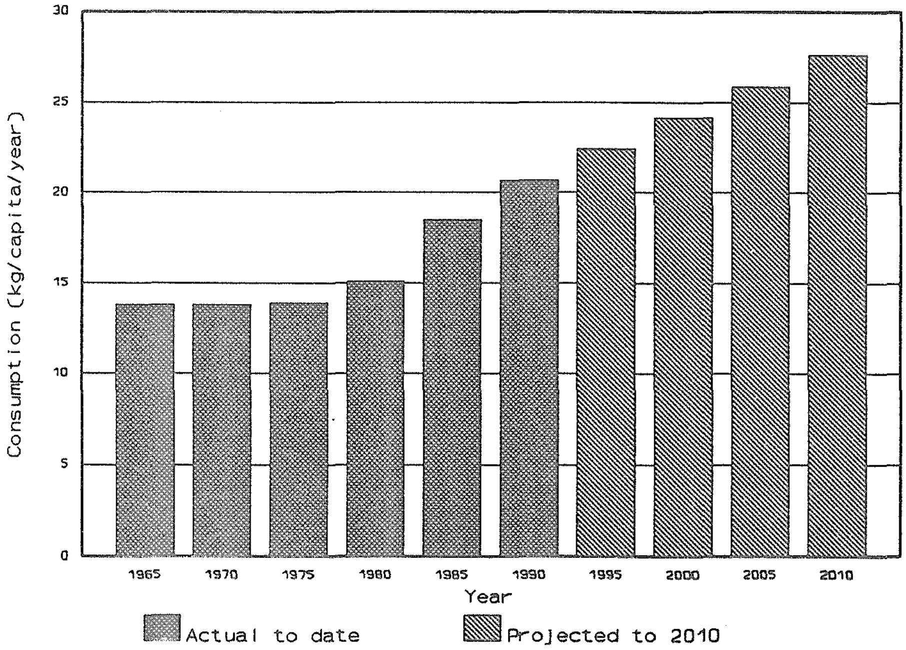

Figure 1: Actual and projected per capita fish consumption in Australia and New Zealand, 1965-2010 (live weight)

If the sub-region's population increase is as projected by FAO (1995) then the total population of the sub-region will be 25,401,000 in 2010, and total seafood demand at this time will be of the order of 700,000 tonnes.

3. SUPPLY

Table 5 provides summary statistics on fish supply in the Australasian sub-region over the past 25 years.

Table 5: Fish supply in Australia and New Zealand (laureti, 1992)

Quantity ('000 tons)	1965	1970	1975	1980	1985	1990
Australia						
Production	78.9	102.4	108.4	132.0	161.0	210.4
Imports	86.5	102.0	124.6	143.2	195.8	210.8
Exports	18.6	36.0	43.8	80.4	78.4	92.9
Net supply	146.8	168.3	189.2	206.6	277.8	328.3
Non-food use	1.1	1.0	2.0	2.2	6.0	5.3
Food supply*	145.7	167.3	187.2	204.4	271.8	323.0
New Zealand						
Production	48.4	59.3	63.5	215.0	304.8	565.4
Imports	5.8	6.7	7.5	9.2	14.5	24.1
Exports	6.3	17.5	23.5	148.7	215.2	303.5
Net supply	47.9	48.5	47.5	75.5	104.1	285.8
Non-food use	0.0	3.5	2.1	10.2	23.0	185.8
Food supply*	47.9	45.0	45.4	65.3	81.1	100.3
Sub-regional total						
Production	127.3	161.7	171.9	346.9	465.7	775.8
Imports	92.3	108.7	132.1	152.4	210.3	234.9
Exports	24.9	53.5	67.3	229.1	293.6	396.4
Net supply	194.7	216.9	236.7	282.0	381.9	614.3
Non-food use	1.1	4.5	4.1	12.4	29.0	191.0
Food supply*	193.6	212.4	232.6	269.6	352.9	423.3

* In theory, food supply = ([production + imports] - [exports + non-food uses]). However, some data also include a correction for changes in inventories, hence the totals may not tally completely.

Substantial increases in production from the region have taken place in recent years, due in particular to massive increases in New Zealand's marine capture fisheries. These have been compensated for to some extent by a net rise in exports such that the increase in fishery products available as food supply to the sub-region, while still substantial, has been less dramatic. There is considerable trade in fishery products between Australia and New Zealand, hence the regional totals for import and export figures may be somewhat misleading, since some imports/ exports are actually internal to the region.

Recreational fishing is an important, and perhaps under-estimated source of fish supply in both Australia and New Zealand. Although figures for total landings by the region's recreational fishermen are not readily available, a survey carried out in Australia in the late 1970's (Fisheries Division, 1978) noted that leisure fishing accounted for about 25% of the fresh fish supply at that time. Given the substantial increases in commercial fisheries and aquaculture production in recent years, the proportion of food supply derived from recreational fishing is probably somewhat smaller now than in the past, but may still be significant.

3.1 Marine capture fisheries

Though they are diverse and occupy one of the world's largest fishing zones, Australia's marine fishery resources are not as abundant or productive as those found in many other parts of the world. This is thought to be because, on average, Australian waters are low in nutrients compared with other regions (Kailola et al, 1993).

In the past, projections of Australia's fisheries potential were optimistic. In 1970, a Food and Agriculture Organisation report estimated that Australia's coastal and continental shelf waters could yield a catch of 2.3 million tonnes annually (Gulland, 1970). Twenty-five years later, however, total Australian capture fishery production has reached only about one tenth of this amount. In terms of total landed weight, Australia's fisheries catch is no longer expected to grow much beyond its present level. Few prospective areas of the Australian Fishing Zone are still to be explored and, while much remains to be learned about the full effects of fishing on at least half of Australia's fishery resources, only 9 commercially significant species are currently thought to be under-exploited or capable of supporting higher catches without affecting their productive potential. On the other hand, 9 species or groups are thought to be over-exploited, and 22 heavily or fully exploited (Kailola et al, 1993). FAO (1995) notes as that there is no potential for future catch increases in either the Eastern Indian Ocean (statistical area 57) or the Southwest Pacific (statistical area 81), which covers most of Australia's Fisheries Management Zone.

In New Zealand, marine capture fisheries have developed very quickly since the beginning of the 1970's, when total landings were only 143,500 tonnes (FAO 1995). According to Ministry of Agriculture and Fisheries (1993), most major fish stocks in the New Zealand EEZ are now fully developed. In addition, some major stocks of orange roughy, rock lobster and snapper are below their optimal size. There may be room for modest increases in catches as stocks are fished down or as they are rebuilt. Any large increases in catches from the EEZ will have to come from new stocks or developing fisheries for new commercial species. The probability of finding large, unexploited stocks of existing commercial species in areas that have been traditionally fished are considered slight.

In both countries, increases in capture fishery production may be possible through both stock enhancement. Parker (1994) refers to the success of a New Zealand scallop stock enhancement programme based on spat collectors, while enhancement experiments for several species are under way in Australia (Morton and Tilbury, 1993). In addition, fishery development prospects in areas that have not been thoroughly explored, such as parts of the sub-Antarctic area, are unknown. These potentials are not so far demonstrated, however, and for the time being most projections assume that fishery production from Australian and New Zealand marine capture fisheries has now peaked at current levels of about 0.21 and 0.55 million tonnes respectively.

3.2 Inland capture fisheries

From the point of view of food production, inland fisheries do not constitute an important sector in the sub-region. Their economic value is related principally to leisure activities, since recreational fishing is popular in the region.

Catches have been stable at about 3,400 tonnes during recent years (FAO, 1995). Some infrastructure developments (dams and spillways), as well as pollution and habitat destruction, may have decreased the availability of freshwater resources. In 1985 three species of freshwater fish having commercial value were placed on an Australian endangered species list (Michaelis, 1985).

It is unlikely that inland fisheries will develop any further considering the ease of access to the sea and the lack of important inland water resources in the two countries concerned.

3.3 Aquaculture

Aquaculture production in Australia and New Zealand, while still small by world standards, has increased more threefold in less than a decade. 1984 production of 19,400 tonnes (FAO, 1992) has grown to over 67,000 tonnes in 1992 (FAO 1994), as shown in table 6.

Table 6: Australia/New Zealand aquaculture production (FAO, 1994)

	1986	1987	1988	1989	1990	1991	1992
Australia	9,221	9,951	13,353	13,676	12,678	14,479	15,771
New Zealand	16,977	19,366	27,821	27,045	28,660	48,660	51,310
Total	26,198	29,317	41,174	40,721	41,338	63,139	67,081

In 1992 New Zealand's aquacultural production was over 51,000 tonnes, of which New Zealand "Greenshell" mussel (*Mytilus canaliculus*) was by far the most important product (46,500 tonnes). Other species produced included Chinook salmon (*Oncorhyncus tshawytscha*, 2,700 tonnes), Pacific oysters (*Crassostrea gigas*, 2,000 tonnes), and scallops (*Pecten novaezealandiae*, 100 tonnes).

Australia's production was somewhat lower at about 16,000 tonnes in 1992. There are now 15 principal commercial aquaculture species, of which 10 are endemic (Kailola et al, 1993). Oysters (Sydney rock oyster, *Saccostrea commercialis*, Pacific oyster, *Crassostrea gigas*, and other *Crassostrea* and *Ostrea* species) are the most important component, together comprising 8,201 tonnes. Other important species/ groups were Atlantic salmon (*Salmo salar*, 3,147 tonnes), rainbow trout (*Oncorhynchus mykiss*, 1,914 tonnes), giant tiger prawns (*Penaeus monodon*, 898 tonnes) and blue mussels (*Mytilus edulis planulatus*, 757 tonnes), as well as freshwater crayfish

(*Cherax* species), eels (*Anguilla* spp.), barramundi (*Lates calcarifer*) and southern bluefin tuna (*Thunnus maccoyi*) (FAO, 1994).

Although unimportant in volume terms, a substantial proportion (about a third) of the value (A$ 315 million in 1994-5, according to Battaglene and Lancaster, 1995) of Australian aquaculture production comprises pearls, a non-food item. Disregarding this component, however, the general trend in both countries is for the production of high-value food species destined for export or for the upper segments of the domestic market.

Both Australia and New Zealand predict strong future growth in this sector and, given the constraints on the expansion of capture fisheries in the sub-region, are actively promoting aquaculture development as the only realistic means to substantially increase the volume of fishery production. Morton and Tilbury (1993) note that aquaculture is not only a means of increasing production but can also be used to improve returns from capture fisheries through coordinated marketing efforts and possible stock enhancement of some commercially caught species.

3.4 Factors influencing supply

The principal factors influencing the supply of fishery products to the sub-region (other than the potentials for increased production discussed in sections 3.1 - 3.3) will be the overall economics of fishing, aquaculture and fishery product trade, and in particular the profitability of seafood exports. These factors will themselves hinge on large-scale features of the global economy such as global currency movements, trends in the major US, European and especially Asian markets for Australasian seafoods, and domestic economic and political issues that impinge on fisheries. Discussion of these macro-economic factors is beyond the scope of the present paper.

At a more "local" or tangible level, factors that directly influence fishery product supply will include fisheries management measures aimed at reducing exploitation, increasing competition for access to limited natural resources, environmental issues, and questions of improved catch utilisation.

Fisheries management. Several marine fishery stocks currently being fished in the sub-region are being exploited at levels beyond that which is thought to be sustainable in the long-term. An example is orange roughy, which is currently reaching the end of its "fish-down" phase (the period at the start of a new fishery when accumulated or virgin biomass is removed). About 50% of Australia's fin-fish (as opposed to seafood) exports in the early 1990's were derived from the sale of this species to the USA. Landings of orange roughy are expected to decline in the remainder of the 90's (Geen and Battaglene, 1992), while in New Zealand the quota management system for this species is becoming increasingly more restrictive in order to reduce levels of exploitation (Parker, 1995). This is one of the more important fisheries in both countries, and its reduction, along with management restrictions on other species, may lead to declines in both the volume and value of landings in the sub-region.

Competition for access. Recreational fishing is an important pastime in both Australia and New Zealand, and in some cases might be more correctly classified as subsistence fishing. In the late 1970's in New South Wales, Australia, it was estimated that at least 30 per cent of the population went fishing, and 20 million person-days a year were spent fishing for fun (Pownall, 1979). Similar patterns were thought to occur in other Australian states. As noted earlier, a 1977 survey estimated that some 25% of all fresh fish consumed originated from recreational fishing (Fisheries Division, 1978). More recently, Geen and Battaglene (1992) point out that growth in recreational catches has led the Government to conclude that both commercial and recreational sectors have to be restricted in their operations in order to sustain fish resources.

In New Zealand, Tierney (1995) notes that 0.5 million New Zealanders, or 15% of the population, spend time marine recreational fishing, principally for about 40 inshore species. Recreational harvest estimates for the five species of prime importance range from 3,000 tonnes (snapper) to 4 tonnes (paua). For some species/ localities recreational harvests are 95% or more of total catches, although the relationship is clearly dependent on the size of the commercial catch.

The actual and growing importance of recreational fisheries in the sub-region will almost certainly lead to future fishery management measures that restrict the activities not only of recreational fishermen themselves, but also of commercial fishermen targeting the same fish stocks. The net result may be a shift of landings out of the commercial and into the recreational/ subsistence sector, resulting in an apparent (or in some cases real) drop in fishery production. Another form of competition for access to marine resources has also arisen in New Zealand recently as a result of concessions made by the Government to the special circumstances of indigenous peoples. Maori claims to control of fisheries and fishing rights were recently addressed by the passing of the Treaty of Waitangi Settlement Act, which has seen Maori communities become the largest fish quota owners in New Zealand. Nearly 40% of all quotas are now exclusively owned by Maoris (Tierney, 1995), and while these are for the most part still available to the commercial fishing industry through joint ventures and other arrangements, there is no guarantee that arrangements will not change in the future, possibly altering patterns of fish supply. The Waitangi Settlement Act also supplemented existing customary fishing rights with provisions for local Maori communities to assume responsibility for managing fisheries within coastal areas of traditional significance, again possibly impacting on commercial fishing activities.

Utilisation. Several fisheries operating in the sub-region take substantial quantities of unwanted "trash" fish which, apart from the odd species of value, are usually discarded immediately at sea. Bottom-trawl fisheries in particular tend to have high levels of by-catch, with some Australian prawn fisheries showing a by-catch: target species ratio (by weight) of 8:1. Some research effort is being aimed at reducing levels of by-catch, but in many fisheries it will not be possible to completely eliminate incidental catches. Development of improved methods of utilising or adding value to by-catch species could result in the processing of some of these species becoming economic, leading to increased fish supply.

There has been a substantial increase in the use of fish for non-food purposes (manufacture of fish meal, pet food, stock feeds, etc.) in the sub-region during the past 5 years, as shown in table 7.

Table 7: Percent of fish used for non-food purposes (Laureti, 1992)

	1965	1970	1975	1980	1985	1990
Australia	1.4	1.0	1.8	1.7	3.7	2.5
New Zealand	0.0	5.9	3.3	4.7	7.5	32.9
Total	**0.9**	**2.8**	**2.4**	**3.6**	**6.2**	**24.6**

All of the increase in non-food use of fishery landings in the sub-region is attributable to changing practices in New Zealand. According to FAO (1994) this is almost entirely due to reduction of certain components of the catch to fish meal, a feature which is associated with the increased landings of high-volume, low-value fish species in recent years. In future, changes in patterns of world fishery supply and demand may make it economic to process some of this catch for human consumption, a practice which could technically increase supply from the sub-region by up to some 190,000 tonnes.

Environmental issues. As in many developed countries, public awareness of environmental issues has become heightened in recent years, and this has impacted on fisheries, where unsustainable marine resource exploitation and fishing practices that result in waste or habitat destruction have become the object of public censure and government regulatory attention. Incidental takes of endangered species such as turtles and seals, or discarding of by-catch species (which in some Australian fisheries include corals), are becoming important issues in some fisheries. Pressure to discontinue fishing practices perceived by the public as being undesirable may ultimately result in management measures that restrict fishing activities for some target species.

According to Geen and Battaglene (1992) "Declining catch rates, changing market conditions, growth in recreational fishing and the increasing environmental awareness of Australian society as a whole are all factors putting pressure on fishermen to adjust their fishing and marketing activities. The medium-term outlook for the profitability of the fishing industry is highly dependent on how well the industry responds to these and other adjustment pressures".

The impact of global climate change on fisheries production in Australia cannot be fully predicted, but a preliminary examination of possible impacts proposed that climate change was likely to affect prawn stocks through changes in critical coastal habitats, western rock lobster stocks through changes in oceanic circulation, and some of the south-eastern fisheries species through ocean temperature rises (Kailola et al, 1993).

3.5 Supply scenario 2010

As already noted, capture fisheries are considered fully exploited in the sub-region. While newly-discovered resources or improved management systems may lead to small increases in landings, these may be compensated for by reduced access to resources by commercial harvesters, environmental degradation, or other forms of marine resource management and conservation. The greatest potential to increase the actual volume of production from capture fisheries appears to be by diverting fish landings that are being used to manufacture non-food products into the human food supply. In recent years, however, the actual trend has been the reverse, with a growing percentage of landings being used for non-food purposes. For the purposes of projection, therefore, it will be assumed that food supply based on landings from capture fisheries will be static, at about 750,000 tonnes.

There is potential for increased production from aquaculture in both countries. However, as current levels of production are small (67,000 tonnes), increases of at least an order of magnitude would be needed before aquaculture began to make the same level of contribution food supply as capture fisheries currently do. In fact, if aquaculture production for food continues to increase at the same rate as in the last 8 years (table 6), production in the year 2010 will reach approximately 160,000 tonnes, or about 20%of production from capture fisheries.

Under this scenario, therefore, total commercial fish and seafood production from the region will be about 910,000 tonnes, of which slightly less than 18% will come from aquaculture, and the remainder from capture fisheries, mostly marine. No allowance is made for the recreational/subsistence catch but this is likely to be of the order of an additional few percent, bringing the total up to somewhere around 1,000,000 tonnes.

4. DISTRIBUTION INCLUDING INTERNATIONAL TRADE

Overall Australia is a net importer of fishery products, having imported approximately 64% of its seafood supply requirements (by weight) in 1992. Nevertheless, Australian exports are substantial (44% of domestic production in 1992) and comprise the highest-value components of the catch (see table 5), with Japan being the main market for Australian seafoods during 1992-93 (37% by value). New Zealand, on the other hand, is a net seafood exporter, having exported about 54% of its total production in 1992. Imports are very small, at only 8% (by weight) of domestic seafood supply requirements. A large component of New Zealand's exports goes to Australia: Bureau of Agricultural Economics (1986) notes that in the period 1985-86 New Zealand was the major supplier of Australian fishery product imports, accounting for 18% by value of all fishery products and 32% by value of fish imports. The same source indicates that New Zealand is not an important export destination for Australian fishery products.

Some of New Zealand's major fisheries land high volumes of relatively low-value species such as hoki and barracouta that are marketed as frozen fillet blocks or used as surimi, and that compete directly with "whitefish" such as cod and Alaska pollack produced by some of the world's biggest fisheries (Parker, 1994). The New Zealand fishing industry, which is currently the country's fourth largest export earner (Tierney, 1995) has set itself the target of increasing the value of fishery product exports to NZ$ 2 billion (from 1993 levels of about 1.2 billion) by the year 2000 through a combination of increased value-added processing, better marketing (including increased targeting of high-value overseas markets), aquaculture, stock enhancement, improved management and development of new fishery activities (Parker, 1994).

Australian fisheries, while less important to the national economy, land a greater proportion of high-value species which attract their highest values when sold on prime overseas markets with a minimum of processing (Kingston and Brown, 1993). The total value of production from commercial wild fisheries and aquaculture in Australia has exceeded A$1 billion each year since 1988. This high value, which is out of proportion to the quantity of landings, is generated partly because the commercial catch has a large component of highly-priced shellfish species such as abalone, scallops, penaeid prawns and rock lobsters. In 1991-1992 these species comprised 58% of the total production value (Kailola et al, 1993). Most Australian exports are in unprocessed or lightly processed form. There has been no significant increase in highly processed seafoods and most value-adding of exports has been because of higher real prices resulting from exchange rate movements, and from targeting of higher-value markets for fresh or live products rather than more "traditional" markets for frozen, canned, cured or other processed fishery product forms (Geen and Battaglene, 1992).

Over the past decade the gross value of Australian fisheries production has quadrupled to reach A$ 1.6 billion in 1993-1994 (Battaglene and Lancaster, 1995). Production is forecast to increase by a further 2% in 1995-1996, based on additional value-adding, increased targeting of high-value overseas markets, aquaculture development and stock enhancement.

Both countries of the sub-region are expecting to profit from the reduction in tariffs on seafood products that will take place over the next 5 years as a result of the Uruguay round of the General Agreement on Tariffs and Trade (Smith and Tran, 1994: Parker, 1994), and both are expecting major growth in seafood exports to Hong Kong, Korea, Taiwan and the People's Republic of China, where rapid economic growth and associated increases in disposable income, as well as geographic proximity, favour seafood producers in the Australasian sub-region.

5. FISH CONSUMPTION 2010

Based on the above seafood demand and supply considerations, the following scenario might be envisaged in the year 2010:

- commercial demand for seafood products within the sub-region will be of the order of 700,000 tonnes maximum;

- supply from commercial operations within the region will be of the order of 910,000 tonnes maximum (ignoring any supply form recreational fishing);

There will be a continued drive to increase exports from the region, especially high-value products to lucrative established or developing overseas markets in Asia. There will also be an increase in imports, probably of lower-value canned and frozen products, to allow satisfaction of the growing domestic seafood demand within the sub-region. Gradually increasing per capita income in the region, as well as a domestic supply that nominally exceeds demand, will both act to support a continuation of the current trend towards increased per capita seafood consumption, which might reach a maximum of about 27.6 kg/ capita/ year by 2010.

6. IMPLICATIONS FOR FOOD SECURITY

Irrespective of seafood product supply and demand considerations in the future, the implications for food security in the sub-region are not significant. Both Australia and New Zealand are relatively affluent countries and both are well-supplied by a wide range of domestically-produced and imported agricultural products. Per capita protein consumption is very high and malnutrition or other problems caused by inadequate supply of food, or of certain types of food, are essentially non-existent. Where dietary health problems occur they tend to be related to incorrectly balanced diets or over-consumption of certain types of foodstuffs an associated obesity, diabetes, coronary problems, etc.

Seafood, while currently increasing in importance in the diet of the sub-region, still comprises a relatively small part of overall protein supply (7.2% in 1992). Cheaper forms of animal protein (such as poultry) are readily available in large quantities in the event that resource-related or economic circumstances result in a diminution in seafood supply. The major concern from a food security viewpoint may be that a reduction in seafood consumption in the sub-region may lead to a gradually increasing incidence of coronary and other non-contagious diseases that seafoods apparently play a role in combating.

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CHINA

Demand and Supply of Fish and Fish Products in China
Perspectives and Implications for Food Security

by

R. Willman
FAO Fisheries Department

Contents

1. REGIONAL CHARACTERISTICS AND ISSUES

China is located in the northwestern part of the Pacific covering 40 latitudes from tropical through temperate climatic zones. The coastline has a length of about 18,000 km. The principal marine fishing areas include the Bohai, Yellow, East and South China Seas. The continental shelf area to the 200 meter isobath covers about 1.5 million km^2.

Major marine species include yellow croakers, hairtail, Chinese herring, sardine, chub and Spanish mackerel, jelly fish, cuttle fish, squid, and shrimps. The Chinese fishing fleet comprises over 100,000 motorised fishing boats which operate from approximately 700 large and small fishing ports. The number of fishermen is estimated at over one million persons. Trawl is the principal fishing gear, followed by purse-seine, gillnet and line.

With marine capture fisheries reaching resources limits, China's fisheries policy has directed increasing emphasis on the expansion of inland, coastal and marine culture activities.

In the marine environment, the range of cultured species has greatly diversified from traditional shellfish such as oyster and clams, and seaweed, to over thirty different species including mussel, shrimp, scallop, sea cucumber and others. In freshwater culture, only a small number of species of carp produce the bulk of the production.

China has a vast area of inland waters of about 14 million hectares including rivers, lakes, reservoirs and ponds. There is also a great potential of lowlying lands which can be utilized for fish farming. In the rural areas, over one million hectares are being utilized for rice-fish farming. The longest history in fresh water culture fisheries and the most advanced technologies are applied in Guandong, Jiangsu and Zhejian Provinces.

2. DEMAND AND CONSUMPTION

2.1 Consumption 1970 to 1990

Fish is an important and highly preferred item of the Chinese diet and average per capita consumption has increased as a result of higher production and of higher incomes. Per capita fish consumption was 9.9 kg p.a. in 1990, up from 4.2 kg in 1980, and 3.7 kg in 1970. Meat consumption increased from 15.8 kg in 1980 to about 30 kg in 1990. In the period 1980 to 1992, average compounded growth rate of fish consumption was 10% (about the same growth rate as meat consumption and real GDP).

In 1990, China accounted for over 15% of world fish consumption and accounted for more than one quarter of the global increase in fish consumption in the period 1970 to 1990.

Fish as a share of animal protein intake declined from the early 1970s (27%) until the early 1980s (17%) and then slightly increased to around 20 % in the early 1990s. The contribution of fish to total protein intake is low at around 4 %. Average per capita intake of animal protein is still at a very low level (15.4 gr per day) compared to Japan (55.4 gr per day) and other OECD countries.

Chinese fish consumption depicts considerable variations between different provinces with much higher intakes in coastal provinces, particularly in South China (according to Globefish database average per capita fish consumption reported for Guandong province is 42.8 kg p.a). These are also the provinces with highest economic growth as well as high rates of urbanisation.

2.2 Factors influencing demand

Apart from population increase, the principal factor which influences future growth in Chinese fish demand is economic growth. The country is far from reaching saturation of either animal protein or fish intakes. Hong Kong, for example, has an average per capita fish consumption of above 55 kg p.a.

Population growth which averaged just below 1.5 % p.a. in the period 1970 to 1990 has a relatively small influence on growth in fish demand even though in absolute terms it is significant because of the large population of over 1.1 billion persons.

completion over land increases from urban and industrial development and the need to maintain agricultural land. There is significant potential to further expand integrated agriculture-aquaculture systems, especially fish cultivation in rice fields.

(2) Brackish and marine waters

In 1992, China was the biggest producer of cultured shrimp (above 200000 tons) but experienced a severe production set back in 1993 and 1994 due to the outbreak of a viral disease which has been linked to poor management techniques including excessive feeding, high stocking densities and inadequate pond maintenance. Since then, production has been around 40 000 tons (Globefish database).

Over half of Chinese marine culture production comprises of various types of molluscs with a generally low ratio of meat per unit weight (around 1 to 5). Public health problems have been experienced in the past due to culture in contaminated coastal waters.

China is undertaking recruitment enhancement through the release of reared fries and fingerlings of selected species in marine waters including shrimp and jelly fish. No information is available on the efficacy and economics of such enhancement. In the case of shrimp, it is assumably rather low because environmental factors are believed to strongly affect recruitment.

In recent years, there has been strong growth in cage culture of live fish (e.g. grouper, sea bream) in South China close to major export markets (Hong Kong, Taiwan, Japan).

3.4 Less waste

In inland water fisheries and aquaculture production, the amount of fish wasted at the processing and distribution levels is believed to be rather small because of the physical closeness of production and consumption.

Waste occurs primarily in marine trawl fisheries in the form of discards and the landing of low value trash fish. Effort reduction and other fisheries management measures could make a significant contribution to further reductions in waste.

3.5 Supply scenario

There continues to exist a significant growth potential of fresh water aquaculture, principally through the rehabilitation of existing ponds (deepening and intensification), the utilization of water logged areas, and the use of the vast areas of paddy fields which are estimated at 20 million ha (Que Wen).

The utilization of this potential is supported by the establishment of increasing numbers of large scale hatcheries. Production constraints include competition over land and

Seas there has been a replacement of high value longer-lived demersal and predatory pelagic species by lower trophic species, primarily small pelagics (FAO Fish. Circ. C884).

In view of increasing problems of overfishing and overcapitalization, China has introduced comprehensive fisheries management legislation in 1986 and taken various management measures including effort regulations through areal licence limits, resource fee charges, closed areas and seasons and gear specifications (Wang and Bing-yi Zhan, 1992).

The heavy exploitation of most marine fishery resources within the country's waters (however, no EEZ yet officially declared) has provided an impetus for the development of long distance fishing fleets since 1985 which operate on the high seas and under licensing agreements in the coastal waters of several countries (e.g West Africa - trawling; South Pacific - tuna longlining). Reported catches of the long distant fleets are in the order of 0.53 million tons. It appears that in West and North African countries, China's long distance fleet is partially replacing East European and former USSR fleets in the exploitation of small pelagics (Globefish database).

3.2 Inland capture fisheries

Inland water capture fisheries produced around 1 million tons in the early 1990s and has depicted only low growth during the last four decades. Already in the early 1950s, inland water capture fisheries produced 680,000 tons before it commenced to decline in the 1960s and 1970s (Zhu De-Shan, 1980).

It reached a low of around 300,000 tons in 1978 but since then expanded again primarily due to improved management and stock enhancement measures.

The reasons for the decline in inland water capture fisheries in the 1960s and 1970s included land reclamation, the construction of water gates and dykes on rivers and lakes, industrial pollution and overfishing (Zhu De-Shan, 1980). Inland water capture fisheries continue to be negatively affected by habitat degradation and pollution and growth prospects largely depend on stocking and other enhancement measures in water bodies where water quality and habitat can be controlled and preserved.

3.3 Aquaculture

(1) Fresh water

Total fresh water aquaculture more than tripled from 2.1 million tons in 1984 to 6.5 million tons in 1993. Highest growth rates were achieved in carp production, especially common and grass carp. Since the mid 1980s, there has also been a strong growth in tilapia production although from a very low initial level.

Production increases were mostly obtained through the expansion of pond area, but also through intensification. The latter is believed to play a more prominent role in future as completion over land increases from urban and industrial development and the need to maintain agricultural land. There is significant potential to further expand integrated agriculture-aquaculture systems, especially fish cultivation in rice fields.

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The utilization of this potential is supported by the establishment of increasing numbers of large scale hatcheries. Production constraints include competition over land and water resources and environmental degradation. These are not believed to be binding except for geographical confined areas such as industrial and urban growth centres.

The future growth in fresh water aquaculture and its structure in terms of species mix and intensity and scale of production will be largely governed by economic factors. Market forces are expected to favour the culture of higher value species which will affect the species composition in polyculture systems. This is expected to increase the use of feed and consequently the risk of negative environmental impacts.

In the case of fresh water capture fisheries, especially in the major rivers, water pollution and habitat destruction are expected to prevent any significant further production increases and may even cause decreases.

Fresh water lakes and reservoirs offer further growth potentials through various combinations of enhancement and culture fisheries in cages and other types of enclosures.

Capture fisheries in Chinese marine waters do not offer any significant growth potential. Future catch increases will largely have to be realized from long distant fleets whose growth prospects are moderate and lay primarily in the ability to outcompete traditional long distance fleets.

The growth potential in marine culture is difficult to predict. The Chinese coastal areas are sub-optimal for shrimp culture. In the northern provinces, only one grow-out cycle is possible due to the continental temperature regime. In the southern provinces, water temperature is not ideal for optimal growth neither of northern species nor of the more tropical ones. For this reason, Chinese shrimp culture depicts limited competitiveness compared to other south and southeast Asian countries.

The potential of coastal aquaculture and marine culture is also affected by environmental degradation which is concentrated in coastal waters.[1] Competition over space is also highest in the coastal zone.

It is expected that marine culture activities will concentrate on high value species oriented towards export markets or domestic high income consumers. Production is expected to grow significantly but will be highly sensitive to price/demand developments and thus economic growth, because of the high production costs involved.[2]

In quantity terms, molluscs will continue to make up the bulk of marine culture production. The overall contribution of marine culture to food production will remain modest, and if feeding requirements are taken into account, could be negative.

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[1] It has been reported that the mollusc culture component of a World Bank funded project had to be cancelled because of high heavy metal contamination in the proposed culture area.

[2] In the culture of grouper, the feeding ratio can be as high as 12 to 1.

4. DEVELOPMENTS IN FISH TRADE AND DISTRIBUTION

Since the mid 1980s, growth rates in the quantities of fish imports have surpassed those of fish exports. Compounded average growth rates of imports in the period 1980 to 1992 were 31% for fresh/frozen fish, 26% for crustaceans & molluscs and 34 % for fish meal. Export growth rates were 12 % for fresh/frozen fish and 21 % for crustaceans & molluscs. In 1992, China exported 190000 of fresh/frozen fish but imported 330000 tons. It exported 239 000 tons of shrimp (crustaceans & molluscs) and imported 42000 tons. Finally, China imported 640 000 tons of fish meal which in live weight corresponds to 3.2 million tons. China is the single biggest customer for Peru's fish meal companies. Including fish meal, China uses about one fifth of total world fish production.

China is expected to become a significant importer of fish and fishery products in the year 2010, especially of live, fresh and frozen fish and of fish meal. The growth rate is expected to be lower than that observed in the period 1980 to 1992 because of the initially very low absolute import quantities. As a minimum, the growth rate is expected to develop in parallel with real economic growth. Fish exports will be limited to a rather narrow range of high value products including high grade tuna, shrimp, molluscs and live and frozen finfish species.

5. FISH CONSUMPTION IN 2010

The growth prospects of Chinese domestic fish supply are good which will allow to maintain a high level of self-sufficiency in fish supply even in view of a rapid growth in fish demand as a result of economic growth and to a lesser extent population increase. Actual fish consumption levels are therefore expected to come close to or tally with the demand forecast of about 15 kg per person and year.

High economic growth is expected to generate enough purchasing power to satisfy any domestic demand-supply gap through increased fishery imports. Consumption levels, however, will continue to depict considerable variations between provinces and population strata.

6. IMPLICATIONS FOR FOOD SECURITY

No overall shortages of fish supply are predicted to occur in China during the coming one and half decades, and probably beyond. The increasing diversification of income levels, especially between high economic growth zones in the Eastern and Souther provinces of China and the largely agricultural areas in the central provinces and the eastern and norther peripheries of the country are expected to result in differential consumption possibilities. These are not, however, believed to occur at a level which would impair basic food security of large population segments.

7. POLICY ISSUES AND INTERVENTIONS

China will continue to satisfy most of its fish consumption requirements through domestic production, especially fresh water culture whose share on total domestic fish supply is expected to increase.

Economic growth, however, will increase animal protein intakes and further diversify consumer demand towards higher value products. This effect will be particularly strong in urban areas and in the coastal growth poles of Southern China.

Prices of marine products are expected to increase more rapidly than those of fresh water species because of the more binding supply constraints of the former. Increasing market-orientation of the economy will direct fish supplies according to purchasing power rather than food needs.[3] Greater market orientation is expected to significantly increase inter-province trade in fish and fishery products.

Increasing fish import needs of China will affect world fish prices. In case fish imports develop in parallel with GDP growth and the later is around 10%, in 2010 fish imports could amount to four times present levels: fresh, frozen fish may reach about 1.2 million tons and fish meal about 2.6 million tons. Real fish prices are expected to continue to rise.[4]

With the opening and liberalization of the Chinese economy, the role of government is experiencing profound changes. While investment and business management decisions are increasingly taken at the enterprise level, government administrations are required to provide an appropriate regulatory framework to ensure the sustainable and wise use of the available natural resources. In this respect, China faces the same fishery and coastal zone management issues as other countries of East and Southeast Asia including over-capitalization of the fishing fleet, need to create alternative employment opportunities for inshore fishermen, inter-sectoral competition, and environmental pollution and habitat destruction. In addition, with greater independence of provincial governments, the need for inter-provincial coordination is expected to raise dramatically to resolve conflicts over shared resources and shared environmental degradation.

[3] An example of this development is reported from Shantou district of Guandong province. Large quantities of small pelagics used to be dried and sold for direct human consumption in the mountainous hinterland. This trade has nearly ceased following the utilization of small pelagics as feed in the culture of grouper, breams and other species for live export to Taiwan, Hong Kong and Japan.

[4] It is conceivable that China may need to restrict the import of certain types of fishery products for conservation reasons. This may occur with the importation of shark fins.

FORMER CENTRALLY PLANNED ECONOMIES

Demand and Supply of Fish and Fish Products in Former Centrally Planned Economies (CPEs)[1]
Perspectives and Implications for Food Security

Report of the FAO Fisheries Department Task Force
Team Leader: L. Westlund

CONTENTS

1. REGIONAL CHARACTERISTICS AND ISSUES

The economic and political changes taking place in the region, due to the transition from centrally planned to market economies, have a tremendous impact on all sectors in the countries and so as well on the fishery sector. In the transition period, the conditions under which the fishing fleets operate have changed, ownership structures are

[1] The report covers Albania, Bulgaria, ex-Czechoslovakia, Hungary, Poland, Rumania, the countries of ex-USSR and of ex-Yugoslavia.

different, the distribution systems for the retail market have broken down, etc. These significant reforms have entailed a drastic drop in fish production as well as in fish consumption.

For the time being, in most of the countries of the region, the sector is still in a vulnerable stage and production and consumption volumes are at best stabilizing. It will probably take some time before the fishing and aquaculture industry has been fully restructured according to the new market conditions and any significant increases in production levels can be expected. In this period, it is important that appropriate support is given to the sector.

2. DEMAND AND CONSUMPTION

2.1 Apparent consumption 1970-1990[2]

In 1990, the average *per caput* fish supplies for human consumption in the region was 19.6 kg (live weight equivalent); during the period 1970-1990, the *per caput* supply had fluctuated between 18.2 kg and 23 kg yearly. Fish represented some 13% of the total animal protein intake. However, important differences exist within the region; in for example land-locked Hungary and former Czechoslovakia, food fish supplies *per caput* were 4 and 7.7 kg, respectively, and in the former USSR over 27 kg. With a population of the region of 412 million, the total food fish supply was almost 8.1 million tons in 1990 (see table 1). It should be noted, though, that recent reports indicate that the consumption has fallen drastically lately because of the decreased catches, collapse of the distribution system, increased prices etc. In Lithuania, for example, the apparent consumption was reported to be only 8.4 kg *per caput* in 1993 compared to 18.7 kg in 1989 (Fisheries Department, Lithuania). For Russia, the corresponding figures are 9 and 29 kg, respectively (Chuksin 1994).

Table 1:

Average food fish balance sheet (Eastern/Central Europe and the former USSR) in 1990

Production (MT)	Non-food uses (MT)	Exports (MT)	Total supply (MT)	Population ('000)	*Per caput* supply (kg)
11 180 000	2 632 000	- 455 000	8 093 000	411 990	19.6

Source: FIDI/FAO, 1995

[2]Consumption is here assumed to equal supply as defined in the food balance sheets prepared by FIDI/FAO (Fisheries Circular FIDI C821), i.e., domestic production - non-food uses +/- trade +/- stock changes (domestic production = production by national fleets but not necessarily from national waters).

Analysing the species composition of food fish supplies, it can be noted that pelagic species are by far the most important species group. In 1990, about half of the supply consisted of pelagics. However, this composition has changed over time; in 1970 only 30% of food fish supplies represented pelagic fish. The relative share of demersals has decreased significantly during the period. In table 2, the *per caput* supply by major species groups in 1970 and 1990 is shown.

Table 2:

Per caput food fish supply by major species groups in 1970 and 1990

Year	Fresh-water/ diadro-mous	Demer-sal	Pelagic	Other marine fishes[3]	Crusta-ceans	Molluscs	Cepha-lopods
1970	3.3	8.6	5.9	0.9	0.1	0.2	-
1990	3.0	4.2	9.8	2.0	-	-	0.6

Source: FIDI/FAO, 1995

During the period 1970-1990, there has been a shift towards eating less fresh fish; the canned fish consumption has increased at the expense of the fresh fish consumption. Table 3 gives the *per caput* supply by main product type in 1970 and 1990.

Table 3:

Per caput food fish supply by major product types in 1970 and 1990

Year	Finfish/ fresh	Finfish/ frozen	Finfish/ cured	Finfish/ canned	Finfish/ other preparations	Shell-fish/ fresh
1970	3.9	7.6	3.6	3.6	-	0.2
1990	2.2	7.5	3.2	5.2	0.9	0.6

Source: FIDI/FAO

[3] Non-specified data of marine landings and therefore not possible to classify in any of the other groups.

2.2 Factors influencing the demand for and consumption of fish and fishery products

In the region, the relative price of fish compared to meat appears to be an important determinant for the demand for fish. Fish is generally considered cheap food and there is a preference for meat *if meat can be afforded.* Fish will be in demand as long as it sells at competitive prices. In some countries, the price of fish has increased substantially recently but fish still remains cheaper than meat. In Bulgaria, prices of fish increased nearly ten times in 1991 compared to 1989, while prices of meat increased far less; nevertheless, fish continues to be only about half as expensive as meat (GLOBEFISH/FAO database).

The availability of meat at competitive prices will have an influence on the demand for fish. Therefore, the domestic production of meat, and in particular poultry, will be an important factor when estimating future demand for fish. If consumers can chose between chicken and fish at the same price, it appears that chicken would most often be preferred. With regard to the local meat production, there is scope for a rationalization given the currently relatively inefficient production methods. There is a need for genetic improvements, better management, better feed products and feeding practices, etc (Marks 1992). When this rationalization has been carried out, the availability of meat may increase. However, this development should be seen in a long-term perspective; it is unlikely that meat production will increase significantly in the near future.

The above reasoning of fish being "only" a substitute for meat is, in particular, true for low-value pelagic species products. It may be that, when economic growth picks up and households disposable income increases, a demand for more valuable species will develop. In Poland, for example, there is already a visible trend of growing demand for white fish (cod, pollack, fresh water species, etc) and salmon (GLOBEFISH/FAO database). These species may not be considered as direct substitutes for the more expensive meat but as alternative products which could be chosen also for their taste as well as for their nutritional value, and not only because of the price. Hence, the economic growth and the development of the purchasing power will be important to future demand, especially with regard to the types of fish and fishery products that consumers choose.

The influence by the industry structure on demand may be considerable in the near future. A new structure will have to be established to replace the old centrally-planned industry. It is expected that the new structure will include international companies since the market potential of the area will attract foreign investors and suppliers. The international companies generally have considerable marketing power and products aggressively marketed may sell well and create demand. The types of products consumed, particularly in the western part of the region, will - in a longer time perspective - be similar to those sold in Western Europe and more frozen products and ready-made dishes will be introduced. A shift can already be seen in Hungary and the Czech Republic (and in former East Germany), where the production of common carp, which traditionally dominated the local fish production, has declined. The reason appears to be that the cost of locally produced fish has increased, while, at the same time, more and different processed fish products (mainly marine) have flooded the markets through increased imports. Local producers have not yet been able to diversify their production and imported products have found a ready market. Moreover, the products are offered at low prices as suppliers are keen to establish themselves on the market.

2.3 Expected demand in 2010

In 2010, it is expected that demand will attain 20 kg[4], i.e., the level of average *per caput* food fish supply in 1990. It is not expected that this level will be exceeded since *per caput* apparent consumption has not been much higher during the last decades even though fish has been relatively easily available.

The species and product composition of demand will very much depend on the economic growth and the purchasing power of consumers. A FAO forecast[5] for the GDP growth gives a *per caput* GDP in constant USD terms (1980 prices) for 2010 of US$ 3 327. This could be compared with the European Union for which the same figure is US$ 19 359. Considering the still relatively low level of income in 2010, it appears that demand will still be oriented towards cheaper fish products.

The population is estimated to increase from 412 million in 1990 to 430 million in 2010[6]. The total fish food demand in the region would then reach 8 600 000 tons.

3. SUPPLY FROM CAPTURE FISHERIES AND AQUACULTURE

3.1 Marine capture fisheries

Total marine landings by the countries of the region attained, in 1993, approximately 5.3 million tons. This represents a significant decrease from ten years earlier when the total catch was 10 million tons (FISHSTAT/FAO database). Recent reports on Russian production - the main fishing nation of the region - suggest further drops in 1994. Russian marine landings decreased by 20% from 4.37 million tons in 1993 to 3.47 million tons in 1994 (Eurofish Report).

The main fishing areas close to the countries of the region are the Okhotsk Sea and the Bering Sea in the northern Pacific Ocean[7], the Black Sea in the south, the Baltic Sea in the west, and the Barents Sea in the northwest. In addition, Poland, Rumania, Bulgaria and the former Soviet Union used to have important distant-water fleets. In 1983, about 60% the production originated from near-by waters and the rest was provided from distant-waters. In 1993, the relative share of the production of near-by waters had

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[4]Projection based only on economic growth.

[5] FONS/FAO data (May 1994) based on IMF/IFS and World Bank data.

[6] ES/FAO projections.

[7] Includes FAO statistical areas 61 and 67.

increased to close to 80% as a result of the diminishing landings by the distant-water fishing fleets.

Table 4 shows the catches in 1983 and in 1993 of some important species in the **Northern Pacific Ocean**. The major white fish species caught are Alaskan pollock and Pacific cod. These two species are considered fully exploited together with all other demersal species which are fully exploited or even depleted. For Alaska pollock in the Bering Sea, agreements have been reached recently between the fishing nations concerned to regulate fishing activities and reduce catches in order to allow for the species to recover from dangerously low levels of abundance. In 1994, a complete ban on fishing Alaska pollock in the international and adjacent waters of Bering Sea was agreed upon by Russia, Poland, USA, Japan, the Republic of Korea and China. The ban has been extended also for 1995 (GLOBEFISH/FAO database). In the case of the Okhotsk Sea, a management agreement for the waters outside the EEZs is currently (mid-1995) being discussed between Russia and other fishing nations concerned, e.g., Poland, Republic of Korea and China.

With regard to pelagic resources, stocks are unstable and it is difficult to predict the abundance; nevertheless, stocks appear fully exploited. The main species are Pacific herring and Japanese pilchard, even though landings of the latter were quite insignificant in 1993, something that has been linked to decadal-scale changes in the marine environment (FAO Fisheries Technical Paper 335). Chub mackerel used to be fished extensively, but lately no catches were reported of this species by the Eastern/Central European or former Soviet Union countries.

Pacific salmon is an important fish for Russia. With regard to salmon stocks outside the region of Sakhalin, pollution problems have been reported (GLOBEFISH/FAO database). Salmon catches have fluctuated considerably lately but were in 1993 estimated at 125 000 tons (FAO Fisheries Technical Paper 335 and FISHSTAT/FAO database). Catches of king crab have fluctuated between 30 000 and 42 000 tons during the last 10 years (FISHSTAT/FAO database).

Total catches in the **Black Sea** dropped drastically between 1988 and 1992; from 887 000 to 321 000 tons, and the catches of the fleets of the region dropped from 426 000 tons to 77 000 tons during the same period. The reason for the decline seems to be a change of the ecosystem caused by a combination of uncontrolled and heavy fishing, nutrient inputs from rivers and the littoral zone, and the introduction of exotic species. Work has begun towards identification of possible control measures that will allow for an economically-productive Black Sea ecosystem to be restored, even though the species composition will differ widely from that prevailing earlier due to the change in nutrient conditions. There is progress being made for the establishment of a new Convention for the Black Sea Fisheries and a Fishery Commission with membership of all coastal states (FAO Fisheries Circular FIRM C884).

Table 4:

Catches by Eastern/Central European and former USSR fleets of some important species in the North Pacific (Polish and Russian fleets).

Species	1983	1993
Alaska pollock	2 747 000	2 349 700
Pacific cod	88 600	95 800
Pacific herring	132 900	115 100
Japanese pilchard	579 900	4 300
Salmons	119 800	125 300
Chub mackerel	122 900	0
Others	389 500	285 300
TOTAL	4 180 600	2 975 500

Source: FISHSTAT/FAO

In the **Baltic Sea**, herring, sprat, Baltic cod and salmon are the main commercial species. The cod stock reached its peak in the early 1980s after which production collapsed; landings decreased from some 450 000 tons in 1984 to less than 50 000 tons in 1993. The agreed TAC[8] for 1995 is 100 000 tons out of which a total of 39 100 tons are allocated to Poland, Russia, Estonia, Latvia and Lithuania. Reasons given for the high variance in abundance are natural environmental factors and - to a lesser extent - the fishing pressure. With regard to herring and sprat, total TAC allocations for Poland, Russia, Estonia, Latvia and Lithuania in 1995 amount to 252 300 tons of herring and approximately 320 000 tons of sprat (IBSFC). However, it should be noted that total quotas for these species have not always been utilized as the fishing effort has been directed to the more valuable cod. Another problem is that the quality of herring caught in the south-east part of the Baltic Sea is deteriorating and are often less suitable for processing, particularly for salting. This quality deterioration could be caused by pollution but is most likely due to an increase in the stock of herring compared to the feeding possibilities and the lack of natural selection, i.e., a decrease in the cod stock, which feed on herring (GLOBEFISH/FAO database).

In the **Barents Sea**, the by far most important species are cod and capelin. Some herring is also fished. The cod stock of the area was depleted in the 1970s and the first half of the 1980s but has since then recovered. In 1993, 582 000 tons were fished

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[8] Total Allowable Catch agreed upon by the IBSFC (International Baltic Sea Fishery Commission),

whereof the Russian fleet caught about 245 000 tons. For 1994, a total TAC of 700 000 tons was agreed upon. The capelin stock showed very low abundance levels in the mid-1980s and all fishing on the stock was banned 1987-1990. In 1991 and 1992, about 1 million tons were caught each year and the stock seemed to have recovered (FAO Fisheries Technical Paper 335). However, in 1993, catches decreased again as only 586 000 tons were caught; Russia's share being 170 000 tons (ICES 1993). It appears that the growth in the cod stock in 1991 and 1992 was due to the high abundance of capelin which is an important feed prey item for the cod. Now when the capelin stock is declining again, it is difficult to say how it will effect the cod stock. The effects might not be large after all because the Norwegian spring-spawn herring stock seems to be recovering after low levels and might replace the capelin as food for cod (FAO Fisheries Technical Paper 335). Russia caught some 33 000 tons of herring in 1993 (ICES 1993).

As mentioned above, the importance of the distant-water fisheries has decreased substantially. Catches from distant waters attained about 1 million tons in 1993 compared to approximately 4 million tons in 1983. In the past, the fleets of the region were all part of an integrated production and distribution system including both catch and processing sectors. The disintegration of the centrally-planned economies also meant a collapse of the distant-water fishing fleets and related systems; the discontinuation of subsidies and the allocation of the vessels to the different, now independent, countries; Ukraine, Georgia, Estonia, Latvia and Lithuania received a large number of vessels but not the supporting infrastructure and facilities including fuel subsidies and access to resources. Moreover, the fleets suddenly had to operate under market conditions. Many of the vessels are in bad condition due to their old age and insufficient maintenance and it is expected that the distant-water activities will be faced out during the next few years due to unsatisfactory profitability of the existing vessels. However, in Russia the Government has launched a program to avoid further decreases in fish catching capacity and production volumes. In this connection, it appears that part of the Russian distant-water fishing fleet will be replaced by new vessels (GLOBEFISH/FAO database).

3.2 Inland fisheries

Total inland water production (aquaculture excluded) of the region attained 563 000 tons in 1992. This represents a decrease compared to 1989 when catches were 718 000 tons (FAO Fisheries Circular FIRI C885). However, it should be remembered that data for inland fisheries production are often very unreliable.

In the region, recreational inland fisheries play an important role but this activity is difficult to quantify since it is seldom covered by statistics at all. In Poland, it is estimated that some 34 000 tons were fished by the members of the Polish Anglers's association. This is more than the total commercial catch from inland waters and fish production from aquaculture combined. It should also be remembered that the estimate omits people fishing without any licence, a number which is doubtless high and tending to increase (Bninska 1994). Also in Russia, the recreational fisheries could be significant; catches could be of the same magnitude as the reported inland commercial landings, i.e., almost 300 000 tons yearly. Generally in the region, recreational fisheries appear to be important for food supplies and should in many cases be considered as subsistence fisheries.

All former centrally planned countries of Eastern Europe have attempted to manage their inland fisheries through stocking. It appears that the economic difficulties inherent to the transitional period have interfered with this practice which could be the reason for the recent lower production levels (Bninska, 1994).

Nevertheless, the relative importance of inland fisheries in domestic food fish supplies has increased when marine catches have decreased. This is especially true for some of the Eastern European countries. In Rumania, for example, inland water fisheries are estimated to contribute some 36% of total fish production today (GLOBEFISH/FAO database). In a land-locked country, inland fisheries together with aquaculture is naturally very important.

Within the former USSR, dam building and pollution have caused a decline in river catches of 20% during the last three decades. Nevertheless, rivers with their reservoirs and smaller lakes are still of importance to the fish industry. The two largest lakes in the area, the Aral Sea and the Caspian Sea, have shown environmental degradation over the past decades due to both climatic factors and to the intensified agricultural and industrial activities in the area. The depth of the Aral Sea has been significantly reduced because of water being used for irrigation from the major affluents. The production declined from 30 000 tons before 1960 (Payne 1994) to zero since 1982. Fish yields from the northern part of the Caspian Sea has declined from 290 000 - 390 000 tons to around 60 000 tons yearly. The water level in this lake was initially reduced but it has since 1977 been raising. Today, the water is flooding the coastal areas including the delta of Volga which is an important spawning area. This development could have a positive effect on the fish resources of the lake.

In general, in recent years, in most of the countries of the region, there has been a decline in production. It appears now that the decline is levelling off and forecasts are that there will be some growth in the future (FAO Fisheries Circular FIRI C885). However, modifications of river systems by engineering works and the increasing demands for water resources from a diversity of users are causing problems to fish and fishers. A sound management for the inland water resources is necessary in order to harmonize the demands and to secure the sustainability of the fisheries. The administration and data recording for water resources have been seriously affected by the political and economic changes that have taken place in recent years. These changes have often disrupted the infrastructure of fisheries management and administration as well as divided the national responsibilities for shared water resources between different authorities. Regarding the fishery resources base, much could be achieved through improvements in fishing management and introduction of fish stock enhancement practices. In the Central Asian countries of the former USSR and in Kazakhstan, there appears to be potential for increased fisheries through stock enhancement in water bodies such as reservoirs and major irrigation canals. In Uzbekistan, for example, it is estimated that the yield from freshwater reservoirs could be increased 4 to 6 fold. However, being an arid area, there is a high demand for water for agriculture irrigation purposes and fisheries are subject to ever changing conditions. Again, proper management of the inland water resources would be necessary (Petr 1994).

2.1.3 Aquaculture

Aquaculture production in the region has fallen by more than half between 1991 and 1992, from 549 000 tons to 242 000 tons. This sharp decline can be explained by the transition from a centrally planned economy to market economy which has created social and economic difficulties also affecting aquaculture. The decline has been mostly felt in the countries of the former USSR; production in Hungary, Poland and former Czechoslovakia has remained stable (AQUASTAT/FAO database).

The most important species cultured in the region are the common carp, Chinese carp and other cyprinids. There is also production of rainbow trout, seabass, pike-perch and Mediterranean mussels (Albania) (AQUASTAT/FAO database). Other species such as tilapia are also being introduced.

There may continue to be further fall in production levels in the future. For example, in the Czech Republic, aquaculture output is expected to fall by 10% during the next five years and the decrease will probably be even higher in the other countries of the region (GLOBEFISH/FAO database). When production revives, a change in species composition and management systems is expected. Production of exotic species, i.e., species new to the region such as tilapia, will continue to increase thanks to greater intensification and to increased use of feeds.

In Hungary, a substantial research and development program for aquaculture is being established. There are also several examples of joint ventures with foreign firms setting up aquaculture production in the country. Some of the species which will be produced are river catfish, silverback - a cross breed between the silver carp and the big head carp - and sturgeon, mainly for exports. Another long term plan is to sell Hungarian aquaculture expertise to other countries (GLOBEFISH/FAO database).

There are plans to intensify the stocking of sturgeon fingerlings in the Caspian Sea. A new transportation system of the stocking material - by boat - will ensure its survival when moved from a fish farm up the Volga river to the Caspian Sea. Now only 5-6% of the 70 million fingerlings actually reach their destination, the rest are eaten by predators on the 200-km migratory route (or sucked into the Volga irrigation pumps) (GLOBEFISH/FAO database).

3.4 Maximal utilization of catches

Together with the distant-water fishing vessels, the coastal states of the region also inherited - from the centrally-planned economy system - large land-based fish processing plants which used to be supplied with raw material by the fleets. Due to the decreased raw material supplies from the fleets and to the economic difficulties caused by the transitional period, the fish processing sector only operates at fraction of its capacity. Moreover, much of the equipment is obsolete and products manufactured of low quality. In fact, the quality of many fish products fails to conform to international standards. There is wide scope for new technologies, mechanized lines, manufacture of cans, etc, and important capital investments are required.

Recently foreign companies have shown interest in investing in the sector through joint ventures. The region is considered an important market and production facilities within the area would be an advantage. Value-added products for the export market could also be produced; labour costs are relatively low in the region.

Herring and sprat quotas are not fully utilized in the Baltic Sea. With improved production facilities, higher quality products could be produced and the quotas could be fully used in the future.

With regard to discards and by-catches of the marine fisheries of the region, very little precise data is available even though it could be expected that this is a matter which should be given attention when discussing the possibilities to reduce waste and improve the utilization of catches. In the Northwestern Pacific, the most important fishing area for the Russian and Polish fleets, total discards appear to be important; they represent about one third of the world's total discard weight. According to "A global assessment of fisheries by-catch and discards" (Alverson et al 1994), 9.1 million tons are discarded[9] yearly in the area. The key contributors to this volume are the large crab, chub and jack mackerel (*Scomber spp and Trachurus spp*), Alaska pollock, cod and shrimp fisheries of the region[10].

In the Berings Sea, data on nine target and four main gear types show that, on a whole, discards represent 14% of total weight of retained catches. The cod, pollock and yellowfin sole fisheries accounted for 71% of the total discarded weight in 1992. The discards recorded for each fishery include sublegal or undersized target species as well as non target individuals. In the pollock fishery for example, pollock alone account for 60-70% of total discards. Yellowfin sole, rockfish and rock sole discards represent 44%, 20% and 32% in their respective trawl fisheries. Halibut is a main contributor in the cod line fishery discards representing about 30% of the total discarded weight.

Applying the ratio 14% for discards/retained catch in the Northwestern Pacific to the total Russian and Polish catches in the area, i.e., almost 3 million tons in 1993, gives a by-catch of about 420 000 tons. However, it should be remembered that this a very simplified calculation giving only an indication of the possible magnitude of the by-catch volume. In order to have a complete picture of the by-catch and discards of the fleets of the ex-CPEs, a much more detailed analysis is necessary, including also the other fishing areas of the region's fleets.

3.5 Future supply of fish and fishery products; scenario 2010

It is not expected that marine capture fisheries from coastal and near-by waters will be considerably increased in the future, the only exception being landings of sprat

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[9] Includes by-catch landed but unreported by species in industrial fisheries.

[10] It should be remembered that the data in the cited report mainly refers to the United States fisheries in the area and not explicitly to data of the fleets of the ex-CPEs.

and herring from the Baltic Sea. In the Black Sea, catches could possibly be somewhat increased at long term with the restoration of the aquatic environment, but historical catch levels will not be attained. The production of the distant-water fishing sector will decrease even further within the next decade.

Inland water fisheries may have a higher output through the intensification of stocking. Aquaculture production will decrease further during the coming five years but then the trend is expected to be reversed.

The fish processing industry will eventually increase its output when the sector has been restructured. It is probable that quite an important part of the investments made in the sector will be by foreign companies, with important international marketing capacity and production will be oriented towards the two markets; lower priced products for the domestic market and value-added products for export.

4. DISTRIBUTION PATTERNS AND INTERNATIONAL TRADE

The distribution system for fish and fishery products, i.e., transport, whole sale and retail outlets, etc, has experienced the same disruption of activities as the rest of the fisheries sector. Today, an important constraint to increasing food fish consumption levels lays in the lack of distribution channels.

The dependence on imports have increased lately since domestic production has decreased substantially. Fish is imported both as raw material to the processing industry and for the retail market. In 1991, in Poland, it is estimated that 45% of the volume of the fresh and frozen fish and fillets imported were directed to the retail market while the remainder went to the processing sector (GLOBEFISH/FAO database).

Generally speaking, exports are considerably more important in value terms than imports; cheap products - in particular raw material - are imported and value-added products and more valuable species are exported. The average export price per volume unit is twice as high as the import price. However, in 1992, the region was still a net exporter also in volume terms.

5. FISH CONSUMPTION IN THE FUTURE; SCENARIO 2010

In 1990, *per caput* food fish consumption was almost 20 kg and total fish supplies amounted to 8.1 million tons. The production of the region was in the same year over 11 million tons, the balance being reduced mainly to fish meal (2.6 million tons) and exported (net trade balance 0.5 million tons). The production has decreased in 1993 to some 6.1 million tons and will probably decrease even further during the next few years. Even if the trend of declining domestic production is reversed by 2010, it is unlikely that domestic production will be much higher than it was in 1993. Consequently, in order to re-establish the *per caput* consumption at the 1990 level, i.e., at a food fish supply of 20 kg/person, imports would need to increase drastically. Part of the raw material going into fish meal could also theoretically be reoriented to food uses but this is unlikely since fish meal is mainly produced from offal or raw material which cannot be easily preserved. It does not seem probable that imports could increase at this magnitude or that a reorientation of the use of cheap fish from fish meal production to human consumption could fill the gap between demand and supply. Consequently, average *per caput* fish consumption in 2010 is expected to remain below the 1990 level and attain 16-17 kg giving a total supply need of 6.8-7.3 million tons.

A drastic increase in imports to the region would have an impact on the global trade patterns. According to the above calculation, net imports would need to be 2.3-2.8 million tons in 2010, assuming that catches and fish meal production remain stable. However, it should be remembered that fish is also an important export product. Hence the volume of fish the region will be buying on the international market could be over 3 million tons. This volume would to a large extent consist of cheaper species and products, e.g., small pelagics.

6. IMPLICATIONS FOR FOOD SECURITY

The following countries of the region are classified as low income food deficit countries (LIFDCs): Albania, Armenia, Azerbaijan, Georgia, Kyrgyzstan, Lithuania, Moldova, Tajikistan, Turkmenistan and Uzbekistan. Limited information is available on fish consumption in these countries, but judging from their geographical location it is assumed that fish plays an important role only in Lithuania and Georgia. In Albania, in spite of being a coastal state, reported fish consumption *per caput* was only 2.3 kg in 1990 and fish constitutes only 2-3% of the total animal protein intake. In Lithuania, fish consumption was 18.7 kg in 1989 but has since decreased to only 8.4 in 1993. For Georgia, no data is available but the country has a sea-going tradition - part of the distant-water fishing fleet of the Soviet Union was located there. In Turkmenistan and Azerbaijan there may be local populations on the coast of the Caspian Sea who are fish eaters.

Russia - although not a LIFDC - is the country in the region reporting the highest *per caput* consumption; in 1990, *per caput* supplies were at almost 30 kg, a figure which has now decreased to around 9 kg. It is clear that especially some of the poorer strata of the population may have lost an important source of protein. The same is probably true for the Estonia and Latvia.

It should also be remembered that income from fishing operations certainly plays an important role in many coastal communities for securing the access to an adequate food supply. Moreover, in some areas the fisheries sector has been - and still is - an important employer.

7. POSSIBLE POLICY INTERVENTIONS

The transition from centrally-planned economies to market oriented economies has created turbulence for all sectors of the economies and so also for the fisheries and aquaculture sector. There is a general need of assistance to governments in policy analysis and strategy design as they undertake to restructure and privatize the fisheries sector. The countries also need support for development of market-system oriented institutions including non-governmental organizations, while the role of government and parliement would focus on legislation, including compatibility with European Union Association Agreements and GATT/WTO. The former institutions and practices do not exist any longer and have to be replaced by new structures. In this respect, there is an urgent need to **review the fisheries legislation and institutions**. The putting in place of a new fisheries legislation reflecting the new economical and political conditions is a prerequisite for a sound development of the sector. Together with a proper institutional set-up, legislation is also necessary for developing and enforcing management measures. A new and intensified approach to management will be necessary in order to sustain future fish production.

Another vital area is the **statistical data collection** system. Today, these functions are to a large extent missing. Again, to develop and implement management plans, adequate and high quality information is essential. It is therefore necessary to recreate a structure for ensuring data collection, monitoring and dissemination. Areas of importance are ranging from price information to analysis of demand and con sumption patterns.

Inland fisheries and aquaculture appear to be the sources from which fish supply could increase in the future. The inland sector needs to be given attention in several respects. A general **management plan for inland water resources** should be elaborated covering the interactions and conflicts between the fisheries sector and other fresh water users, such as the agricultural sector. The influence - possibly increasing - on resources by recreational fisheries should be taken into account. Furthermore, the development of **fish yield enhancement strategies** for a variety of inland water bodies - through the development and application of new technologies - would be an important aspect of managing the fishery resources and ensuring a sustainable production.

The **aquaculture sector needs to be restructured**. The previously state-owned enterprises are now in the transition to new ownership structures. However, part of the sector has stopped functioning because of this transition, and the production is decreasing. Appropriate government intervention for the rehabilitation of the sector is necessary. This would include provision of support infrastructure, assistance to develop business plans for potential fish farmers and investors, etc.

The **fish processing industry needs up-grading**. The fish processing industry used to be an important part of the fisheries system but production has dropped due to decreased domestic catches. However, the basic infrastructure is still available even though significant investments will be needed for improving the processing facilities in order to produce competitive products. Increased competition should be expected not only in the export market but also in the domestic market. An up-grading of the fish processing sector would ensure better quality and safer products for the domestic market, enhance exports foreign exchange earnings, create employment and possibly enhance the use of resources which today are not fully utilized such as Baltic herring and sprat.

National and regional **distribution systems** need to be established. An important problem in marketing and distribution of fish and fishery products is the lack of infrastructure, both in the form of equipment and enterprise structures.

8. CONCLUSIONS

Fish has long been an important food item in some of the countries of the area. The main fish consuming country is Russia but also in other sea bordering states, such as Latvia, Lithuania and Estonia, fish plays an important role.

During the centrally-planned era, catches by national fleets were the main source of supplies. Landings were supplied to the local markets but often more valuable species, eg cod or squid, was exported or traded for cheaper fish in order to ensure the food supply. Today, this structure does not exist any longer and the whole fisheries system is experiencing the same transitional period as the rest of the economic and political systems of the countries. What will be the outcome of this period of change is difficult to predict and the attempts made in this report are to a large extent speculations. However, there are some trends which appear to be more clear than others. For example, for future consumption, production by national fleets will be less important than in the past and the dependence on imports will increase. Economic growth will have a major impact on both the demand and the availability of fish and fishery products in the countries. It seems probable that in the long term the markets for fish in Eastern and Central Europe will develop and become similar to those of Western and Central Europe, eg. Austria and Germany. Russia will become an important actor in the future international trade in fish and fishery products, both with regard to imports and exports.

The development of the region will not depend only on the region itself. Fisheries is a highly international business and any local situation should be seen in a global perspective.

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JAPAN

Demand and Supply of Fish and Fish Products in Japan
Perspectives and Implications for Food Security

by

R. Willman
FAO Fisheries Department

CONTENTS

1. REGIONAL CHARACTERISTICS AND ISSUES

Japan comprises four main islands and thousands of smaller islands which lie off the eastern coast of the Asian continent and extend over a distance of 3,800 km from north to south. Rugged mountains account for 80 percent of the land area. Cold currents from the north and warm waters from the south wash the extensive coastline and contribute to a rich marine life. Fishing and fishery products have become deeply engrained into the Japanese culture and food habits.

Japan is among the leading nations in fish production, consumption and trade. Its total fish production stood at 8.1 million tons in 1993, and imports reached 3 million tons valued at US $ 14.2 billion.

Japanese fisheries can be classified into six categories: distant water fisheries; offshore fisheries; coastal fisheries; marine aquaculture; inland water capture fisheries and inland water aquaculture. The distant water fisheries underwent significant adjustments with the extension of national jurisdiction over 200 miles and with increasing competition on the high seas from long distance fleets of other countries. This has result in lower landings but even more so in lower value of long distance catches.

The mainstay of the offshore fishery operating beyond 12 miles include small pelagics and several demersal species including Alaska pollack and various kinds of cephalopods. Total offshore catches were in the order of 4.3 million tons in 1993. Small pelagics have depicted great variations in abundance due to environmental changes and in recent years catches have declined significantly.

Coastal fisheries are conducted mainly within the 12 mile territorial waters of Japan and are considered fully utilized, or even over-exploited. Catches have remained fairly steady during the last thirty years at around 2 million tons.

Marine aquaculture is generally conducted in protect coastal bays with favourable currents. The main species cultured include seabream, scallops, and seaweeds. Total production was in the order of 0.82 million tons in 1993.

Coastal waters and habitats are considerably affected by environmental degradation caused by industrial and urban developments and by fisheries and aquaculture themselves. Reclamation, dredging and construction of marine facilities have led to the loss of coastal nurseries and habitats. The overloading of organic materials from, among others, left over food and faecal pellets from aquaculture grounds have degraded the water and bottom quality in semi-enclosed bays leading to a reduction in bio-diversity (Nakata, 1995). Inland water capture fisheries and aquaculture produce each around 90,000 tons and thus make only a small contribution to total fish production. Inland water capture fisheries depict a declining trend since the late 1970s due to deterioration of the environment.

Japan has a unique and comprehensive system of fisheries management. Coastal and inland fisheries are regulated by fisheries cooperatives through a system of fishing rights while offshore and long distance fisheries are managed through a fishing licensing system. The Fisheries Law and the Fisheries Resource Protection Law form the legal basis for fisheries management with broad authority given to the Ministry of Agriculture, Forestry and Fisheries and the prefectural governors.

2. DEMAND AND CONSUMPTION

2.1 Consumption 1970 to 1990

Japanese fish consumption is among the highest in the World (around 71 kg per capita p.a). It has remained fairly steady during the last two and a half decades ranging between 65 and 71 kg. Among OECD countries, Japan depicts an exceptionally high share of fish in animal protein intake of over 40 percent. Per capita fish consumption is seven times higher than beef, six times higher than chicken and five times higher than pork. These ratios have not drastically changed during the last two decades, in spite of a significantly higher average increase in the price of fish compared to meat and diary products. However, average prices of beef are still twice as high as average fish prices which is a unique feature among OECD countries.

Japanese fish consumption behaviour is highly sophisticated with differential preferences - and thus prices - not only for different species but also for different parts of the fish, fishing grounds where the fish has been caught, and if it has been cultured or produced from the wild. Highest preference is given for the consumption of fresh fish but demand is highly diversified and includes an increasing share of processed products, both traditional and novel types. At present about two-thirds of fishery production is used as materials for processed products. The principal species (species groups) consumed are squid, shrimp, tuna, jack mackerel, saury, sardine, yellowtail and mackerel and a large variety of crustaceans, molluscs and seaweeds.

2.2 Factors influencing demand

The principal factors which influence Japanese fish demand are economic and culture and tradition. Population growth which is close to zero will have a negligible influence on future fish demand. The aging of the Japanese society may have some influence on fish consumption as there is a greater preference for fish among older people.

However, it is open to speculation if the present younger generations who eat relatively more meat will maintain their consumption pattern as they grow older or increase their fish consumption as presently observed with older people.

Economic growth is not expected to further increase fish consumption levels in Japan. Any changes will relate to substitutions from lower to higher value products, and possibly from fish to other sources of animal protein.

2.3 Demand projections for 2010

The high level of fish consumption is expected to continue during the next decades but may slowly drop because of changing consumer preferences. Younger generations appear to have higher preferences for meat than older people. Economic growth and greater openness to foreign influences and habits are likely to encourage diversification of consumption attitudes which will also benefit from the removal of trade restrictions and tariff reductions following the conclusion of the Uruguay Round. The latter is expected to significantly lower prices of beef. These developments are not, however, expected to dramatically lower presently observed average per capita fish consumption level of about 71 kg within the coming one and a half decades for various reasons including tradition/culture, health and the aging of the Japanese society. A fair estimate is that average fish consumption will stay within the range of about 65 to 71 kg as observed during the last two and a half decades.

The composition of the fish consumption basket is expected to continue to change from lower value to higher value products. The latter are expected to include a higher share of 'easy-to-prepare' and 'ready-to-eat' products as well as products sold through fast-food chains. The sophisticated nature of fish consumption attitudes has important bearings on domestic production strategies which need to focus on those types of products where Japanese producers have a clear competitive advantage over foreign suppliers. These include, for example, ranched products which can be marketed as 'fish from the wild' rather than cultured products.

3. SUPPLY

Japanese fish production reached a peak in 1988 at just below 12 million tons of which over 90 percent was contributed by marine capture fisheries. Since then a relatively sharp drop has occurred due to a decline in catches of the offshore fishery, especially Japanese sardine (pilchard) and Alaskan pollack, and a gradual reduction in landings of the Japanese long distance fleets both on the high seas and in other countries' EEZs.

3.1 Marine capture fisheries

The decline in offshore small pelagic landings from above 4 million tons in the early 1980s to 1.7 million tons in 1994 has considerably affected the fish meal and fish culture industry. The declining catches and abundance of Japanese sardine are not necessarily solely related to fishing but probably also caused by decadal-scale changes in the marine environment (FAO Fish. Circ. C884). Japanese non-local catches declined from 2.1 million tons in 1970 to 0.9 million tons in 1993 and are expected to further decline gradually as large companies disinvest their long distance fishing activities.[1]

This process essentially occurs because of the increasing competition from emerging long distance fleets both on the high seas and in foreign EEZs (e.g. China, Taiwan, Korea), as well as due to the expansion of fishing capacities by coastal countries.

Coastal capture fisheries are over-capitalized and over-fishing of valuable species is quite common in spite of the elaborate inshore fishery management system. Over-capitalization has been fuelled by the availability of abundant low-interest institutional credit. Production of coastal fisheries excluding aquaculture has been stable during the last three decades while fishing capacity has increased significantly even though the number of fishermen and fishing enterprises has declined (Hiroyoshi).

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[1] Some of the recent decline in non-local catches is also due to the reflagging of Japanese fishing vessels estimated at about 340 vessels in the period 1991 to 1993 (based on Loyd's registry). The reflagging is believed to occur for several reasons including Japanese licensing requirements for long distance vessels.

3.2 Inland capture fisheries

Inland capture fisheries is of minor importance in Japan and has no potential for further expansion.

3.3 Aquaculture

(1) Fresh water

Fresh water aquaculture is of minor importance and has limited growth potential.

(2) Brackish and marine waters

Marine aquaculture production increased modestly since the mid-1980s and was reported at 0.81 million tons in 1992 valued at US $ 3.5 billion. This excludes culture of seaweed which is of considerable economic importance. Seaweed makes also a nutritional contribution through its rich mineral content which places it in the category of health food.

Japan is experimenting with a range of enhancement technologies in marine waters including the release of artificially reared seedlings (e.g. salmon, shrimp, scallop), the construction of artificial reefs and areas of upwelling, and marine afforestation (e.g. seaweed reef restoration).

There is some debate if these measures will contribute to the restoration of the environmental quality of coastal areas and enhance fisheries productivity in the long run. Concern is expressed about unknown impacts on biological diversity and ecosystems (Nakata, 1995).

3.4 Less waste

With the exception of discarding and low value by-catch, there are only negligible amounts of waste involved in fish handling and distribution. Highest standards of handling and preservation are maintained because of high consumer standards and the strong influence of product quality on prices.

3.5 Supply scenario

The future development of Japanese fisheries will be largely guided by economic factors, especially the extent to which the domestic industry can compete with foreign suppliers. The level of technical and financial support provided by the government will hereby continue to play an important role. The competitive edge of the Japanese industry will increasingly be in the production of high value products tailored to increasingly sophisticated consumer markets.

In quantity terms, Japanese fisheries are unlikely to depict any significant growth during the coming decades. Modest production gains made through culture and ranching are likely to be offset by a further gradual decline in the output of the long distance fleets due to competition from countries with lower labour costs.

The focus of the large Japanese fishing companies will be on trade and value-added production. An emerging strategy of securing fish supplies is through joint-venture and charter arrangements with fishing fleets operated by foreign companies, mostly from neighbouring countries.

The major factor resulting in considerable variability of domestic fish production until the year 2010 is the natural fluctuation in the abundance and, thus, landings of small pelagics. The actual production in 2010, thus, may vary between 8 and over 10 million tons.

4. DEVELOPMENTS IN FISH TRADE AND DISTRIBUTION

Total fish import quantity reached 3 million tons in 1992 comprising of 55 % fresh/frozen fish, 27 % fresh/frozen crustacean & mollusc (mostly shrimp), 12 % fish meal, and the remainder of canned products. Average annual compounded growth rates of import quantities during the last decade were as follows: fresh/frozen fish 13%; fresh/frozen shrimp 6.3%; smoked/dried fish 0.4%; canned fish & shrimp 13 % and fish meal 13.5 %.

Japanese fish exports amounted to some 425000 tons in 1992 comprising of 63% fresh/frozen fish, 4% crustacean & mollusc, 10% canned products, and 11% each fish meal and fish oil. Fish exports depict a modest declining trend since 1988, assumably due to the decline in domestic production as well as the appreciation of the Japanese Yen.

Fish marketing and distribution is highly regulated under the Japanese Marketing Law which provides for two principal types of markets: production district wholesale markets located at ports of landing and consumer district wholesale markets located in consumer areas (Fisheries of Japan, 1991). Fishermen usually are required to market their catch in an assigned production district wholesale market.

5. FISH CONSUMPTION IN 2010

Domestic fish production will not place any constraints on actual consumption levels in 2010 because any supply-demand gap will be closed through imports.

6. IMPLICATIONS FOR FOOD SECURITY

Domestically, there are no threats of food insecurity.

7. POLICY ISSUES AND INTERVENTIONS

To maintain competitiveness, the Japanese fishing industry will need to augment average labour and capital productivities, particularly of the household-based inshore sector but also of the processing industry, through various adjustment processes including (i) introduction of labour saving technologies in fish capture, culture, processing and distribution; (ii) rationalization of the fishing fleets through a reduction in the number of vessels/fishing units, and (iii) improved fisheries management of inshore and offshore resources. Rationalization of the processing industry will increasingly entail the relocation of operations to foreign countries through joint-venture and other arrangements because of lower labour costs and preferential access to raw materials.

Government's and industry's attention is expected to focus on the consolidation of the profitability of the industry and the reduction of high levels of implicit and explicit subsidies which the sector presently receives. Without such restructuration, Japanese fisheries are expected to continue to "age" as indicated by the problem of recruiting young people into the production sector. The latter problem is partly being addressed through the employment of foreigners but such employment is expected to remain confined to offshore and long distance fleets.

Improved fishery management is expected to focus on increasing the production of high value species. This will entail the continuing use of traditional types of management techniques (regulation of effort or catch; closed seasons and areas) as well as innovative attempts at manipulating the natural environment in order to favour habitat, growth and recruitment of preferred high value species.

Sea ranching is expected to become the preferred form of 'culturing' fin fish species in Japan for several reasons including (i) avoidance of spatial competition in inshore waters; (ii) avoidance of effects of water pollution; (iii) maintenance of product characteristic as 'wild fish' thus realizing higher prices; and (iv) lower production costs. Sea ranching has become a major fishery research focus in Japan with presently some 60 stations established throughout the country.

The growth in marine culture over the coming two decades is not expected to result in any significant substitution of present levels of fish imports. However, in quantity terms the growth of fish imports observed since the late 1980s is unlikely to continue at the same high rate because of saturation in consumption levels, a slow down in the shrinking of long distance and offshore catches, and improved management of inshore fisheries.[2]

[2] The present strong Yen, however, may temporarily increase fish consumption to a new historical height.

MIDDLE EAST

Demand and Supply of Fish and Fish Products in the Middle East Perspectives and Implications for Food Security

by

M. Ben Yami, FAO Consultant
based on the work of the FAO Fisheries Department Task Force
Team Leader: G. Everett

CONTENTS

1. REGIONAL CHARACTERISTICS AND ISSUES

1.1 General

The countries covered by this report are: Afghanistan, Bahrain, Cyprus, Ghaza Strip, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Malta, Oman, Qatar, Saudi Arabia, Syria, Turkey, U.A.E., and Yemen. They border the Eastern Mediterranean, Black Sea, Caspian Sea, Red Sea, and the Northwest Indian Ocean including the Gulf of Aden, the year 2010. There are at least 1.5 million people in the region, mostly small-scale fisherworkers and their immediate families, whose living depends directly on fishing.

1.2 Special features

The fishery resources of the region range from very poor and poor in the Eastern Mediterranean, Red Sea, and now also in the Black Sea, to medium and rich in the Northwest Indian Ocean. The two countries of this region included in the list of the 50 leading fishing countries are Turkey (32nd in 1993) and Iran (42nd in 1993). The region's only extensive continental shelf is off the southeastern tip of the Arabian peninsula, and in the Persian Gulf.

There is only one major river system: the Tigris-Euphrates. Its 535 000 m^2 basin spreads over six countries of the region. Many of the region's lakes dry seasonally or are too saline to carry exploitable fish stocks. Turkey, (see 1.5 below), is an exception owing to its geographical location at the north to the mainly arid Middle East. (The fishery of the landlocked Caspian Sea, because of its marine character, is regarded for the purpose of this report, as marine fishery).

The region differs from most other parts of the world also in its cultural and socio-economic structure. It comprises countries of mainly Islamic culture, but with very different natural, human, economic, and financial resources, and an extremely wide range of standards of living and per caput incomes. Iran, with some 63 million, is the most populous country, while Cyprus, Malta, and some of the Gulf countries have populations not exceeding 1 million. Some of the countries have large populations of imported labour, others a large tourist turnover which, in both cases, affects the level and character of demand and consumption. Although most of the fisheries are supported by small-scale and medium-scale operators, the role of women in fish processing and trade is less important than is some other areas (Africa, Asia, Latin America). At the subsistence and small-scale levels, fish are often sun-dried and/or salted but with the exception of Turkey, hardly ever smoked.

1.3 Issues

1.3.1 Environment

During the 1980's and 1990's there were dramatic, largely anthropogenic environmental changes in the Black Sea that resulted in a collapse of all major fisheries. This calamity was caused by the expansion of an exotic combjelly (Mnemiopsis sp.), which in turn, most probably, was stimulated by heavy eutrophication from polluted rivers and other run-off. The Turkish landings decreased from many hundreds to tens of thousands of tonnes. A substantial decrease in the oil content in the remaining fish indicates that the collapse of stocks is linked to ecological factors rather than overfishing. A spill-over effect was reported also from the Sea of Marmara and even the Aegean and Mediterranean seas.

The eastern Mediterranean, always considered among the least productive marine areas in the world, has been exposed increasingly to pollution-caused eutrophication. While a moderate level of enrichment, if controlled, may enhance production of commercial fish in oligotrophic waters, negative side-effects are common, creating touch-and-go situations. The eastern Mediterranean is affected by increasing pollution from shipping, especially oil tankers, and industrial, urban, and agricultural run-off that should cause concern among the area's nations. In recent years, seasonal or occasional blooms of jellyfish and algae have been occurring every summer. In summer 1995, jellyfish expansion along the whole eastern coast of the Mediterranean assumed unprecedented proportions. The recent discovery that the combjelly (Mnemiopsis sp.) that devastated the Black Sea ecosystem, is also present in the northeastern Mediterranean, is alarming news.

Considerable environmental degradation has been reported also from the Caspian Sea where Iran supports an important fishery.

The Persian Gulf is another area threatened by pollution. Apart from the environmental effects (e.g., stunting growth of shrimp and the virtual collapse of the Saudi shrimp fishery, due to enormous oil spills and heavy smoke during the 1991 hostilities), it is constantly threatened by heavy oil traffic. Although in recent years the tanker traffic decreased, this seems to be a temporary situation.

1.3.2 Management

Without rational and realistic management of the fisheries and the marine environment, especially in the Black and Mediteranean seas and in the gulfs of Aden, Oman and the Persian Gulf, there is little chance that the present yields can be increased or even sustained. In some areas excessive licensing of foreign fleets is claimed to affect local fisheries. The region's inland fisheries are based in many areas on a rather delicate environmental balance and can be badly affected by miscalculated human activities.

1.3.3 Fish and food security

In some countries fish may be losing its role in food security while becoming less affordable by the poorer sectors of the population. In the future, this trend may become more and more important in the populous countries of the region such as Iran, Iraq and Turkey but in those countries lacking major mineral resources such as Oman and Yemen much of the population is found along the coast where certain species of fish are plentiful and low priced.

1.4 Marine resources

There is little evidence of large under-exploited commercial food fish resources in the region, except perhaps, the Caspian kilka (Clupeonella spp.) and the small pelagics (mainly clupeids and Indian mackerel) of the Northwest Indian Ocean. However, these are fluctuating populations and related stock abundance and yield estimates vary. There seems also to be some potential for enlarging the cephalopods yields in the Gulf of Aden. Barring environmental fluctuations, there is no reason to expect any substantial increase of the total yield of tuna-like fishes in the Western Indian Ocean. The region's share in this multi-national fishery could increase, though.

An acoustically assessed unexploited stock of 4-5 million tonnes of not yet commercial tiny mesopelagic lantern fish (Myctophide) has been located off Iran and Oman. By other estimates the size of that stock in the Gulf of Aden is some 17 million tonnes. Main concentrations of lantern fish abounded particularly off Oman where sustainable yields of 200 to 300 thousands of tonnes per year were estimated. Utilization of these fish has yet to be studied, fishmeal and oil for animal and farmed fish feeding and associated by-products being the most probable outcome.

There are insufficient data for stocks estimates for both the Black Sea after their recent collapse, and for the Eastern Mediterranean (whose fishery resources represent only a small fraction of the total resources in the region).

The eastern Mediterranean has little potential for increased landings from capture fisheries. However, offshore fish farming in cages is now being experimented with in unprotected waters in Cyprus and Israel. If this proves profitable, then open-sea cage farming may gradually contribute to the supply of high-value fish, especially if it spreads also to Lebanon, Syria (which have virtually no protected waters), and those parts of the Turkish coast which lack protected waters.

The natural potential (water temperature and quality, topography, inexpensive labour) represents a favourable environment for cage farming in the many protected waters in the Gulf of Suez, Red Sea, and the Persian Gulf.

1.5 Inland resources

Only Iraq, Iran and Turkey have inland capture fishery resources of major importance, while Israel has a well managed fishery in Lake Kinneret with landings up to 2 000 t/year.

Iraq's inland water fishery is based on the Tigris-Euphrates riverine system, its lakes, and seasonal floods (with a flooded area of 15 000 to 20 000 km^2), and it plays an important role in the country's economy. Most probably a potential exists for development of this resource through management, stocking, and enhancement of extensive culture practices. Iran has several lakes and many rivers. Its huge fishery in the Caspian Sea is often considered as a part of its inland waters fisheries.

Turkey, with its 8 333 km of coastlines, 175 000 km of rivers, 1 million ha of natural lakes, 170 000 ha of reservoirs, 70 000 ha of lagoons and 700 small reservoirs used for local irrigation and water-supply needs, has immense resources potential for marine and inland fishery and fish farming. A further potential is evolving with the planned and ongoing dam and reservoir construction. No doubt, Turkey's inland fisheries can still be significantly enhanced.

In general, the climate in the region is favourable for freshwater fish farming, and depending on the availability and price of water, feeds and energy, there is a substantial potential in some countries for further development of aquaculture, starting with extensive and ending with super-intensive systems. Utilization of brackish and warm water sources may carry such systems into arid environments lacking freshwater sources, as is already done in Israel.

2. DEMAND AND CONSUMPTION

The average regional fish consumption per caput at 4.6 kg/year (1990), is well below the world's average. Apparent consumption and supply related trends during the period 1965-1989 have varied between countries.

In Turkey, for example, both the fish per caput supply and the fish share in the general animal protein intake increased. In Iran, in spite of its fast growing population, the fish supply and its share in the general protein supply, increased quite considerably. There was, on the other hand, a dramatic decline in Iraq. In Israel, the fish contribution to animal protein intake during the same period declined slightly. Similar trends occurred in Malta where fish supply doubled, but its share in protein intake increased only slightly, and in U.A.E. where per caput supply has increased and fish percentage in animal protein declined. In Oman, in spite of a very substantial increase in fish supply, there was a significant decline in their share in the animal protein intake. This information indicates improving standards of living in the four last countries, especially in Oman, if the evident increase of meat consumption is accepted as an indicator. In Yemen where fish consumption per caput is more than 20 kg/year in the south and southeast and only 3.1 kg/year in the north, the average consumption figure must be much lower than the per caput supply.

The relative and absolute increase in the consumption of meat usually implies an increasing demand for higher-value fish species and, vice-versa, a more moderate increase in or declining meat consumption may indicate potential demand for low-price fish in the respective countries. The present rather low demand for fish in some of the countries is due to two causes: their absence from the traditional diet of populations in the interior and low purchasing power. Habits, however, are undergoing external influences and are changing. For example, the main consumers of the canned fish imported predominantly from the Far East and Southeast Asian countries are reportedly the many foreign workers that are employed in the oil producing countries.

Lebanon is a special case. The volatile political and security situation which prevailed for years reduced the supply to 1 500 t of local production and 4 000 t of imports which could not satisfy a demand estimated at about 20 000 t/year.

In Afghanistan and Syria, fish play a marginal role in the national diet, if at all.

3. SUPPLY

FISH SUPPLY IN THE REGION

Country	Year	Supply per caput kg/year	Share in animal protein intake, %
Bahrain	1990	19.0	11.0
Cyprus	1990	15.3	6.6
Iran	1990	4.8	8.7
Iraq	1990	0.7	1.7
Israel	1989	22.5	9.5
Kuwait	1990	7.5	6.8
Malta	1990	21.2	12.3
Oman	1990	24.3	19.5
Qatar	1990	19.7	9.0
Saudi Arabia	1990	7.1	5.9
Syria	1990	0.5	0.7
Turkey	1990	4.6	8.6
U.A.E.	1989	26.2	12.4
Yemen	1987	6.3	13.3

3.1 Marine capture fisheries (see table: Landings)

In some countries of the region, fishing communities are scattered over large areas at great distances from each other and fishing activities are often nomadic in character. This may result in poorly recorded landings of the small-scale fisheries, and in underestimation of their socio-economic importance, including for subsistence and local food supply.

The bulk of fish yields are of marine origin. Reported landings are quite stable. Iran's production is increasing consistently, over 10% of its landings coming from the Caspian Sea. The Turkish and Israeli landings have recently declined, the former due to the Black Sea calamity, the latter because of local difficulties in marketing small pelagics and of the reduction of its distant-water operations in the Atlantic Ocean. Oman's landings, consisting chiefly of pelagics (tunas, kingfishes, and small pelagics), show annual fluctuations between 100 and 170 000 tonnes. Some increases were reported by Yemen and U.A.E. At least 10% of Bahrain's, Saudi Arabia's and UAE's, 4% of Yemen's, and almost a quarter of Iran's landings consist of tuna-like fishes, kingfish (also called Spanish mackerel Scomberomorus commerson) being the predominant species. Most of these catches are taken inshore by small-scale fishers.

FISH LANDINGS IN THE MIDDLE EAST REGION ('000 t) 1993

Marine finfish	1 138
Shrimp and other crustaceans	9
Inland waters (capture fisheries)	101
Fish farming	66
Total for the region	1 315

3.2 Inland fisheries (see table: Landings)

Inland capture fisheries of significant importance exist in Iran, Iraq and Turkey and (as a proportion of its total fish supply) also in Israel. Iran derives major benefits in terms of foreign currency from its high-value caviar-producing sturgeon fishery in the Caspian Sea area. Altogether, Iran's inland fishery is responsible for some 15% of the total yields, the share of aquaculture growing at the expense of capture fishery. In Iraq, inland capture fishery of the Tigris-Euphrates system provides over half of the country's fish supply. Recent reports, however, suggest degradation of the fishery in the southern marshlands which can be associated with hostilities in the area.

3.3 Aquaculture (see table: Landings)

Freshwater fish farming is on the increase in the region. It is producing major yields in Iraq, Iran, Israel, Syria, Turkey, and Saudi Arabia. Less substantial commercial and experimental aquaculture projects were reported from Bahrain, Cyprus, Jordan, and Kuwait. Fresh and brackish water aquaculture has been developing in Cyprus (trouts), Iran and Iraq (mainly carps), Israel (mainly carp-tilapia polyculture and intensive monoculture), Syria (mainly carps), Saudi Arabia (mainly tilapia), and Turkey (mainly trouts). Various technologies are applied, however, in countries where fresh water supply is severely limited as, for example, Israel and Saudi Arabia, which use more intensive methods, and brackish water and effluents.

In Turkey, modern fish farming is a new subject. The entrance-controlled lagoon fisheries which have been practised in Turkey for centuries can be classified as an example of extensive aquaculture. There are about 26 enclosed lagoons in which nearly 2 000 tonnes of fish are annually produced.

Additionally, interesting developments occurred in the last decade in the farming of marine fish, mainly in Turkey where yields of some 500 t of seabass (Dicentrarchus sp.) were expected in 1995, in Cyprus, and in Israel, the latter with some 300 t of gilthead bream (Sparus auratus). This industry is using floating cages, mainly but not only in protected waters. In Israel, farmed fish represent some three quarters of the national fish production.

3.4 Utilization

3.4.1 By-catch and discards utilization

In the late 1970's FAO undertook a study aimed at an assessment of the availability and composition of by-catch and discards in the southeastern part of the region and of their possible preservation and utilization for human consumption and other purposes. The following eight Middle East countries were surveyed: Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, and UAE. Iran and Iraq, at that time the largest fish producers in that area, had the largest quantities of by-catch at sea. There has not been, however, any apparent follow up to that effort, except for an Omani survey to establish by-catch and discards levels which was done in the late 1980's. Undoubtedly, commercial utilization of the by-catch can only take place if a demand evolves for products that can be derived from this resource which is at present wasted. In recent years, in Yemen for example, there is a trend of increasing utilization of some of the previously discarded or "third-rate" fish.

The feasibility of avoiding by-catch through selective fishing must be investigated from both technological and biological points of view to establish the character of the by-catch and the bioeconomic benefits that can be derived from such an effort.

3.4.2 Utilization of catches

Larger fish are sold fresh or fresh-frozen. Only in areas that are remote from markets and where refrigerated transport is not available, demersal and the larger pelagic fish are salted and sun-dried. In the southern part of the region small pelagics caught by small-scale fishermen, if not sold or locally consumed fresh, are mainly beach dried and often (e.g., in Yemen) used for feeding cattle.

3.4.3 Industrial processing

So far, Turkey has been the only major industrial fish-processor in the region. The Turkish industry, however, suffered a major setback due to the recent collapse of the pelagic stocks in the wake of the Black Sea environmental calamity. Previously, a share of the 400 000 t or more of the Turkish anchovy (Engraulidae) landings was utilized in various forms, fresh and preserved, for human consumption, including canning for export. The remainder served as raw material for reduction plants. In 1992 with landings down to about one seventh of the previous figure, and raised prices, only a fraction of the anchovy catch was canned and reduced. The lack of anchovy has brought about a shift to canning of other species, such as Aegean sardine, imported mackerel, and even farmed trout.

There is a trend towards development of fish canning industry in Oman, Saudi Arabia, U.A.E. and Yemen which already is a major exporter of canned small pelagics, spurred by the growing demand and the resulting imports, but damped by supply seasonality and unrestricted competition from the imports.

Israel has several small canning and/or fish processing plants. The raw material consists of imported sardines, mackerel, etc., which are canned or smoked, as well as farmed and larger imported fish processed into ready-for-cooking, mostly frozen products.

Commercial interests in the Arabian Peninsula are considering establishing modern canning plants, reportedly in Oman.

3.5 Supply scenario for 2010

With fisheries operating within a complex and quasi-chaotic system, this section must be highly speculative. Past trends cannot indicate future development in capture fisheries that are exploited close to maximum yields. Climatic instability and political volatility that may affect stocks and fishing effort, contribute to the uncertainty. On the other hand, the peace trends in the Near East and the long awaited relief of tensions in the Gulf area would serve as stabilizing and encouraging factors for trade, investment and development in the region. This might be particularly important in view of the probability that the bulk of any supply growth would come from aquaculture and from intra-regional trade.

3.5.1 Marine fisheries

No significant increase in landings can be expected from increasing the fishing pressure on presently exploited resources. The only increases may come from catches of low-value fish, such as sardines (Clupeidae) and Indian mackerel (Rastrelliger kanagurta) off Oman and Yemen, and perhaps, a few thousands tonnes of cuttlefish (Sepioidea) from the Gulf of Aden. If Somalia develops a pelagic fishery, Somali landings in Yemen can be expected. Yields of shrimp will fluctuate at about the present level. However, if countries of the region become more involved in the international tuna fishery in the Northwestern and Western Indian Ocean, around 2010 they may be able to produce yields of significance both in tonnage and value. A good indication of movement in this direction is the new Omani-Saudi joint venture to establish in Oman a 12 000 t capacity tuna canning plant. Some extra supply of food fishes, such as squid and ribbon fish , may come from a by-catch of the (potential, though not yet feasible) meso-pelagic fishery.

According to some estimates, Iran's potential yields in the Caspian Sea may reach 100 000 t/year. On the other hand, anthropogenic processes make the future of the Caspian far from clear. Reports from Iran indicate a downward trend in the shrimp yield in the Gulf with catches dropping down to 17 t/year/vessel.

Anything may develop during the next 15 years if the Black Sea is still affected by pollution and combjelly. If, however, a new and more favourable ecological equilibrium evolves, Turkey's Black Sea yields of anchovy (Engraulis spp.), horsemackerel

(Trachurus spp.), and chub mackerel (Scomber japonicus) may partly or fully recover and its processing industry recuperate.

In the eastern Mediterranean there is little chance of sustaining the present yields without concerted management measures to limit fishing pressure, at least such as undertaken by Cyprus and Israel, as well as much more effort aimed at containing the sea-polluting run-off. Owing to the peace process in the area, one may hope for joint management schemes among all eastern Mediterranean countries, especially those sharing a common continental shelf.

3.5.2 Inland capture fishery

With growing demand and the construction of new impoundments and man-made lakes, investments aimed at enhancement of inland fisheries can be expected. Stocking and other operations, including quasi-culture methods may, where successful, increase catches significantly. This is particularly so for countries like Turkey, Syria, Iran, and Iraq. While carps and tilapia would augment local supply, trout, crayfish, and exotic species such as striped seabass may find their way to extra-regional markets.

3.5.3 Aquaculture

Fish farming, especially in sea water, is the only sub-sector that, can contribute to a substantial increase of yields in the region. This is provided that even theoretically there is sufficient demand for high-value prime fish, and that know-how, seed and feeds are made available. The region's natural conditions (warm water throughout the year, many inshore sheltered and quasi-sheltered sites inshore and among islands) are favourable for cage farming of prime marine fishes suitable for the more affluent local/national consumers and for export within and out of the region. Such species include the gilthead seabream and European seabass already commercially farmed off Israel's Red Sea coast, red seabream and an Indo-Pacific variety of seabass massively farmed in Japan and young tuna caught alive and brought up to commercial size as done in Australia.

One mariculture option is intensive or even super-intensive shrimp (Penaeidae) farming which, with the possible rise in prices, may become economically feasible especially where energy costs are low. Research in this direction has already been taking place in some of the countries for several years.

It can be seen from experience during the last decade that a rapid increase in the supply of cultured fish has an immediate negative influence on prices which may drop from their former, investment-attracting levels, and drag the new operations into the red. If, however, the world demand for prime fish continues to expand proportionally to the growth of the better-off sectors of its population, thousands of tons of regionally farmed fish could be produced to supply in this market. Marine fish farms and associated packing and processing plants could help ease the fishing pressure on coastal stocks by attracting labour from among the fishing population.

Because of the limited water resources in most countries, fish supplies from freshwater fish farming are not expected to increase proportionally to demand, except where prices of either water or energy (for closed-system and super-intensive culture) are low enough. Increased production of the more expensive species such as striped bass, trout, crayfish, freshwater prawn, etc., is more probable than that of the cheaper carp and tilapia. In Israel, for example, where during the last decade the production of freshwater fish farming increased by some 2 000 t (13%), the share of the low-priced fish (carp, chinese carps) decreased by 20-30%, while that of higher-priced species (tilapia, trout, striped bass) increased by 25-200%. The official target in Israel is a further increase of yields by 50% to reach almost 22 000 t in 2000 at the expense of imports. If this trend prevails, towards 2010 Israel's farmed fish production may reach 30 000 t.

Future development of any type of aquaculture will no doubt depend also on the development of new technologies, including production of feeds that can replace some of the fishmeal and fish oil. These will become more and more expensive with the increase of demand with hardly any increase in supply ("the fishmeal trap"). The only so far unutilized fish resource in the region appropriate for reduction is the tiny mesopelagic lantern fish. Exploitation of this resource would depend upon emergence of an appropriate market, economically and environmentally feasible capture and processing technologies, and willing investors, altogether a rather tall order. A breakthrough in this direction could be, for example, reduction and processing of small pelagics and meso-pelagics into edible and tasty, hence, attractive products.

3.5.4 The most optimistic scenario

The most optimistic scenario would add towards the 2010 about 250 000 t of mesopelagics, industrially reduced to some 50 000 t of fishmeal, which may serve partly at least for aquaculture. Freshwater farming will double or triple its production, while marine fish farming may develop to produce some 20 000 tonnes of prime fish. The Black Sea pelagic fishery may recuperate to about its former level, and Iranians may succeed in developing their fishery to about the predicted yields levels. Altogether, the following amounts of fish may amplify the present (1994/5) catches:

Kilka	75 000 t
Oceanic tuna	50 000 t
Small pelagics, incl. Black Sea	250 000 t
Cephalopods	5 000 t
Mesopelagics	250 000 t
Other marine fish and shellfish	-
Marine culture	20 000 t
Aquaculture	90 000 t
Total:	**790 000 t**

4. DISTRIBUTION AND INTERNATIONAL TRADE

The international trade is mainly with non-regional partners, Cyprus, Iran, Israel, Saudi Arabia and Turkey are the principal importing countries, while Iran, Oman, Turkey and Yemen are the principal exporters. Cyprus is a relatively large importer (6 900 t in 1993) which contributes to its high per caput supply figure. This figure, however, is misleading, for Cyprus has a substantial turnover of tourists, the actual number of consumers in Cyprus being much higher than its nominal population. To a lesser degree, the same can be said of Israel.

Iran's main export product is caviar, but it is developing also its lobster packing/freezing industry for export. Oman exports tuna, cephalopods, abalone, and prime fish, much of it within the region and, in 1993, it exported 46 000 t, close to 40% of its total landings. Turkey exports mainly prime fish and shellfish, although prior to the Black Sea calamity it used to export also anchovy in various forms. Among its clients are also Cyprus, Lebanon, and Saudi Arabia.

Israel and Saudi Arabia with hardly any exports represent attractive markets for frozen and canned products. In the other massive fish trading countries the trade is much more balanced. A substantial share of the exports find intra-regional markets.

Canned fish are mostly imported but, in recent years, also exported. In 1992, Yemen exported 15 000 t of canned mackerel, Oman 190 t, Saudi Arabia 335 t, and UAE 250 t.

The 1992 imports of canned fish in the non-Mediterranean countries were, as follows: Jordan - 2 520 t, many of which from the region; Qatar - 450 t; Saudi Arabia - 15 500 t; UAE - 3 700 t; Yemen - 1 000 t.

5. FISH CONSUMPTION 2010

There are many factors that can influence future fish consumption in the region: (i) supply capacities; (ii) the general economic situation in the region, always affected by the exploitation level of its natural wealth, in particular oil, and by the often unstable national and international political/security situation; (iii) the well-being of the intermediate (low-to-medium income) sectors of the population whose purchasing power will determine the demand; (iv) how many of the consumers will be able and willing to pay the minimum prices for the fish that the various fishery industries must charge to keep their operations financially feasible.

In 1992, the total consumption in the region was 940 000 t with production at about one million tonnes. If, according to some estimates, the economy grows and per caput consumption increases from 4.6 to 5 kg/year in the 2000 and 7.5 kg/year in 2010, with a population of 272.6 million in the 2000 and 343.5 million in the 2010 the demand should increase to 1.4 and 2.0 million tonnes, respectively.

However, a 60% increase of per caput demand in 15 years would indicate also a substantial rise in the standard of living. Such rise is normally characterized by decreasing population growth rate and in an increase in the consumption of meat at a higher rate than that of fish. On the other hand, at least in two of the region's more populous countries the standard of living seems to be rather declining. Thus, barring major immigration into the region, the demand in 2010 may not reach the above mentioned value (see also Section 2, above).

In any case, capture of food fish in the region cannot be doubled, even in the most optimistic scenario, and any major increase of supply can only come from imports and aquaculture development. Since, however, similar gaps between demand and supply must occur also in many other regions, there seems to be little chance for massive supply of imported fish at prices accessible to the average and, for that matter, the poorer consumer. Altogether, whatever the theoretical demand will be, a realistic 2010 fish consumption figure would probably not exceed one-and-a-quarter million tonnes and an optimistic figure might reach one and a half million.

6. IMPLICATIONS FOR FOOD SECURITY

Apart from the more remote coastal and some floodplain areas where subsistence fisheries still exists, fish supply has not been playing and is not going to play any dramatic role in the food security of the Middle East. Countries of this region have been spared periods of famine of the sort that plagues Africa where the rain-dependent economy is supported by subsistence farmers and cattle growers lacking any financial reserves that can carry them over periods of drought. Farming practices in most of the Middle East's arid or semi-arid areas have undergone ages-long adjustment to the climatic conditions. Its other areas enjoy a permanent supply of river water.

The social and cultural structure and certain political realities bring about several sorts of intra-national and international support especially among Arab countries of the region. Cyprus, Israel, and the oil-producing countries are not influenced to a serious degree by rainfall for their food supply. Turkey which experienced some dry years has been recently undertaking many irrigation projects based on its rivers' water. Jordan's water supply to agriculture is soon going to improve as a result of the Middle East peace process.

The potential growth of fish supply, predominantly from aquaculture and mesopelagics, will hardly contribute to the food security of the lower-income groups with deficient animal protein intake. This is because of the high price of farmed fish, and because mesopelagics would be utilised, if at all, for reduction rather than for human consumption. At best, the mesopelagics will ease the "fishmeal trap" and help in the development of aquaculture. At worst, the fishmeal will be exported out of the region with only little social and national benefits.

Especially in coastal fishing communities, low-income groups will have in the future less and less access to food fish, because of higher prices and improving marketing channels through which fish will be carried from the beaches and fishing centres to urban, affluent markets. Less fish will be beach-dried and otherwise traditionally processed and subsistence fisheries will give way to commercialization. Nonetheless, capture fisheries and fish farming will remain a major and potentially growing employer both as a primary industry and through the associated secondary industries and services. Hence the important though indirect role fish may play in the food security of even those fishworkers and their families who cannot afford to eat the fish they are catching and processing. This can be true only if the region's hundreds of thousands artisanal and small-scale fishers will not be deprived of their resource base by intruding large-scale operations.

Turkey, climatically and geographically the odd man out, is one of the seven self-sufficient countries in the world as far as food resources are concerned. However, the high rate of increase of its population may create problems in the future in terms of satisfactory nutrition. Yemen and Oman are the only countries in the region in which fish will continue to play a relatively major role both in the food supply and the national economy. Iraq and Iran are in an intermediate position. In the other oil-producing countries, and in Cyprus, Israel, Jordan, Lebanon and Syria, the role of fish in food security will remain, though for different reasons, quite modest.

7. POSSIBLE POLICY INTERVENTIONS

7.1 Policy implications with respect to resources exploitation and sustainable fish food supply

In view of the high level of exploitation of fisheries resources, sustainable fish food supply from capture fisheries is almost synonymous with rational fisheries and environmental management. This emphasizes the need for wider implementation of the resolution of the FAO 1984 World Conference on Fisheries Management and Development calling governments to review individually and jointly their present strategies and policies.

The challenge is to provide a rational basis for the exploitation of fisheries resources. This, in turn, requires scientific input on one hand, and development where possible of decentralized management approaches, such as co-management, on the other. There is the need for awareness and consideration of all environmental issues associated with fisheries management and development including reduction of waste and controlling pollution. Rational management requires also withdrawal of subsidies especially to commercial large and medium-scale operations, while giving serious consideration to the well-being of the small-scale fisheries sector usually supporting the poorest population groups. All such objectives cannot be achieved without political will and enforcement means.

Management and research and development considerations, such as resources allocation and research funds, should relate to the supply of low-cost protein products for human consumption. New policies must also recognize that every separate geographic, environmental, and socio-economic situation may need adaptation of specific options and solutions.

Natural and anthropogenic environmental processes and the resulting climatic and other variations are affecting both the state of the resource and the fishing success to such a degree that steady-state models in population dynamics do not seem to be adequate any more for fisheries management purpose. Thus, future stock assessments in the region ought to be preceded by a broad ecological evaluation. To be useful for management, the stock and yield assessment process ought to reconcile ecological, biological, social and economic criteria.

7.2 Allocation of stocks and distribution of benefits

Attention must be paid to areas with excessive fishing pressure, in particular in the case of trawling in the Gulfs, and to conflicts between various sectors fishing the same grounds and/or the same stocks. Normally in small-scale fisheries more people can make their living, while producing the same yields out of the same resource, as in larger-scale operations. Improved marketing channels will enable the delivery of fresh fish also by small-scale fishery operators. Consequently, to assure sustained fish supply and equitable benefits distribution over the region's coastal areas and to maintain the role of the capture fisheries as a massive employer, fishery allocation policies should aim at directing the larger-scale operations to only those stocks and grounds where they would be unable to compete for and cause damage to resources harvested by the local artisanal and small-scale fishers.

7.3 Development of marketing channels and fish processing industry

Any shift from animal-feeding and reduction of small pelagics to canning or other processing for human consumption should be encouraged. For this purpose, governments may first develop the fisheries-related infrastructure, then support in various ways private investments in fish transport, storage, and processing plants. This course of action would be particularly important for Oman and Yemen both with access to substantial stocks of small pelagics.

7.4 Legislation: management steps for sustainable exploitation

Important changes in fishery management regulation, in particular limiting of fishing effort, were recently reported by Cyprus, Israel and Turkey. For example, Cyprus and Israel limited the size of their fleets of trawlers and inshore fishing boats, with the former introducing also seasonal closure of its trawl fishery.

In some areas (the various gulfs of the region, Eastern Mediterranean), some fish populations are exploited by more than one country. Thus, attention must be drawn to the ever increasing importance of inter-governmental and international collaboration in fisheries management, including joint legislation, monitoring and surveillance systems, and even joint enforcement. For example, Cyprus has evoked the need for international regulation of the swordfish fishery in the Eastern Mediterranean. Also in the southeastern area of the region there are several populations of pelagic fish, fully or over-utilized, such as the Spanish mackerel of the Arabian Sea, that would benefit from sub-regional regulation. The region's Mediterranean countries would benefit in this respect from fuller participation in the deliberations and activities of the General Fisheries Commission for the Mediterranean (GFCM) and the Mediterranean Regional Aquaculture Programme (MEDRAP).

The Indian Ocean Fishery Commission had set up a special committee for the management of fish stocks in the Gulf. It is an advisory body and has no regulatory or, for that matter, any other power. This committee however, can become an important tool in formulating and negotiating international agreements related to the management of joint and straddling fish stocks.

7.5 Development issues

7.5.1 Small-scale (artisanal) fisheries

The region's governments should formulate well balanced policies related to the importance of this sector in the region both as a producer and employer. If the general strategy as adopted by the above mentioned FAO Conference is to be followed, such policies would give emphasis to the provision of credit and credit mechanisms accessible to small-scale operators, infrastructure (shelters, access roads, marine safety facilities, such as lighthouses, radio communication, etc., and shore facilities for community fishery centres including fish markets), advisory service for fisherfolk organizations and cooperatives, and special programmes for women. Such programmes ought to be preferred over direct financial or other material support, grants, subsidies, etc. UAE, for example, reported launching a social amenity related programme, Iraq and Turkey have been using cooperatives as a small-scale fisheries development tool while Qatar legislated a loan law for the artisanal fishery sector.

In many areas, the status of coastal fishing communities can be significantly improved (through improved marketing, processing, services and credit facilities) without increasing fishing effort. Nevertheless, precautionary management, desirable in the co-management form, ought to be considered to prevent over-exploitation of the inshore stocks serving as a basis for the small-scale fisheries. Options, such as directing coastal manpower away from capture fisheries to other employment through training, and development of other industries in the coastal areas could be considered.

7.5.2 Private-sector investments

Several governments made substantial investments in fisheries through state-owned and para-statal companies which still maintain their holdings and executive powers. In the future, however, the trend towards greater privatization promoted by most international banks can be expected to become a matter of policy in most countries. Turkey, for example, already emphasized its policy encouraging commercial and private sector investment in fisheries while restricting the government's role to providing infrastructure and favourable economic environment, as well as funds for research, training, extension, and administration. Oman issued a call on the private sector to invest in fishery enterprises and, reportedly, is planning a joint venture with an European company aimed at the exploitation of the mesopelagic resouce. Saudi Arabia grants interest-free loans for investments in vessels, engines and fishing equipment.

7.5.3 Large pelagics

The region's countries bordering the Indian Ocean have been watching for some time the international distant waters fishery for large pelagics, mainly tuna species, in the Arabian Sea and the Northwest Indian Ocean. It will be only natural if within the foreseeable future some regional private interests undertake to participate in earnest in the exploitation of the oceanic fishery resources. The respective governments would be well advised to join or cooperate with the Western Indian Ocean Tuna Organization (WIOTO) and support international management agreements related to large pelagics.

7.5.4 Mesopelagics

Governments ought to pave the way for commercial ventures aimed at harvesting and processing mesopelagics, especially through surveys and research in fishing and fish processing technology. Also, special mesh-size and minimum fish size regulations may be needed to enable legal utilization of the tiny lantern fish. Nonetheless, in view of the major investments involved, any financial support ought to be conditional to a solid economic basis.

7.5.5 Aquaculture

In most countries, especially on the Arab Peninsula and in the coastal zone of Iran, there is no tradition of fish farming. Also, conditions (lack of freshwater resources, size of investments needed for marine farming ventures) are not favourable for small-scale aquaculture operated by local farmers or fishers. Therefore, governments might adopt policies aimed at attracting commercial interests and company financing of socially and environmentally sound both, land-based and marine aquaculture development.

Legislation regarding aquaculture development may have to do with land allocation, allocation of water resources, allocation of marine sites, environmental control and protection, and ownership of fish and shellfish grown in national (public) waters.

7.6 Environmental threats, management, restoration, and enhancement

Countries bordering the Persian Gulf and Gulf of Oman have a joint interest of preserving their waters from pollution. It seems that here joint regulation and enforcement would benefit all involved. In particular the semi-enclosed Persian Gulf is ecologically vulnerable, and hence the importance also of environmental protection throughout the Tigris-Euphrates river system flowing into the Gulf. In the Mediterranean where international agreements aimed at protection of that sea have been reached under the umbrella of FAO/GFCM and other international organizations, the main problem consists in the implementation and enforcement of the rules agreed on. The Black Sea remains an open wound that only time and nature, as well as political will, and consolidated national and international efforts can heal.

The world-wide tendency toward integrated coastal management, in which fisheries play an important role, will spread also throughout the Middle East. A special issue is coastal protection. This is largely a national issue and some countries are already well aware of the dangers of environmental degradation of their shores. Bahrain, for example, reported on steps taken to restore mangrove areas, while, on the other hand, some misgivings were voiced regarding the environmental soundness of coastal aquaculture ventures in Iran. In the Eastern Mediterranean and the Gulf of Aqaba concerns have been expressed about possible excess local eutrophication under and in the vicinity of floating cage farms, not to speak of all the urban, industrial and agricultural sewage flowing untreated into the sea.

Enhancement of inland fisheries involves a policy of stocking of lakes and reservoirs and of prevention or treatment of run-off. Turkey, for example, is already using computer programs in an integrated river management pilot study in the Yesilirmak basin. Iran has been constructing hatcheries and releasing fingerlings into reservoirs and natural basins. Israel has been stocking tilapia and grey mullet in Lake Kinneret for the last 40 years.

Another environmental issue is the presence of heavy metals and other poisonous substances in marine food. Chemical testing of fish and shellfish meat, such as those carried out by UAE off Abu Dhabi, and occasionally also in Israel, ought to become a routine in all countries, especially those whose waters are known to be affected by considerable industrial, agricultural, and urban run-off.

7.7 Training

Whatever would be the eventual national and regional policies embraced by the countries of the Middle East in the next century, their implementation would require suitable personnel both academic and otherwise. Long-term planning by the governments ought to ensure that candidates have timely access to both university and short-term training and, where necessary, financial support. Iran, for example, has a Fisheries Research and Training Organization which could serve as a sub-regional centre once certain political problems in the region have been solved. FAO's experience and facilities could then be of particular assistance in this respect.

7.8 International trade

Although at this time most of the fish trade both import and export, is with countries out of the region, all factors are present for further development of intra-regional fish trade and joint ventures. Governments might encourage this objective also by supporting INFOSAMAK as an important tool for providing information and data and assisting traders from the region in locating and establishing contacts with suitable trade partners.

8. CONCLUSIONS

In general, the role of fish as food in the Middle East is relatively minor. Only six of the smaller countries in the region with a total population of about 10 million had a per caput supply exceeding 9 kg/year (FAO, 1993). With rather modest prospects of increasing marine landings of food fish and the most likely sources for maintaining the present per caput food fish supply being aquaculture and imports, fish consumption would be tending toward the better-off sectors of the population. Thus, it does not seem realistic to assign fish a major direct role in the region's food security, apart from that in the subsistence diet of some more remote coastal riverine communities. On the other hand, a number of people, difficult to define but certainly more than a million, will continue to depend on fish harvesting, processing, and marketing, and on giving services to fishers and the fishing industry, as sources of income.

However, there remains the possibility that hard-to-predict techno-economical breakthroughs, such as utilization of the millions of tons of fish (presently reduced worldwide for animal feeds) for low-price product for direct human consumption, their possible replacement as raw material for fishmeal by the mesopelagic myctophids, and possible recovery in the Black Sea, may bring about positive deviations from this forecast.

Although in most countries of the region there are presently little fish farming activities, the anticipated rise in the standard of living and expansion of market for high-value food products may in the future become a stimulus for just such a development. The technologies are available in the region, people can be trained, and seed and feeds acquired or locally produced. It is the increase of demand and purchasing power and hence fish prices that may trigger the launching of commercial ventures in marine and super-intensive freshwater aquaculture especially in the countries of the Arab Peninsula, Iran and Iraq.

Altogether, since the increase of fish supply cannot be expected to match the population growth, less fish per caput will be available, with an increasingly larger share of those fish which are eaten being the more expensive (farmed) fish. Thus, the amount of fish per caput accessible price-wise to low-income sectors of population would be decreasing. The influence of this process on the food security will greatly differ, however, from country to country, because of the wide range of the general state of their economies in the Middle East region.

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NORTH AFRICA

Demand and Supply of Fish and Fish Products in North Africa Perspectives and Implications for Food Security

by

M. Ben Yami, FAO Consultant
based on the work of the FAO Fisheries Department Task Force
Team Leader: G. Everett

CONTENTS

1. REGIONAL CHARACTERISTICS AND ISSUES

1.1 General

The countries and their populations (1990, in millions) covered in this report are, from east to west: Egypt (53), Libya (4.5), Tunisia (8), Algeria (25), and Morocco (25). They take up the whole southern coast of the Mediterranean and, in addition, three quarters of Morocco's 1 750 km coastline borders the Atlantic Ocean, and Egypt has some two thirds of its 2 420 km coastline bordering the Gulf of Suez and the Red Sea proper. Only two of the region's countries (Morocco with landings exceeding 620 000 t and Egypt with over

300 000 t), which between them produce over 80% of the region's fish, were included in the 1993 list of the world's 50 leading fishing nations. There are at least a million people in the region, predominantly small-scale fisherworkers and their immediate families, whose living depends directly on fishing.

1.2 Special features

Average per caput consumption of 7.1 kg (1990) is relatively low for coastal countries and can be explained by the fact that the population of Morocco which produces about half of the region's fish tonnage is less than one fifth of the region's total population. Also, about 0.25 million tonnes (that is about a quarter of the total landings) are either not used as food or exported out of the region. The region's marine fisheries are undertaken predominantly by small-scale operators, the rest consisting of small to medium trawlers and purse seiners not exceeding 27-30 m in length. In Morocco, in addition to the thousands of small and medium-size fishing boats, there are also some 600 large fishing vessels both Moroccan and foreign .

Apart from Egypt, which is producing almost all the freshwater fish of the region, any capture or farming of freshwater fish in inland waters is marginal.

In many areas of the Mediterranean, coastal activities other than fisheries, especially recreational tourism, are considered of higher economic value. This trend, previously a characteristic mainly of the European shores of the Mediterranean, is nowadays expanding also to North Africa.

The combined effect of intensive fishing activities and the progressive enrichment due to run-off of nutrients and other polluting agents on fisheries in the semi-enclosed Mediterranean has accelerated over the last decade. This ongoing change is now a matter of concern to Mediterranean countries, in particular in view of the ecological calamity that recently befell the Black Sea and its fisheries, which appears to have also been triggered by anthropogenic (human caused) effects.

1.3 Resources

General:

The continental shelf of the Southern Mediterranean is less productive than the northern one where many European rivers pour nutrients into the sea. However, like in the north, here too the yields increased during the last decades. The increasing production of what would normally be overfished or fully exploited stocks is now explained by anthropogenic enrichment. However, although a moderate level of enrichment in oligotrophic (poor in nutrients) waters has been shown in many seas as enhancing production of commercial fish. Although, in many areas of the Mediterranean the enrichment has caused a few negative side-effects, and such a situation left uncontrolled, like in the Black Sea, is bound to bring about an environmental calamity.

There are many coastal lakes and lagoons along the Mediterranean coast of, in particular, Tunisia and Egypt, where rich fisheries, some extensive, some semi-culture, have developed.

At present it seems unlikely that any underexploited stocks might have been left in the Mediterranean, with the possible partial exceptions of some small pelagics in its western end and some reportedly underutilized stocks off Libya. There is, however, scope for substantially intensifyng exploitation of small plagic stocks off the southern Atlantic coast of Morocco.

Algeria:

Algeria has a shelf area of over 10 000 km². It borders the Alborean Sea through which surface Atlantic waters enter the Mediterranean importing relatively high production levels yielding 5 t/km²/year. There appears to be an underexploited stock of anchovy (Engraulis sp.) and, perhaps, also of other small pelagics off Algeria. The country lacks permanent rivers and is poor in freshwater resources, hence, there are virtually no inland fisheries or aquaculture.

Morocco:

Morocco commands large fishery resources in its Atlantic Ocean EEZ, where the bulk of its 60 000 km² shelf is located. These include small pelagics, like the clupeids (Sardina pilchardus, Sardinella spp.) estimated at 3 to 8 millions of tonnes and exploited also by foreign fleets, chub mackerel (Scomber japonicus) which is apparently fully exploited, horsemackerel (Trachurus spp.), and anchovy. These are mostly highly variable and difficult to assess straddling stocks, shared in part with Mauritania. Abundance variations are due to unpredictable climatic changes and fishing effort variations. Heavily exploited demersal stocks comprise hake (Merluccius merluccius), breams and porgies (Sparidae), and other finfish, and cephalopods (cuttlefish, octopus, squid). In recent years, the pelagic yields appear to fluctuate at about their maximum level, while the demersal and cephalopod stocks are evidently either fully exploited or overexploited and in need of effort reduction.

In the Mediterranean, Morocco borders the relatively productive waters of the Alborean Sea.

Tunisia:

Tunisia, although the smallest of the region's countries, has a large continental shelf area of 77 300 km² along its 1 300 km long coastline. Much of Tunisia's relatively large yields come from the locally enriched waters of the Gulf of Gabes. There seems to be, however, a distinct downward trend in the landings of tuna-like species (from 6-8 000 t in the late 1980's to about 2 000 t in 1993). Other resources are considered fully or even over-exploited.

Libya:

Libya's shelf area of 50 000 km² lies along its 1 685 km long coastline. The Gulf of Syrta is seasonally a very productive area. The waters off Tripoli and Benghazi are locally enriched by urban runoff. By some estimates, so far unconfirmed by an FAO fishing survey, Libya's marine fishery is under-exploited and yields can be tripled.

Egypt:

Egypt has a wide continental shelf opposite the Nile Delta and the Sinai Peninsula in the Mediterranean with potential trawling grounds of some 28,000 km^2. This is by far the biologically richest shelf area in the Eastern Mediterranean (averaged yields 1.6 $t/km^2/year$), although its productivity decreased after the erection of the Aswan Dam in 1964. Since then, sewage, often discharged via coastal lagoons, and petrolic waste discharged mainly by oil tankers using the Suez Canal, are causing enrichment and/or pollution of coastal waters. The collapse of the 18 000 to 25 000 t/year seasonal sardinella (Sardinella aurita and S. maderensis)) fishery off the Nile delta after 1964, when the Nile's nutrient-rich outflow was severely reduced, brought this fishery down to 550 t in 1966. Since the eighties, however, sardinella and other small pelagic catches in Egypt's Mediterranean waters keep growing and reached about 50% of the pre-Aswan period. Also catches of some demersal fish have grown significantly. These positive phenomena may be a result, at least in part, of anthropogenic enrichment.

In the Red Sea, where roughly half of Egypt's marine fish are harvested, the bulk of the fishery potential lies in the shallow Gulf of Suez which with 8 400 km^2 of fishing grounds produces some 80% of Egypt's Red Sea landings. In that area, there seems to be a major, underutilized stock of anchovy (Stolephorus sp.), as well as some potential to increase the catch of cuttlefish.

1.3.2 Inland fisheries

Egypt is the only country in the region with inland fisheries of major significance. These are based on the river Nile and its tributaries, Lake Nasser, Lale Quarun, Delta lakes, and a large network of irrigation canals and impoundments. These waters are considered fully exploited.

During the last four decades, major anthropogenic changes have occurred in Egypt's inland waters ecosystems. The erection of the Aswan Dam created a major freshwater lake, Lake Nasser, shared by Egypt and Sudan, the Egyptian part having an area of 5 250 km^2. Another major freshwater lake, the 223 km^2 Lake Quarun, becomes more and more saline, its fish fauna changed from freshwater to euryhaline. Substantial urban and agricultural run-off enriched much of the brackish coastal lakes and lagoons where productivity increased during the last few decades. Stocking with marine, euryhaline fishes, such as grey mullets (Mugilidae) and sole (Solea sp.) and other semi-management and management practices has enhanced the total inland waters yield potential of the country. There may be further scope for enhancement of the inland fishery through more stocking and semi-culture and culture methods.

1.4 Main issues

Environment: Further enrichment and other pollution in the Mediterranean may critically affect the fisheries if the marine ecosystem becomes seriously upset.

Fishery management and optimization: these are becoming essential to sustained yields both in the Atlantic Ocean where Morocco commands vast resources, and in the Mediteranean where there is a marked over-capitalizaiton in the fleet.

Inland fisheries and aquaculture: without further enhancement of this mainly Egyptian fishery and further development of aquaculture, overall fish yields would stagnate. On the other hand, unchecked and badly executed enhancement and development may cause locally excessive environmental enrichment.

Utilization of small pelagics: fish which might be used for canning or fresh-frozen products are presently sold for reduction. With changes in the demand-supply-price-production costs system, additional amounts of fish may be supplied for human consumption.

Export markets: these may increasingly draw away locally produced fish out of the region, cause across-the-board price increases and reduce low and medium-price fish supply to the lower income sectors of the population.

Small-scale fisheries: the bulk of the fish are caught by small-scale fishermen operating from open boats and small fishing vessels. Management measures that may allocate coastal resources to larger-scale fishing vessels and foreign fleets may cause serious socio-economic displacements for the fishermen and their families.

Tourism and per caput consumption: accelerating development of the tourist industry in the region is affecting the per caput consumption figures. A tourist can afford and may consume 3-5 times the national per caput average and, thus, bias the statistics. Fish consumption by tourists is a growing phenomenon which, in the future, would tend to reduce the supply of higher priced fish to the local consumer.

Fishing pressure on the resources in the Moroccan EEZ: the present effort exerted by some 600 large fishing vessels is much too high for rational and economically feasible exploitation of the resources. If the present rate of effort continues, major overfishing, in particular of the demersal finfish and some of the cephalopods may occur.

2. DEMAND AND CONSUMPTION

During the last 25 years the per caput consumption more than doubled. Nevertheless, with a present average of 7.1 kg/capita/year, the peoples of the region (with the exception of certain coastal, riverine, and urban areas), do not consume much fish. This is due to a combination of reasons: traditional preference of meat, poor distribution, relatively attractive export and local urban and tourist industry markets, etc. Nonetheless, in most areas, fish are appreciated food items and actual demand is very much influenced by the consumers' purchasing power, and the respective prices of fish, meat, and poultry.

In Egypt, where about half of the region's population lives, increased fish production, some 100 000 t/year of fish imports, and dwindling fish exports indicate a healthy demand and sufficient purchasing power for the fish landed. The share of fish in total animal protein per caput supply increased during the 1961-1990 period which, along with the increase of per caput meat protein supply by 32% during the same period, indicates improvement in the average purchasing power. Eventually, however, the development of per caput fish consumption would depend very much on the availability at a low price of popular farmed fish, such as tilapia (Oreochromis spp.), marketed fresh.

In Libya although the meat protein consumption tripled between 1961 and mid-1970's, it has stagnated since. The fish protein share during the 1961-1990 period fluctuated wildly between 2 and 11% which indicates either central interventions in fish supply (including imports) or a statistical artifact, rather than demand fluctuations.

In Tunisia the total animal protein per caput consumption increased, during the same period, by almost 40% with the share of fish increasing by 50%. This again indicates improvement in standard of living and a healthy demand in spite of the population growth and the resulting chronic unemployment. The country has been subject for some time to economic and political crises which, no doubt, influence both the demand and supply.

In Algeria the total animal protein per caput supply increased during the same period by 32%, but the share of fish stagnates. Whether this indicates a stable, limited demand, or problems of distribution, purchasing power, etc., is not clear.

In Morocco, the rather stable per caput supply of animal protein and fact that the fish share in the total protein supply during the 1961-1990 period more than tripled, indicate a continually increasing demand for fish and fishery products. There appears to be an increasing domestic demand for fishmeal as well as for the low-price mackerel and anchovy.

No doubt, the demand in the region as a whole is going to increase significantly, spurred by population growth, including the growth of the higher income sectors of the population, by tourism development, and by gradual development of inland markets in the more remote areas.

FISH PER CAPUT SUPPLY IN THE REGION
KG/YEAR IN 1990

Country	Fish	Fish share in animal protein, %
Algeria	3.8	7.0
Egypt	8.5	17.5
Libya	2.5	2.7
Morocco	7.5	19.1
Tunisia	9.5	15.3

3. SUPPLY

The total landings in the region exceeded 1.1 million tonnes in 1993, an increase of 82 000 t (7.5%) since 1990. This nominal growth stems mainly from Morocco's increased catches. Other countries of the region had either approximately steady or lesser yields than in 1990.

3.1 The marine fisheries (see table: Landings)

Marine landings in 1993 reached over 888 000 t.

FISH LANDINGS IN THE NORTH AFRICA REGION ('000 t)

Total marine finfish and cephalopoda	869.9
Shrimp and other crustaceans	18.2
Inland waters (capture fisheries)	165.1
Fish farming	66.4
Total for the region	1 108.5

Four fifths of the region's marine yields are landed in Morocco, mostly from its Atlantic waters, the bulk of it being small pelagics (Sardina pilchardus, Sardinella spp., Trachurus sp., and Scomber spp.). Morocco and Egypt between them land 80% of the crustaceans, mainly Penaeid shrimp. Egypt is taking 900 t of bonito (Sarda sarda and Scomberomorus commerson), two thirds in the Mediterranean and one third from the Red Sea.

More than half of Egypt's fisheries yield comes from inland waters, more than a quarter from marine capture fisheries and the rest from fish farming. Raising fish on rice fields has produced substantial yields, and efforts are being made to further this development. Most of the fish farmed are common carp (Cyprinus carpio), tilapia and grey mullets.

Shrimp and crab fisheries which in the 1960's exceeded 7 000 t/year, practically collapsed during the 1970's, their decline being at that time attributed to the reduced supply of nutrients by the Nile. During the 1990's shrimp made a gradual comeback to their former level.

Apart from Egypt, significant inland waters fishery and aquaculture has yet to develop in the area, although some initiatives in marine fish and shell farming were reported from Algeria and Tunisia as well as from Morocco (including 100 t of trout) which has about 500 km^2 of impoundments. Marine farming is advancing in Morocco which is now producing some hundreds of tonnes of gilthead bream Sparus auratus), seabass (Dicentrarchus spp.) and oysters, and in Tunisia with a production of about 1 000 t.

3.2 Utilization

In Egypt, where most fish are consumed fresh, salting has been the traditional way of processing seasonal surplus yields. With the improvement of marketing channels, salting gradually gives way to more modern methods that upgrade the products value, leaving less low-cost product for the local markets.

In Libya with half of its yield being small pelagics, there is some local canning and reduction industry. It imports some 1 300 t of, probably, high quality fish. Its 2 000 t of exports include a large proportion of tunas.

In Tunisia, some three quarters of the catch is consumed fresh, including most of the small pelagics. Still, there is an active canning industry which is processing about one quarter of the total production. The per caput consumption in the coastal areas reaches some 20 kg/year, no doubt partly because of the substantial tourist industry, and is very low in the interior.

Most of Morocco's pelagic catch is either canned or reduced, chiefly for export. Much of the rest, including some 100 000 t of shellfish and cephalopods, is also exported but mainly in fresh-frozen form. Foreign and domestic markets compete over demersal finfish and fishmeal.

3.3 By-catch and discards utilization

On Mediterranean fish markets one may find that even the smallest fish, shellfish, and cephalopods fetch reasonable, and sometimes quite high prices. This reduces the by-catch and discards to non-commercial species jettisoned by trawling vessels. In a few places the discards may come in amounts justifying reduction plants, though here and there they may be utilized as addition to feeds in animals and poultry production or, even as fertilizer. In the Atlantic Ocean trawl fishery, discards are much higher and, as for example when fishing for cephalopods, may reach 50%.

3.4 Supply scenario towards 2010

Substantial increases in marine fish production, apart from those that may stem from fluctuations in the yields of small pelagics, in particular along the southern Atlantic coast of Morocco, are unlikely. Past trends in fully and over-exploited fisheries can hardly indicate the future ones. The most optimistic scenario, therefore, can only anticipate growth coming from aquaculture development both inland and marine.

In Egypt, raising tilapia and some other fish in rice fields may possibly double, bringing the fish yields up by some 25 000 t. Further development of aquaculture in many of its inland and coastal lakes, canals and impoundments may also produce some farmed fish. There is little chance of increasing Egypt's Mediterranean landings, except if further enrichment of coastal waters will enhance the stocks without causing harm. The Red Sea landings may produce some additional tens of thousands of tonnes of anchovy and cuttlefish. Fish supply in Egypt, however, may be negatively and significantly affected if the ongoing erosion of its Mediterranean beaches and of some of the silty sand bars separating the north Nile Delta lagoons from the sea is not stopped. It is almost certain that the productivity of any of these coastal brackish lagoons will decrease as soon as it becomes a bay wide open to the sea.

Libya, by some estimates, has the natural potential to increase its landings by 20 000 t or more. Tunisia can be expected to develop marine farming and integrate still more in the European fish and shellfish market. Morocco and Algeria may develop a small pelagics fishery to tap the reportedly underexploited anchovy stock in the Alborean Sea. Very attractive prices of prime farmed marine fish might trigger introduction and development of offshore cage farming.

To sum up, marine landings may increase by as much as 50 000-100 000 t, inland fishery and aquaculture (mainly in Egypt) by another 50 000 t. Development of marine farming may result in some 20 000-30 000 t of prime fish and shellfish. Altogether, the fishery production in the region may increase by some 10-15%. Any higher increase could be possible only if sufficiently high prices of prime fish and shellfish would spur unprecedented development of intensive and super-intensive aquaculture, and of inshore and open-sea cage farming of marine fish.

4. DISTRIBUTION AND INTERNATIONAL TRADE

Fish and fish products exports from the region are stimulated by prevailing haigh prices and strong demand in the international market for certain products. However, an income effect beneffiting a part of the population and increasing tourism is having a discrete impact on domestic trade of those products.

Fish foreign trade structure varies from country to country.

Egypt has adopted the policy of exporting high-value fish such as, gilthead bream (Sparus auratus) and seabass (Dicentrarchus spp.), mainly to south European markets, while importing mainly low-price fish needed to enhance the animal protein supply to the low-income sectors.

Libya, between 1990 and 1993, increased tenfold its modest fish export, mainly of shellfish.

Tunisia has increased considerably its exports of crustaceans and molluscs. Most of its shellfish yield (mainly the shrimp Penaeus kerathurus and grooved carpet shell Ruditapes decussatus) is exported.

Algeria's foreign trade in fish shows substantial deterioration. In 1990, Algeria imported almost 2 000 t of frozen fish, in 1993 the figure dropped to 45 t.

Morocco, with some US$540 million exports of fresh, frozen, reduced and canned marine products, is one of the world's largest fish exporters. In Morocco, export of finfish halved between 1990 and 1993, while that of shellfish and cephalopods, exported almost exclusively to Japan, increased considerably, indicating the relative strength of the respective foreign markets and the role of shellfish, fetching about US$3 000/t, play in earning foreign currency. At the same time, Morocco exported only some 10% of its 34 000 t fishmeal production. The canning industry keeps developing as do landing and transporting facilities at the ports of Agadir and the new one at Tan Tan, and along the coastline. This includes handling and freezing of fresh fish for national and export markets. Often, the

Mediterranean catch is insufficient for the local demand and fish are bought over from the Atlantic coast in the south of the country.

5. FISH CONSUMPTION 2010

5.1 General

Several factors would influence the future consumption in this partly oil-rich and partly fish-rich, but politically volatile region, situated not far from affluent European fish markets: (i) regional supply which, after every wild stock is fully exploited, can grow only through the development of marine farming; (ii) the internal political situation which can greatly affect the general economic situation in some of the region's countries and in particular potential investments (such as marine farming, intensive aquaculture, processing industry, etc.); (iii) the standard of living of the intermediate (low-to-medium income) sectors of the population; (iv) how the local and export prices would balance against the regional consumers' purchasing power. This balance will determine how much and at what price fish produced in the region remain available to regional consumers.

The population in the region is expected to grow to 173 million, that is by 47% as compared with 1990 (if the present population growth rate of 2.5% drops towards 2010 to 1.9%). If the present trend in per caput consumption persists, the demand in 2010 at, say, 10 kg/year, should reach 1.7 million tonnes of fish. This means an increase of supply by about 70% in 20 years. This sort of demand is not likely to be met from local supply, (see above). Massive importation of cheap fish is not likely, for similar situations will develop also in other regions. Even with considerable development of aquaculture, enhancement of inland fisheries, and increase of imports, the best forecast cannot anticipate per caput consumption exceeding 8 kg/year. Thus, the maximum 2010 consumption figure would be around 1.3-1.4 million tonnes. Major increase of inexpensive fish availability can occur if millions of tonnes of fish, presently utilized both worldwide and in the region for reduction, are directed to human consumption. Such development would require both technological adjustments and new and different marketing opportunities.

Egypt's population is expected to reach 70 million in 2000 and, towards 2010 will probably exceed 80 million. To meet the target of 10 kg per caput set by the Government, 800 000 t of food fish would be needed. For this purpose both the national production and the fish imports would have to double. This is a very tall order in view of the trends in the world in general described above, both in the region and Egypt itself. It seems therefore reasonable to assume that at the present growth rate of its population and with per caput production of US$1 300 (1992) growing to, say, US$2 000, Egypt's per caput consumption will at best remain at its present level of 8-8.5 kg/year with total consumption not exceeding 550 000 t.

5.2 Libya

In Libya, the future fish consumption will depend less on local supply than on the general economic and other developments. If all goes well, with continuing oil revenues, Libya would be able to import the fish needed to satisfy the rather slowly rising per caput demand which may reach 7-8 kg/year.

5.3 Tunisia

In Tunisia an expanding economy and in particular the touristic sector will continue to contribute to increasing demand which could be met by imports, enabling per caput consumption of 11-13 kg/year. In the Tunisian context, however, it is important to remember that this is an average figure intended to indicate not an across-the-board but rather a sectorial increase in fish consumption.

5.4 Algeria

Present trends in this country, influenced by the political situation, preclude predictions as to what may happen after things normalize. But, even the best scenario would not carry the per caput consumption beyond 6-7 kg/year.

5.5 Morocco

Morocco, with its rapidly diversifying economy, including developing fish marketing channels and fish processing capacity, has within the last three decades more than tripled its per caput consumption. This trend, which has been more moderate for some years now, will be further affected by attractive foreign markets and rising prices. Altogether, assuming that development of aquaculture would alleviate this effect and more of the small pelagics would go for direct human consumption, the present 8 kg/year per caput consumption may rise to a level of 10 kg or thereabouts.

6. IMPLICATIONS FOR FOOD SECURITY

The role of fish for food security is understood here as the role fish are or may be playing in supplementing the minimum diet of populations at large and, in particular, of sectors having low purchasing power. In addition, however, fish have a role to play in food security even if fishworkers themselves cannot afford to eat them, as long as the fishery provides them with an income sufficient to buy food.

North African countries, except for some coastal areas and the Nile valley, are arid or semi-arid, with basically well adapted and well-balanced desert and Mediterranean-type agricultural sectors. In the climatically arid Nile valley the steady supply of water and irrigation systems make farming independent of rainfall. Therefore, years of famine, such as plaguing the countries further south, have been very rare in the region's history.

In the coastal and riverine areas both capture fishery and fish farming are widely practised and relatively large local populations presently have access to the less expensive fishery products, fresh or processed. Thus, also in the future, in the above areas fish may play important role for food security. However, any increase of fish supply from the capture fisheries requires a major and successful management effort. Otherwise, any significant addition can only come from aquaculture, whether through intensification of the freshwater fish farming, or through development of marine farming, including offshore cage culture. As such culture methods are feasible only for high-price fish and shellfish, their contribution to the food security of the lower-income groups with deficient animal protein intake would be marginal. At times, amplified production may pull down prices, as it has happened in the past with farmed Norwegian salmon, European trout, and the Mediterranean gilthead seabream, but never to a level accessible to low-income groups in the region. Only a major technological breakthrough, such as production of low-cost feeds, generation of cheap energy, the above mentioned re-directing of fish from reduction to food fish market, or considerable socio-economic advancement can improve the prospects for more equitable fish supply.

There is a fair chance for such an advancement. The North African region with its huge mineral and fish, as well as human resources, and great potential for further development of the tourist industry could become the scene of rising standards of living if its peoples manage to maintain internal and international peace, an attractive economic and cultural atmosphere, and curb the runaway population growth.

However, as things appear presently, neither the regional nor the global fish supply can catch up with the population growth and fish prices will rise. Therefore, fish consumption among the coastal and riverine fishing communities, rural folks in the interior, and other low-income groups will, most probably, gradually decline, with the more affluent sectors taking an increasing share of the fish production.

Egypt with its dense and fast growing population concentrated along the Nile Valley and in the Delta region, is in many respects different from the other countries of the region. So far it has managed to maintain its average per caput fish supply. However, lacking data on the internal distribution of fish consumption, predictions as to the future role of fish in the national food security would be sheer speculation. In Libya, which is importing some two thirds of its food, food security depends rather on its oil and gas revenues than on own production. Production growth which might come from commercial fish farming would certainly be oriented towards the more affluent market, and would not affect directly the food security situation. In Algeria, Tunisia and Morocco, food security among the coastal, fishing populations, will depend mainly on having undisturbed access to their traditional resources.

Throughout the region, fisheries and associated services and industries will continue to play a major role as an employer of millions, and thus, contribute indirectly to food security.

7. POSSIBLE POLICY INTERVENTIONS

7.1 Policy implications with respect to resource exploitation and sustainable fish food supply

Marine fisheries of the region will not be able to sustain for long their present yields without rational, well designed and well executed fisheries and environmental management. This, because growing demand and rising prices may generate excessive fishing effort and a consequent overfishing on one hand, and continuing pollution on the other may harm the whole fishery ecosystemr.

The FAO 1984 World Conference on Fisheries Management and Development called governments to review individually and jointly their present strategies and policies. This call is even more relevant in the Mediterranean than in some other world seas and oceans. The Mediterranean is well researched and ample scientific data and information are available. Research institutes and individual investigators on one hand, and international organizations and societies that focus on the protection of its marine environment and management of its fisheries, on the other, are active. There is thus no lack of awareness of the environmental issues associated with fisheries management and development, nor lack of the knowledge essential for formulation and implementation of related regulation. What is needed, is political will, enforcement means, a fuller participation of the region's countries in such organizations as the General Fisheries Commission for the Mediterranean (GFCM) and the Fishery Committee for the Eastern Central Atlantic (CECAF), adoption of joint management measures, and formulation of steps specific for the individual countries.

The intensive anthropogenic environmental processes occurring in the Mediterranean, combined with climatic variations, are affecting fish stocks and fishing success. This is a very dynamic ecosystem in which steady-state models in population dynamics by themselves are most probably inadequate for fisheries management purpose, for factors other than fishing pressure greatly influence the state of the resource. Hence, to assure reliable stock, yield, and allowable effort assessments in the region, an ongoing programme of internationally concerted ecological monitoring and evaluation is indispensable. The resulting measures, which should be jointly formulated by the countries of the North African region together with the other countries bordering the Mediterranean, ought to reconcile the fisheries management steps with ecological, biological, social and economic criteria.

7.2 Allocation of stocks and distribution of benefits

Attention must be paid to areas with excessive fishing pressure, especially with respect to trawling, and to conflicts between various sectors fishing the same grounds and/or the same stocks. Normally more people can make their living in small-scale fisheries while producing the same yields out of the same resource, than in larger-scale operations. Projected improvements in marketing channels and in the design and technology applied in the smaller boats should increase the delivery of fresh fish by small-scale fishery operators. Thus, to assure both sustained fish supply and equitable distribution of benefits over the region's coastal areas and to maintain the role of the capture fisheries as a massive employer, fishery allocation policies should aim at directing the larger-scale operations to only those stocks and grounds which the local, small-scale fishers are unable to exploit feasibly.

7.3 Development of marketing channels and fish processing industry

In view of the fact that increase in demand is expected to exceed that of supply, upgrading of the catch value (for example, canning sardines instead of reducing them to fishmeal) should be a matter of policy. This may call for encouraging investments in various sorts of fish handling and processing facilities which will lead to the final processing of fisheries products destined for export being done in the countries where the fish were captured.

7.4 Legislation

Decisive legislative steps are going to be crucial for sustainable exploitation of the region's marine resources. The demersal stocks cannot withstand for long constantly increasing pressures driven by the climbing prices on the Mediterranean markets for such highly valued fish as, e.g., red mullets (Mullidae), breams and porgies (Sparidae), groupers and basses (Serranidae), and soles (Solea sp.).

Some countries have taken already various management steps. Morocco, for example, proclaimed a closed season for the cephalopod fishery in its Atlantic waters while Algeria declared a summer closure of trawling within a 3-miles wide coastal strip.

Nonetheless, the present state of fisheries legislation ought to be revised throughout the region with special attention given to regulating trawl fisheries, through determination of minimum codend mesh size, also limiting fishing power (limiting the number and horsepower of trawlers, seasonal closures, etc.). The region's countries would benefit also in this respect from fuller participation in the deliberations and activities of the GFCM and the Mediterranean Regional Aquaculture Programme (MEDRAP).

7.5 Development issues

7.5.1 Small-scale (artisanal) fisheries:

This sector no doubt deserves the special attention of governments, not so much for reasons of potential production increases, but rather for its socio-economic role as the most important production sector and employer in the marine and inland fisheries and as a massive fish consuming population. However, the small-scale sector is often deprived of modern credit and service facilities thus reducing its potential share in the benefits derived from the resources. Provision of such facilities ought to be an important part of fisheries policies of the region's countries.

In Egypt, with over 80 000 members strong (1992) fisheries cooperatives, and in Libya there is an active policy of promoting the establishment of fishing cooperatives.

7.5.2 Private-sector investments

Long-standing, worldwide experience shows that governments are not good fishers. Most statal and para-statal enterprises have proved eventually to be unprofitable. Fishing is a highly individualistic profession, hence amenable to private enterprise and and initiative and to the bonuses it brings with success. Fishers cooperatives can function well only on a voluntary basis and only if they bring their members perceived benefits. Appropriate government policies may both encourage private investments and direct them to the desired locations, resources, and development objectives.

Egypt, for example, adopted a policy of encouraging private investments in large fishing vessels with a view to developing its distant water fisheries, while Morocco has been encouraging private investments in fish processing plants and other sectors of its huge fishery industry.

7.5.2 Inland capture fisheries

Policies regarding this sector would be specific to the particular situation in each country. Egyptian inland capture fisheries produce major yields and their enhancement has become a matter of policy. Also Algeria, Tunisia and Morocco have reported taking various measures in this direction including stocking of lakes and reservoirs.

7.5.3 Marine farming

Demersal fish, crustacean and mollusc prices on the Mediterranean European markets are among the highest in the world. This demand caused the expansion of cage farming all over the northern Mediterranean. Growing fish in floating cages in sites sheltered from weather requires less investment capital and less operational costs than in ponds, or where cage farms must be established offshore. On the other hand, open-sea fish farms have a less harmful effect on the immediate environment. Governments may adopt policies of various degrees of promotion and encouragement of marine farming development, bearing in mind the dearth of sheltered areas in much of their coastal waters and thus its physical and financial riskiness. Special legislation may be needed for site allocations and ownership rights on cage raised fish, and to assure environmental protection, especially in sheltered and shallow waters. This is because aquaculture of any sort increases nutrient load and thus affects the environment, including any neighbouring fishery as well as the farming operations themselves. The related policies, therefore, must provide for a legal/regulatory basis needed to prevent related environmental damage.

7.5.4 Freshwater aquaculture

Formulation of policies related to the development of aquaculture has become an issue of growing importance in general and in the North Africa region where additional production is unlikely to come from the capture fishery, in particular. Economically, socially, and ecologically sound development of fish farming operations ought thus to be promoted by those governments that have not yet done so. In particular and where feasible, polyculture systems requiring low-inputs and integrated with animal husbandry and using only cheap vegetable feeds should be promoted and supported by state services (e.g., veterinary, seed production, training and extension, etc.).

A high priority given to aquaculture was reported from Egypt, Tunisia and Algeria. Egypt is expected to continue developing its aquaculture through the promotion of freshwater and marine operations and hatcheries producing fish seed, by encouraging rice farmers to breed fish in their fields, and by creating access to water canals and drains for cage farming by private enterprise. Algeria instituted the policy of providing services and promoting private enterprise in aquaculture in its freshwater lakes and impoundments, and in its one well-protected marine area, the coastal Melah Lake.

7.6 Environmental threats, restoration and enhancement

Countries bordering the Mediterranean have a joint interest in protecting their waters from pollution, in particular from non-biodegradable contaminants. One danger is the presence of heavy metals and other poisonous substances in marine food. Chemical testing of fish and shellfish meat ought to become routine in all countries, especially those whose waters are known to be affected by considerable industrial, agricultural, and urban run-off. Another environmental issue is the concern expressed about excessive local eutrophication in the vicinity of floating cage farms. In the semi-enclosed Mediterranean more than local and national interests are involved, so that jointly discussed regulation and enforcement would benefit everyone.

The world-wide tendency toward integrated coastal management will also spread to the Mediterranean. A special issue is coastal protection which, however, would usually remain a national issue. Some countries, in particular Egypt where the environmental degradation of its shores threatens its delta lake fisheries, are already well aware of the problem. Egypt is planning to pay greater attention to environmental protection, for example, by periodical dredging to clear silted lagoon inlets.

In the Mediterranean, several international agreements aimed at environmental protection and fisheries management have been reached or are being negotiated under the umbrella of FAO/GFCM and other international organizations. National policies should include participation in the discussions and implementation and enforcement of the rules already agreed on.

8. CONCLUSIONS

Present trends (e.g.: increased fish resources explotitaiton, limited domestic supply, increase in population) will not have the same impact on the counries of the region. However, bearing this in mind, those trends to prevail, in the future the gap between fish supply and demand, probably attenuated by circumstamcial increases in lower value fish imports, will, in general, widen and the contribution of fish to food supply will diminish substantially as well as its importance to food security.

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SOUTH AMERICA, CENTRAL AMERICA AND THE CARIBBEAN

Demand and Supply of Fish and Fish Products in South America, Central America and the Caribbean Perspectives and Implications for Food Security

by

FAO Fisheries Department Task Force
Team Leader: K. Leendertse

CONTENTS

1. INTRODUCTION

1.1 Background

The present document has been prepared to provide background information on fish as food demand and supply in the South America and Central America/Caribbean regions. This information should serve as regional input to the Main Technical Conference Document for the Conference on Sustainable Contribution of Fish to Food Security, to be held in Kyoto, Japan, from 4 to 9 December 1995.

To this purpose, the paper will examine regional perspectives for demand and supply of fish and fish products, identify regional characteristics and issues that would contribute to a strategy for increased supply of fish and fish products in order to meet demand, and identify possible interventions open to governments and institutions in the regional context.

1.2 Regional characteristics and issues

The fisheries in Latin America and the Caribbean have not developed homogeneously throughout the region. Traditional pelagic or shrimp fisheries may dominate in some subregions and demersal fisheries in others. The characteristics of the aquatic resources as well as historical, economic, social and political factors condition the structure of the fishery sector, although in general, the Latin American fisheries are export oriented, with the exception of some countries, notably in the Caribbean. The capital and technology intensive, modern, export industry coexists with a weak market for small scale fisheries that, however, have an important social and economic impact.

Latin America and the Caribbean contribute approximately 17 percent to total world captures, mainly from Peru, Chile, and Mexico. Annual growth has been around 6 percent over the last decade. The composition of the captures in volume is dominated by small pelagic species, that are mainly destined for the fish meal industry. Demersal species, second in quantity, are mainly intended for fresh consumption or freezing, and exports. Shrimp and lobster fisheries are commercially the most important fisheries and shrimp culture is developing relatively rapidly in some parts of the region. The fisheries sector in the region contributes to foreign exchange earnings, employment, food supply to internal markets, and development of coastal regions. For millions of people, fisheries constitutes a unique and only way of living. The most significant importance of the sector is found in its contribution to foreign exchange earnings in many countries in the region. Marine capture fishery is by far the most important subsector, whereby both industrial and artisanal exploitation have a significant role. The inland fisheries are characterized by small scale activities that have importance in social and economic terms in certain countries. Although certainly with growth potentials, aquaculture contributes only a minor part to total production in the region; estimates for 1992 amount to 1.86 percent.

The state of the industrial and semi-industrial fishing fleet in the region is rather poor. In general, these fishing vessels are old and a significant percentage of the fleet is reaching the end of its lifetime. In some countries, the industry is confronted with serious problems and used vessels are purchased from industrialized countries.

In some cases, these boats were not adequate for fisheries in the region. In almost all cases, these vessels are characterized by high operational and maintenance costs, which has its influence on productivity and profitability of the operations. On the other hand, renewal of the fleet could increase drastically the effective capacity to the detriment of stocks and overall catch and could also lead to over-investment.

Adequate port facilities for industrial fishing do exist in the region. Organization of port activities, however, is generally lacking. In most of the countries, artisanal fisheries take place in total absence of infrastructure and services.

Specific issues in Latin American and Caribbean fisheries of importance to the role of fish in food security were identified as:

- small pelagic and economic problems: small pelagic species are generally caught for fish meal production. However, the industry now finds itself at a turning point, with an old fishing fleet where threatening overcapacity and overinvestments may jeopardize new investments. Promotion of small pelagic for human consumption needs product development and marketing;

- intraregional trade: lack of transport and high tariffs, poor infrastructure and trade barriers, are characteristics that hinder development of intraregional trade;

- aquaculture potentials and institutional framework: although endowed with favourable conditions for aquaculture practices, the subsector has only marginal importance in economies in the region;

- by-catch and developing of strategies for its utilization for human consumption: fish by-catch could contribute considerably to food resources if efficiently recovered, processed and marketed;

- unreliable statistics: inland fishery resources may hold potentials for increase. However, lack of reliable statistics hampers sustainable development efforts of these fisheries;

- management practices: fishery administrations being reduced in size, their tasks and sustainable management practices need urgently to be reviewed.

The region has been divided into two country groups (subregions), that are composed as follows:

- South America: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Malvinas/Falkland Islands, French Guyana, Guyana, Paraguay, Peru, Surinam, Uruguay, and Venezuela;

- Central America and the Caribbean: Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Cayman Islands, Costa Rica, Cuba, Dominicana, Dominican Republic, El Salvador, Grenada, Guadeloupe, Guatemala, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Netherlands Antilles, Nicaragua, Panama, Puerto Rico, St Kitts and Nevis, Saint Lucia, Saint Vincent, Trinidad and Tobago, Turks and Caicos Islands, British Virgin Islands, and US Virgin Islands.

It should be noted that this division of the region would not always be consistent with existing (sub-)regions (e.g. Latin America and the Caribbean) but that it was made for analysis purposes. As will follow from this paper, Latin America as well as Central America will be characterized by high production - low consumption while the opposite will be the case for the Caribbean.

2. DEMAND AND CONSUMPTION

2.1 Fish for food from 1970 to 1990

Apparent consumption (fish for food supply) consists of production - non-food uses - exports + imports +/- stock changes (Laureti, 1992). The *per caput* supply in Latin America and the Caribbean in 1990 was 8.99 kgs. This figure is well below the world's average of 13.32 kgs. Also, for both groups the share of fish protein in total annual animal protein supply is lower than for the world as a whole. For Latin America and the Caribbean as a whole, the share of fish protein amounts to 8.12 percent of animal protein against 16.1 percent for the world (Figure 1).

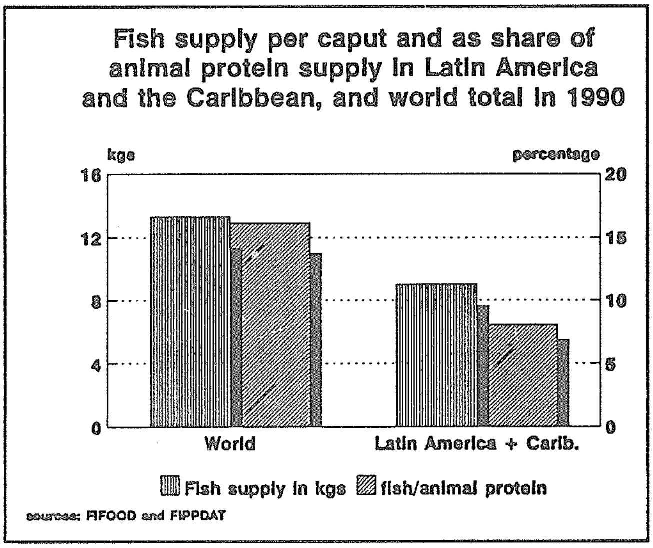

Figure 1

These figures mask significant differences between countries or even regions within a country. Table 1 shows the per caput supply and the share of fish in animal protein supply for the countries in the two groups.

Table 1: *Per caput* supply in kgs and fish as share of animal protein supply in South America and Central America/Caribbean in 1990

Country	per caput supply (kgs)	fish/animal protein (%)
South America		
Argentina	6.1	2.7
Bolivia	1.2	2
Brazil	5.7	5.9
Chile	25.5	19.4
Colombia	2.4	2.7
Ecuador	8.5	11.8
Malvinas/Falkland Islands	12.5	...
French Guyana	39.3	21.4
Guyana	41.6	42.4
Paraguay	3	3.3
Peru	29.3	31.8
Surinam	6.7	9.2
Uruguay	5.2	2.9
Venezuela	14.9	15.8
Central America		
Belize	6.1	5.1
Costa Rica	5.2	7
El Salvador	1.5	3
Guatemala	0.8	3
Honduras	0.7	1.3
Mexico	11.4	8.8
Nicaragua	0.4	0.9
Panama	17.3	16.9
Caribbean		
Antigua-Barbuda	43.9	20.8
Aruba	41	...
Bahamas	19.5	11.5
Barbados	29.7	16
Cayman Islands	26.2	...
Cuba	18.5	14.3
Dominicana	24.7	15.7
Dominican Republic	6.3	9.6
Grenada	26.7	27.8
Guadeloupe	42.2	27
Haiti	4.2	15.3
Jamaica	16.6	17.8
Martinique	40.9	25.2
Montserrat	10.5	3.5
Netherlands Antilles	28.8	15.1
Puerto Rico	0.6	0.6
St Kitts and Nevis	45.2	28.1
Saint Lucia	20.7	14.9
Saint Vincent	12.1	11.4
Trinidad and Tobago	4.9	6.2
Turks and Caicos Islands	46.8	...
Virgin Islands, British	86.1	65
Virgin Islands, US	7.5	...

... = information not available
Source: FIFOOD

The *per caput* supply in South America would range between 1.2 kgs per year in Bolivia and 41.6 kgs in Guyana. In Central America, the *per caput supply is extremely low and* ranges between 0.4 kgs in Nicaragua and 17.3 kgs in Panama. In most of the islands of the Caribbean, apparent fish consumption is over 20 kgs *per caput* and ranges between 0.6 kgs in Puerto Rico and 86.1 kgs in the British Virgin Islands. Access to resources may be an important factor in fish supply. A case study in Itacoatiara, Amazonas, in 1981 estimated the daily supply of fish at 104 grams, or about 38 kgs *per caput* on a yearly basis, whereas the apparent consumption *per caput* in Brazil as a whole in 1990 was estimated at 5.7 kgs.

The same information is provided by the tables in appendix 1, whereby these figures are placed against the global context and which also provides information on the share of fish in total protein supply. The tables show that *per caput* fish supplies in Caribbean island States generally are significantly higher than in Central American and South American continental States, and even most of them appear to have higher supplies than the world average of 13.32 kgs. However, the figures for Caribbean islands may be flattered because of the influence of tourism. Especially in islands with low population figures, the impact of high influxes of tourists on the average fish consumption will be very high. For example, the consumption of fish by the more than 560 000 tourist arrivals in Aruba in 1990 will have a significant impact on the *per caput* supply of 41 kgs, if the total supply is divided only by the total population of 60 000. In British Virgin Islands, the country with the highest *per caput* supply in the region, tourist arrivals in 1990 amounted to 303 000, of which 160 000 overnight stays, against a total population of 13 000.

Also in the Latin America and Caribbean regions, fish is important as a source of protein. The relative importance of fish in people's diets is shown in table 1 in appendix 1. It shows, for example, that in Peru fish contributes 31.8 percent to animal protein supply and 13.5 percent to total protein supply but in neighbouring Colombia these percentages are only 2.7 and 1.2 respectively. In the British Virgin Islands, fish contributes 65 percent to animal protein supply, whereas in Puerto Rico it constitutes only 0.6 percent of animal protein intake. Generally, the share of fish in both animal and total protein supply is higher in Caribbean island States, which, besides influence of tourism, could be related to a more important fish eating tradition as compared to mainland countries.

During the last two decades, the world's *per caput* supply increased from 11.33 kgs in 1970 to 13.32 kgs in 1990. Also in South and Central America, apparent consumption grew during the same period. In South America, average apparent consumption in 1970 was 7.2 kgs in 1970 and increased to 8.7 kgs in 1990. In Central America, *per caput* fish for food supply grew from a low 3.7 kgs in 1970 to 9.2 kgs in 1990, while it peaked in 1981 with 10.6 kgs. This means an increase of *per caput* fish for food supply in South America of 21 percent and of as much as 149 percent in Central America. In the Caribbean, apparent consumption in 1990 was back at 11.4 kgs, the same level as in 1970, with a highest consumption in 1985. How this relates to apparent consumption in the world as a whole is shown in figure 2. The development of fish supply in South America followed the world trend and peaked in 1979, but we saw that the average apparent consumption in this region was generally lower than in the world as a whole. Fish for food supply in Central America has increased more rapidly than world consumption, whereas fish supply in the Caribbean lacked behind world developments.

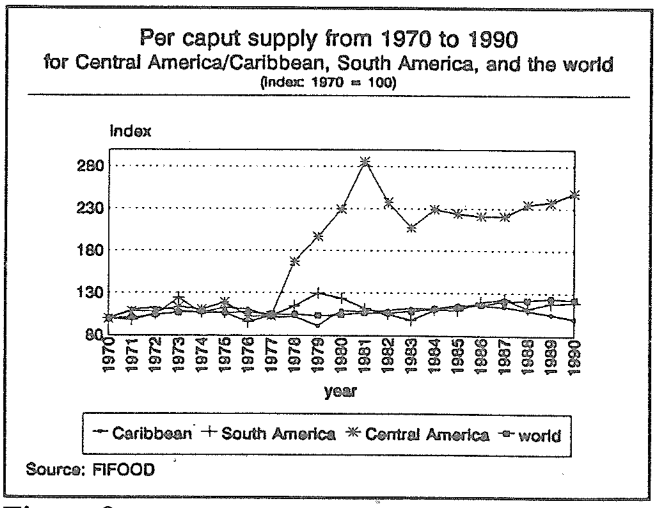

Figure 2

2.2 Factors influencing demand

Factors influencing demand have been identified as: population growth; economic growth; prices and alternatives; fish-eating traditions; competition of non-food uses; urbanization rate; etc. For the South American, Central American and Caribbean subregions, these characteristics are as follows:

Population growth: in Central America and the Caribbean, population increased between 1970 and 1990 with 58 percent from 98 million to 155 million people. During the same period, population in South America grew from 191 million to 294 million people, thus 54 percent.

Economic growth: average GDP *per caput* at 1980 US dollar constant prices, increased in Central America/Caribbean from $ 1 615 in 1970 to $ 2 115 in 1990; average GDP peaked in 1981 with $ 2 357, the year in which *per caput* fish supply also peaked to almost 11 kgs. In South America, average GDP *per caput* grew from $ 1 765 in 1970 to $ 2 110 in 1990; the highest score was recorded in 1980, while *per caput* supply peaked in 1979. It is noteworthy, that GDP growth in South America was slower than in Central America/Caribbean, while in the latter also *per caput* fish supply grew more rapidly.

Table 2: *Per caput* GDP and fish supply in 1970 and 1990

		Central America/Caribbean	South America
1970	GDP/*caput* ($) Fish/*caput* (kgs)	1 615 5.7	1 765 7.2
1990	GDP/*caput* ($) Fish/*caput* (kgs)	2 115 9.7	2 110 8.7

Prices and alternatives: the above showed the importance of disposable consumer incomes for consumption of fish and fish products. Also important are prices of these products and competition from alternative protein suppliers, such as white meat and diary products. In the region, especially chicken has proven to be very competitive against fish products. Several studies in different countries in the region on components of household expenditures, such as for fish, meat and seafood, have shown that competitive pricing is a determining factor. Compared to alternatives meat and chicken, fish prices are relatively high and therefore disadvantageous for fish consumption. The price of fish is affected by variables such as seasonality, marketing conditions, distribution, infrastructure, costs of inputs (particularly fuel), and domestic markets supply. Especially the last factor shows a certain leanness in the region as prime products are exported and the bulk of small pelagic harvests are directed to fish meal industries. Nevertheless, in both country groups the *per caput* consumption of fish and fish products compared to the main competitor, meat (including chicken), have shown the same patterns between 1970 and 1990, mostly affected by patterns in economic growth.

Tradition: cultural and traditional values attributed to food products often dominate over nutritional value in consumption patterns. In Latin America, people are more used to eating non-fish sources of protein such as red meat in countries like Argentine and Uruguay, while in countries in Central America such as Honduras consumers have a preference for rice and beans. Islands in the Caribbean, on the other hand, have a more distinct fish-eating tradition. Regarding fish products, consumers in the region have a preference for fresh fish, including fresh-refrigerated or fresh-cooled. Second in preference, frozen fish products are available in some countries in South America. Canned products may be in demand in distant markets and because they are easy to preserve and consume. In some countries, fish is traditionally consumed in a processed form (cured, dried and salted). During Lent (Holy Week), the whole continent registers a peak demand for fish products. This is the only time when all social sectors of the population without distinction consume fish and seafood. Another important cultural factor is taboos on fish consumption; iced fish is not eaten in the Caribbean and people in the Amazon do not consume scaleless fish (e.g. catfish).

Fish for food v fish meal: more than 75 percent of total production in 1990 in South America and 27 percent in Central America and the Caribbean was directed to non-food uses, i.e fish meal industry. An important foreign exchange earner, the fish meal industry is the main competitor for fish for human consumption. However, although 85 percent of the total Chilean production in 1990 went to non-food uses, it seems that salmon exports brought more foreign exchange to the country than fish meal exports.

Urbanization rate: access to main markets is considered as an important factor for fish consumption. Urban agglomerations, with fish markets and fish and seafood restaurants provide important outlets and cater for large populations. Urbanization rate in South America went up from 60 percent in 1970 to 75 percent in 1990. In Central America/Caribbean, the urban population made up for 51.9 percent of total population in 1970 and 64.1 percent in 1990. It is noteworthy that, contrary to GDP *per caput*, a stable urbanization growth of around 0.6 percent per year in Central America/Caribbean and around 1 percent per year in South America, did not affect significantly consumption patterns. It may also be argued that physical access to resources would have more influence on people's consumption.

Social conflicts: important social disturbances, such as civil wars, have a significant impact on supply and therefore on fish consumption. In those cases, exploitation may become difficult and local markets often inaccessible. For example, Nicaragua has seen a dramatic decline in production from more than 10 000 metric tonnes in 1978 to an ever low 2 465 metric tonnes in 1986, while imports had dropped to zero since 1985.

2.3 Demand projections for 2010

It is assumed that population growth and economic growth are the predominant factors for future demand projections. On the basis of an expected GDP *per caput* increase for the period 1990 to 2010, it is assumed that *per caput* fish consumption in Central America/Caribbean could reach 11 kgs in 2010. A population increase from 154 873 000 in 1990 to 222 257 000 people in 2010 would then lead to a total demand for fish for human consumption of 2 445 000 metric tonnes. Given the apparent consumption in 1990 of 1 446 000 metric tonnes, this level of demand would need an increase of supply with roughly 1 000 000 metric tons.

In South America, GDP *per caput* is expected to reach $ 3 300 in 2010, and fish demand is estimated to grow to 10.5 kgs *per caput*. With a population increase from 294 115 000 in 1990 to 398 278 000 in 2010, total fish demand would grow to 4 182 000 metric tons. In 1990, the apparent consumption was 2 687 000 metric tonnes and therefore an increased supply of 1 495 000 metric tonnes would be needed to meet demand.

3. SUPPLY

In the region, especially in South America, the sector is characterized by production for non-food uses (i.e. fish meal) and export of prime fish commodities. In 1990, total production in Latin America and the Caribbean amounted to 16.3 million metric tonnes. However, due to 11.3 million metric tonnes for non-food uses and a negative trade balance of 850 000 metric tonnes, apparent consumption reached only 4.15 million metric tonnes.

3.1 Marine capture fisheries

Marine fisheries in Central America and the Caribbean takes place in two major fishing areas: the Western Central Atlantic and the Eastern Central Pacific. In the **Western Central Atlantic**, landings have decreased from 2.6 million metric tonnes in 1984 to 1.7 million metric tonnes in 1992.

Most of this decline can be attributed to US fisheries. Stocks in US waters are likely to be fully exploited and fishing efforts are decreasing. US fisheries contributed up to 60 percent of the area's landings in 1984 but only 35 percent in 1992. Landings in the Central America and Caribbean area have been relatively stable during the last decade. There may be some under-utilized resources but their estimated potential yield in the near future appears to be small, with the exception of cephalopods. The potential for squid fisheries in the eastern Caribbean is almost undeveloped. Furthermore, there may be increase in landings of small pelagic in certain areas but yields would be insignificant.

In the **Eastern Central Pacific**, the total production of the area has fluctuated between 1.5 and 1.8 million tonnes per year but was down to 1.3 million in 1992. The catches are dominated by small pelagic species. Fisheries are strongly influenced by the California Current System and environmental changes such as "El Niño". The potential of certain stocks is therefore particularly difficult to predict since abundance varies from one year to another. Stocks that are lightly exploited include the Pelagic jack mackerel and North Pacific anchovy. In 1987, a total biomass of small pelagic species of 1 million tonnes was confirmed. Also for certain demersal species there may be potential for development; the biomass has been estimated at 250 000 metric tonnes. Squid and crab are two other lightly exploited stocks.

Marine fisheries in South America are effected in three statistical areas: the Southwest Atlantic, the Southern Oceans, and the Southeast Pacific. Total catches in the **Southwest Atlantic** increased from less than one million tonnes in the mid-1970s to 2.4 million tonnes in 1987, after which they declined and are now relatively stable between 2 and 2.2 million tonnes. Variances in yearly production are mostly due to fluctuations in the catches of squid, hakes, other demersal species in the Patagonia and Slope areas, and of sardinella off Brazil. Apart from sardinella, other clupeoid and small pelagic are lightly fished in the region. There are indications that the stock of anchoveta off southern Brazil, Uruguay and northern Argentina could tolerate increased fishing pressure, but up to now further development of this fishery has been hampered mostly by economic limitations. Weakfish in northern Brazil may have possibilities for further expansion. Stocks of short-fin squid and common squid are considered lightly exploited in the northern coastal areas. However, the overall abundance of these stocks is reported to be highly variable due to natural causes.

In the **Southern Oceans**, an important development has been the reduction in krill harvests due to a reduction in Russian and Ukrainian fishing effort. Krill constituted since the late eighties around 80 to 90 percent of total production and a decline of krill production since 1989 had therefore serious consequences for total production. Total production grew since the mid-1970s from 188 000 tonnes to 499 000 million tonnes in 1989, after which catches fell to 284 000 tonnes in 1991, with a new rise to 356 000 tonnes in 1992. On the whole, the fish resources in the area are considered very limited and would not sustain higher catch rates.

In the **Southeast Pacific**, total landings seem to be levelling off at around 14 million tonnes per year since 1990, after an increasing trend that started in 1983-84. Current catches levels are now similar to the pre-1972 collapse of the anchoveta fisheries, but the species composition is quite different. Major changes seem to be occurring particularly with respect to pelagic stocks. The area was affected a mild "El Niño" phenomenon in 1991 and 1992, that to some extent has been responsible for a slight decrease in catches of some species. The central and southern part of the area is dominated by small pelagic fisheries with approximately 90 percent of total landings. In the north, the main inshore fisheries are for shrimp and offshore for tuna. Pelagic stocks have exhibited large variability in abundance, which is also the case for squids. The latter were considered until recent years to be unexploited but since 1990 landings have increased from 21 000 metric tonnes to some 120-130 000 metric tonnes in 1991 and 1992. Considering the variability of the stock, its long-term potential is difficult to predict.

3.2 Inland capture fisheries

In Central America and the Caribbean, fresh water fisheries is rather insignificant. 94 percent of the total fresh water capture fisheries production in the subregion stems from Mexico. Most Caribbean islands do not have any inland waters of importance and consequently inland fisheries is virtually non-existent. Total production in 1990 in this subregion amounted to 197 500 metric tonnes.

In South America, the richest freshwater fish fauna in the world can be found. However, relatively few species are exploited and, at least theoretically, there is a potential for increased production through the development of fisheries of new species. Exploitation of fresh waters is virtually all at an artisanal level and catches are marketed locally. Today, rivers like the Parana and the Paraguay are hardly exploited for food fish production and the Amazon and Orinoco systems still seem under-exploited. The total potential of the Amazon and its tributaries is estimated at some 500 000 metric tonnes. On the other hand, there are areas which are over-exploited, including certain parts of the Amazon and Orinoco as well as the Magdalena and parts of Negro. It should be remembered that there may be a considerable production from subsistence and recreational fisheries which may not be recorded. Furthermore, increasing pollution of the water systems may have a detrimental effect on food fish potentials. In 1990, the total production of inland capture fisheries in South America amounted to 307 000 metric tonnes.

3.3 Aquaculture

Although aquaculture production in the Latin America and Caribbean region has shown a significant increase of around 15 percent yearly in recent years and total production went up from 117 000 metric tonnes in 1984 to 325 000 metric tonnes in 1992, its contribution to total fish production is limited to a mere 1.86 percent in 1992. The average annual production increase over the same period was around 14 percent. Could this growth figure be maintained during the next 15 years, the actual aquaculture production in 2010 would amount to roughly 3.3 million metric tonnes.

Most of the aquaculture production originates from very few countries. In 1992, 36 percent of total was produced in Ecuador and 21 percent in Chile, while only Mexico, Brazil, Colombia and Cuba produced more than 20 000 metric tonnes. However, during the period 1982-92, aquaculture took off in many Latin American countries. It is expected that appropriate marketing infrastructure, sufficient diffusion of technologies, adoption of adequate policies and an appropriate institutional setting may boost the subsector as a whole.

3.4 Less waste

Post harvest losses are made as soon as fish is harvested. In that sense, discards can be considered post harvest losses. It is important to consider the distinction between physical and economic post harvest losses. Economic losses are felt when catch value goes down, e.g. because of lack of means of conservation, insects, breakage, etc.. Physical losses occur when catches or parts of catches have to be dismissed, e.g. because of poor processing. In industrial fishing, economic losses are generally low, whereas physical losses may be as high as 10 percent.

In artisanal fishing, physical losses are generally low (estimated in the range of 5 percent) while economic losses may be considerable. Loss of weight through processing is often felt a post harvest loss but it needs to be stressed that lost weight often consists of only water.

Utilization of fish by-catch and discards as well as improved processing practices could contribute to fish food supply. By-catches are especially important in volume and percentage of total catch in shrimp trawling. Contrary to Africa and some areas of Asia, where considerable portions of the by-catch is retained by artisanal fishermen, in Latin America and the Caribbean a very large share of the by-catch is reported as being discarded. Depending on the area, shrimp to by-catch ratios may differ considerably. Total world discard weight has been estimated at 27 million metric tonnes, In Latin America and Caribbean statistical marine areas, including the Atlantic and Pacific Antarctics, the total discard was estimated at 5 808 093 metric tonnes or 21.5 percent of total world discards. Total estimated by-catch of shrimp fisheries was estimated in Latin America and Caribbean statistical areas at 2 358 731 metric tonnes or 21 percent of world total, of which 2 276 159 metric tonnes (96 percent) was discarded.

3.5 Supply scenario 2010

The species which are fished commercially are generally in an advanced stage of exploitation and are in most cases intensely or fully exploited, in some cases even overexploited. Real production increase in Central America and the Caribbean could eventually only be expected from cephalopods and perhaps some demersal species and in South America from weakfish, anchoveta and squids. Fluctuations of abundance, however, requires a precautionary assessment of the marine production potentials.

Inland fisheries in South America may expand to non- or under-exploited species in some of the river systems and reservoirs, although certain areas show signs of over-exploitation. Shrimp, tilapia and salmon aquaculture in the region presently produces mainly for markets outside the region. Unless certain conditions would be met, there seems to be no reasons to expect that aquaculture would respond to local demand to the extent that it will contribute a significant part to total supply.

4. DISTRIBUTION, INCLUDING INTERNATIONAL TRADE

The attractiveness of the developed markets which generally offer high prices and better terms of payment, had always a strong impact on fish trade in the region. In Latin America, the improvement in frequency and modes of transport, and the shortage of traditional species on the world market, led to an increase in trade flows towards Europe, Japan and the USA; on the negative side this has reduced the interest and volume of trade towards intraregional trade.

Many exporters took the opportunity of using air transport. In addition, major transport routes for refrigerated goods go to the developed world limiting intraregional trade.

Intraregional trade has been particularly hampered by the lack of transport and high tariffs. The lack of port infrastructures or the cost increase due to poor port and road transport infrastructures are also serious problems to overcome.In many cases it is easier to ship fish to a developed country than to a neighbouring country (Caribbean - Central and South America, Chile-Brazil, Peru-Colombia, Peru-Brazil, Guyana-Jamaica, Cuba-everybody, etc.).

Due to economic constraints some countries which depended heavily on imports have substantially reduced fish intake since they were and some still are unable to purchase the necessary volume of fish at the international market. At different periods of time, the case of Jamaica, Chile, Brazil and more recently Cuba are good examples.

In many countries, import tariffs can be as high as 30-50% on fish imports, however the number of regional groups aimed at reducing importing duties is growing, a good example of which is the MERCOSUL initiative. Bi-lateral agreements such as between Chile and Mexico would lead to more fish trade between the countries in the region as they are complementary with respect to composition of fish production. In some countries, the economic liberalization policy guaranteed the producers a free market price on the domestic market: as a result, exports have declined, creating more supply to the domestic market.

5. FISH CONSUMPTION IN 2010

In view of the assessment of the current fish food supply situation and the limited possibilities to increase supply and the expected demand growth from 4 133 000 metric tonnes in 1990 to 6 627 000 metric tonnes in 2010, one is confronted with an anticipated demand-supply gap of 2 494 000 metric tonnes, or 60 percent of apparent consumption in 1990. It may be expected that, as a consequence, prices of fish and fish products will rise, which may lead to a reduction in demand and expansion of efforts to increase fish food supplies, so that a certain equilibrium between demand and supply at a certain price level will be reached.

It may be assumed, that any increase in supplies of food fish in the region should come from small pelagic or from diverting to local markets some of the prime fish now exported. The use of small pelagic implies a reduction of supplies for fish meal and fish oil production. Diversion of exports seems less realistic in view of its importance as foreign exchange earner, unless prices in domestic markets will be competitive with prices in international markets. Boosting of aquaculture efforts may eventually lead to a more substantial contribution of this subsector to fish supply. Additional increase in fish food supply may be expected from by-catch utilization, reduction of post harvest losses, and rational utilization of available resources.

6. IMPLICATIONS FOR FOOD SECURITY

If supply would not be able to meet future demand, what would this imply for food security in countries in the region?

It has been argued that increased incomes would lead to an increase of demand for fish products. But even with a stable *per caput* consumption, demand would increase at the rate of population growth. In this scenario, demand for fish products in the region in 2010 would amount to roughly 5.6 million metric tonnes or an increase with 36 percent to the 1990 consumption figure. This could have serious effects on people that are dependent on fish for daily nutrition and/or derive a substantial part of their incomes from fishing activities, i.e. people that have direct access to fish resources.

Food security is considered to be low in low-income food-deficit countries (LIFDCs). In the Latin America and Caribbean region, ten countries (Bolivia, Colombia, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Nicaragua, and Peru) have been identified as LIFDCs. In four of these countries (Peru, Haiti, Ecuador, and Dominican Republic), fish has a significant role in people's diets. In these countries, fish contributes around or more than 10 percent to animal protein supply. In Peru, the contribution of fish to animal protein supply amounts to 32 percent and 13.5 percent to total protein supply. But even in more developed countries, the level of poverty and malnutrition may be very high for a large percentage of the population.

Fishing activities can also play an important role in incomes of people in coastal states or coastal areas. Artisanal fishermen in the Amazon system may fully depend on fish as food but also as source of income. Fishing activities may secure people of sufficient revenues to diversify their diets. Fishing as economic activity may be considered important for example in Chile, Ecuador and Honduras. Fish is also important as input in the tourism industry in many Caribbean island States.

7. POSSIBLE POLICY INTERVENTIONS

It has been observed that present supply would not be able to meet future demand. Various areas of possible improvements have been identified and this chapter describes how these ameliorations could be seen in the Latin American and Caribbean context.

Possible interventions that could enhance the role of fish in food security have been identified on the basis of the assumption that these interventions should be open to governments and institutions, and that they could comprise international assistance and promotion and assistance to national initiatives and TCDC.

7.1 Institutional strengthening and improved management

In many countries in the region, fisheries play an important role in national economies. With resources under threat and many people depending on fishery activities (be it economically or nutritionally), the sector needs management to ensure a sustainable contribution of fisheries to nutrition and economic well-being.

Many countries lack the institutional capacity and appropriate administration to govern the sector in an appropriate manner.

Management practices have so far not been sufficiently assessed. Taking into consideration biological, economic as well as social aspects of fishery, proper management may have to be adopted to ensure responsible fishing practices.

At present, most fishery administrations are being reduced in size. Thus a review of the tasks of the public administrations in support of fisheries is urgently needed in the countries in the region.

7.2 Technology improvements

The technology to diverse to direct consumption part of the actual huge regional catches of small pelagic species, as well as that for better utilization of by-catch, and those non-utilized and under-utilized species is largely available but needs further economic assessment prior to application. The main barrier to development of these resources is not lack of knowledge, but the lack of an effective infrastructure for handling, processing and marketing within the countries of the region. The most challenging problem remains how the resultant products from these resources could be brought to significantly greater utilization for human consumption. The various technological options need to be applied from the market place and from the point of view of the consumer. This is the most challenging problem in post-harvest technology facing fishery scientists which can only be faced through commitment and perseverance.

7.3 Increased utilization of small pelagic for human consumption

It is assumed that non-food uses of fish production in the region consists of fish meal production from small pelagic resources. When considering that in 1990 11.3 million metric tonnes had been applied for non-food uses and the anticipated supply-demand gap in 2010 would amount to 2.5 million metric tonnes, obviously the alternative that has the highest potential to generate increased supply is utilization of small pelagic fish species for human consumption.

In favour of utilizing small pelagic for direct consumption is the fact that resources are generally available and the species are highly nutritious and very much appreciated as fresh or frozen fish, or after processing by curing or canning. On the other hand, resources are highly seasonal, making the development of a consistent processing and marketing strategy difficult, and species rather fragile.

Their small size and many small bones and their strong flavour may reduce their appeal to consumers. Long term variations in abundance are also a hinderance, as exemplified by historical variations in Peruvian anchoveta and Chilean sardine stocks. Because of this unreliability of the resource, excess catches have been diverted to the fish meal industry and this conservative industry controls the utilization of small pelagic species. Large volumes of these species in the region and low local demand have stimulated fish meal production.

The role of fish meal in food production should not be overlooked and it was indicated that fish meal cannot totally be replaced with vegetable protein.

Low prices for small pelagic species and the high quantities of production make the eventual use for human consumption into a political decision. Product development and marketing, in order to stimulate consumption and open up markets with economic incentives for producers and traders, will be key issues that need to be addressed from an international perspective.

It is important that new products be developed taking into account traditional food habits and requirements, and that have the characteristics favoured by consumers. Market acceptability and sustainability should be demonstrated in order to convince conservative fish meal companies to produce for human consumption.

7.4 Promotion of aquaculture and its diversification

In Latin America and the Caribbean, although endowed with appropriate conditions for development of the activity not only at subsistence level but also on a larger scale, traditionally aquaculture has not been a major activity and therefore not disseminated on a significant level. Although during the last decade, the region has seen an important increase in aquaculture activities in different countries, the subsector remains only of marginal importance to the economies in most of the countries, with some exceptions such as Ecuador and Chile.

Nevertheless, in the global context, aquaculture has had a stable increase in volume and percentage of its contribution to fish supply and holds one of the few possibilities to increase supply of fish and fish products. Also in the region, the production tripled during the last decennium and its share in total production increased from 0.97 percent in 1984 to 1.86 percent in 1992. At the average annual production growth rate of 14 percent during 1984 to 1992, the extrapolated production in 2010 would amount to 3.3 million metric tonnes, enough to meet the growth in demand. However, species composition of aquaculture production has not been favourable for local consumption and activities have been oriented towards export markets, such as salmon and shrimps. Most likely because of production of high valued export species, the total value of aquaculture production of the main commodities, excluding aquatic plants, in 1992 amounted to US$ 1.3 billion, or an average value per tonne of around US$ 4 000 which is well above averages in the other regions. Almost 42 percent of total value, or US$ 540 million, was produced in Ecuador and 21 percent, or US$ 270 million, in Chile. With the export oriented subsector, this means considerable contributions to the countries foreign exchange earnings (total export free-on-board value in Ecuador in 1992 was estimated at US$ 3 billion against current prices, and for exports of non-fuel primary products at US$ 1.58 billion).

Certain conditions may have to be met in order to ensure a sustainable contribution of aquaculture products to fish supply and therefore food security. Among those factors are: development of domestic and external markets for aquaculture; diversity in products, also low value - high protein species; conservation of biodiversity and sustainability of aquatic resources; contribution to people's well-being. Activities may have to be undertaken in planning for development of the subsector, placing aquaculture in its environmental context, transfer of appropriate technology, capacity building, etc.

7.5 Rational exploitation of inland fish resources

Inland fisheries has been characterized by small scale artisanal activities. Its production of around 500 000 metric tonnes in 1990 may hold potentials for increase and be expanded to under- or non-exploited species. In view of lack of reliable statistics on production and potentials, development of the subsector requires cautionary approaches. It is therefore important that collection and dissemination of statistical data be improved in order to assess exploitable potentials of inland resources.

It is believed that poor conservation facilities and undeveloped local markets may impede further increase of supply from inland resources. Activities may include development of domestic and external markets for specific products from Latin American inland waters, improvement of infrastructure for better conservation and opening up of internal markets, consumers extension work, etc..

7.6 Improved utilization of by-catch and marketing

The magnitude of the present by-catch resource in the Latin America and Caribbean fisheries has been recognized and the quantities likely to be generated and discarded, particularly by the shrimp fishing industry in the region have been assessed. There appears to be a considerable variation in by-catch yield, depending on the fishing ground. For example, in the South Atlantic Region, the Gulf of Mexico, the Gulf of California and the Guyana coast, the estimated shrimp to by-catch ratios are 1:3, 1:9, 1:10 and 1:20, respectively. At global level FAO has estimated that between 5 and 20 million tonnes of fish suitable for human food are caught every year and then promptly thrown overboard.

Abundant literature on by-catch utilization in the region is available including biological, technological, logistical and marketing and financial aspects. Existing data indicate that fish by-catch, if efficiently recovered and processed, could contribute significantly to food resources, particularly in all places where shrimp trawlers operate.

By-catch usually comprises a large number of different small, often very bony, fish. They are largely discarded overboard, for the simple reason that it is not profitable for the fisherman to preserve them in ice and bring them ashore. Because of their small size, their market price is generally very low and, despite the fact that they are as nutritious as large fish, it is the latter that the consumer wants and is prepared to pay a high price for. Fishermen lack incentives to land by-catches, whereas the target product, shrimps, catches high prices in export markets. Handling and marketing of by-catch products in local markets should therefore be made more profitable in order to make better use of them.

7.7 Improvements of quality assurance and consumer safety

Water supply and food security are necessarily interlinked. Contagious diseases are still present despite considerable improvements in vaccinations and awareness building. If fish lives or breeds in polluted water with faecal waste, pesticides or industrial waste, its consumption may be harmful to human health.

Population living in marginal areas under poor hygienic conditions and depending on street vendors for food supply are especially susceptible to health risks. Under these circumstances, fish products quality may deteriorate and become hazardous to people's health. Studies on foods prepared and sold by street vendors showed that high risk dishes included popular fish and seafood dishes. Countries in the region have now acknowledged the need for preventive control methods to ensure the quality of fish products and FAO, through its Technical Cooperation Programme, assists countries in the training of professionals to confront new sanitary requirements for quality in major markets.

7.8 Development of intraregional trade and elimination of trade barriers

Although port facilities do exist in the region for industrial fishing, organization of port activities is generally lacking. Improvement of these facilities and amelioration of port management may enhance intraregional trade. Bi-lateral as well as regional agreements could further lead to more fish trade between countries in the region.

High import tariffs on fish has hampered the development of intraregional trade. Regional groups aimed at reducing import duties have been established and are becoming more important. Further encouragement of such initiatives will enhance product flows within the region and therefore availability of fish products in domestic markets.

7.9 Reduction of post harvest losses

Post harvest losses do occur not only because of discards and by-catches, especially in shrimp trawling, but also after landing in processing and delayed distribution. Improved processing techniques in artisanal fisheries will reduce losses, whereas better landing and distribution facilities on local sites with improved infrastructure for direct distribution to domestic markets could insure a lower rate of spoilage.

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SOUTH ASIA

Demand and Supply of Fish and Fish Products in South Asia Perspectives and Implications for Food Security

by

Kee-Chai CHONG and Donna J. NICKERSON
FAO/Bay of Bengal Programme

CONTENTS

1. INTRODUCTION

Food, air, and water, especially of a clean and wholesome quality, are the basic needs of human beings. These basic needs, and in particular food, must be accessible and available at affordable prices to the masses, especially the poor segment of the population. For example, water is seemingly abundant and unlimited in supply. More than three-fourths of the earth is covered in water; likewise the human body is also made up of more than 80 % water. However, in reality, a large segment of the world's population, especially that of developing countries has no access to clean water at all, let alone running potable supply to their residence. In Sri Lanka, only 55% of the rural and 80% of the urban population has access to safe water, in Pakistan 50%

of the rural and 85%, of the urban population, in Bangladesh, 85% and 82%, and in India, 78% and 85% (UNDP 1995). Over time, the quality and more recently the quantity of water has rapidly deteriorated from mismanagement of this once abundant natural resource. In fact, the poor of the developing world are paying more for their increasingly limited supply of safe water.

It is meaningless to talk of accessibility and availability of food if it is not within the purchasing power of the masses. In an increasingly economic liberalization global climate where free enterprise and competitive market forces are relied upon to allocate and transform scarce resources into goods and services in meeting market demand and need, accessibility to and availability of food for the poor must first address the ability of the poor to pay for this basic need.

Purchasing power derives from gainful employment and other income-generating livelihood means. More specifically, it is the earned income at the disposal of the buyers or consumers of the goods and services like fish which matters. Like the rest of the world, the South Asian seafood market is responsive to price and income changes. The income and price elasticities of the demand for and supply of fish can be imaginatively applied to ensure accessibility and availability. For many species, fish are usually inelastic to price changes in the past. However, given the health image of fish today, they are now more and more elastic to both price and income changes. Today, fish is no longer the cheap or inexpensive source of protein it once was.

2. DEMAND AND CONSUMPTION

2.1 Fish as a Source of Food and Protein: Historical Patterns and Current Trends in South Asia

Fish as a source of good quality protein has historically been more readily available to the poor, especially in the rural areas of many developing countries. This is partly because in the past fish is more readily accessible as a source of food since they can be caught or harvested from the many water bodies found in the rural coastal and inland areas. The people did not have to pay for the fish as fisheries resources are generally open access or common property resources. Only labour is needed to catch the fish. This is especially the situation in the South Asia where fish have traditionally contributed approximately 40 percent of the total animal protein intake of the population (Table 1). The average contribution of fish to the total animal protein intake in South Asia is nearly five times that of the contribution in North America and Europe and more than double the world average of 16 percent.

Other sources of animal protein such as red meat or poultry, mutton and beef have historically not been as readily available to the region's poor. This is due to several factors. Firstly, their supply was limited since the livestock sector and commercial industry was not yet developed. Secondly, they were beyond the means of the poor. Thus, the poor had to rely on plant protein sources such as lentils and grains, as well as fish for their protein requirements. Fish is so important in the diet of the Asian that the adage "Fish and rice make a Bengali" was coined. In fact, the Bengalis are so fond of fish that they even consider fish as staple vegetarian fare. In Bangladesh, 80 percent of the total animal protein intake is obtained from fish.

An emerging trend in the developing countries of Asia, long used to fish as a traditional source of protein is an increasing shift to other animal protein sources such as red meat, including chicken, mutton and beef. At a time when consumers in the industrial countries are turning away from red meat due to health considerations, beef, and in particular steaks are now very popular among Asians and they are not cheap. Its popularity is particularly more pronounced among the younger generations.

In South Asia, where the vegetarian diet was prescribed and strictly observed, stemming partly from poverty, extended famines and religious beliefs, food habits are also rapidly changing, again especially among the younger sets and religious conversion. More and more of the region's population are taking up non-vegetarian diet as well as shunning away from fish as a traditional source of protein. Beef steaks are considered up-market and prestigious. With steadily increasing affluence and growing middle class in the region, demand for red meat is projected to grow rapidly. Subsequently, the livestock industry will expand and demand for fishmeal-based livestock feeds will have direct relevance for fisheries and its implications on securing fish supply for the poor.

2.2 Food Self-Sufficiency and Food Security Policy

As a matter of policy, the poor's rights to food and food entitlement are provided for by government. However, the fisherfolk and their communities are relatively more disadvantaged compared to the poor found in the other sectors of the economy. Besides being more numerous and illiterate, they neither own land nor do they have other tangible assets. In short, they are worse off than the rest of the poor in their community and country. Today, their plight is even worse than before because the natural resources from which they derive a means of sustenance or livelihood security have been or are increasingly being impaired, degraded or destroyed. In the past, they have depended on the abundant living resources found in the sea, rivers and other waterbodies for food.

Unlike agricultural cereals and grains, vegetables and fruits, fish is relatively more perishable. As such, the management of its supply like grain and cereal stockpiling and inventory as food security measures is more difficult. Not only does fish storage require heavy capital investments in ice-making and cold storage plants but its distribution and transportation call for a full complement of refrigerated trucks, insulated fish boxes, and other equipment and facilities to prevent spoilage.

This does not imply that self-sufficiency in fish cannot be considered as a policy instrument, similar to self-sufficiency in vegetables and fruits which can also be relatively perishable. However, it should be emphasized that the costs and benefits of managing the supply of fish as a food security measure due to its greater perishability must be taken into account. In addition to the above consideration, other options to secure future supply of fish for fisherfolk and other rural poor can also be considered, especially in terms of physical accessibility to fisheries resources. This is because smallscale artisanal fisherfolk are increasingly being displaced due to competition from large scale commercial fishing or forced out of their traditional fishing ground.

Because of the ever growing and widening gap between food production and consumption in keeping pace with a rapidly spiraling population, governments have single-mindedly pushed for food self-sufficiency and food security as national policy goals to be achieved at whatever cost to the national treasury. Such national goals are routinely budgeted into the national five-year plans at every planning cycle.

Thus, governments in developing countries intentionally legislate and institute agricultural and fisheries policies and strategies to bring about food security by providing subsidies, tax incentives, and other opportunities to develop self-sufficiency in food production of cereals, grains, vegetables and fruits, chicken, mutton, and beef, as well as fish, especially in rural inland and coastal regions. Such policies often include provisions for food imports, if and when necessary.

In India, fisheries as a State and Union (Central) Government subject is enshrined in the country's Constitution[1]. Through the government's continued commitment to bring about self-sufficiency in food, the Indian food reserves today top 36 million tons. As large as this reserve is, it is estimated to tide the country for merely three months at the most.

Conversely, in Bangladesh, even though the Government has remained steadfast in its commitment to food self-sufficiency, the country is constantly under the grip of food shortages due to the vagaries of weather such as flooding, and shortfall in donors's foodgrain supply. For Pakistan, where the government has been able to achieve a certain level of food self-sufficiency recently, the problem now is one of quality instead of quantity.

In the case of the segment of the population with low income, special programmes and provisions must and are made by the governments to secure the necessary minimum supply of food to meet their needs. However, such provisions must take into account the increasing economic liberalization climate that many developing country governments are adopting. This is because the administration, operation and management of supply of and demand, including need for food are not only complex but have proven costly.

For example, governments can certainly help in providing accessibility to and availability of food in a variety of ways such as through policy, market and R&D intervention, including stockpiling and maintaining food reserves, especially for emergency use. In addition, such food must be able to reach the masses at the place and time desired, especially during emergencies such as crop failure, famine or natural calamity. This implies that the food distribution network must also be well developed and maintained. It must be recognized that the distribution network for fish is different to the one for cereals and grains. This then is the crux of food security upon which public safety, social and livelihood security as well as national security depend.

In South Asia, as is also true elsewhere in the developing economies, governments are urgently as well as acutely aware that they have to safeguard the interests of traditional smallscale fisherfolk who constitute the bulk of the poor in their respective countries. In South Asia alone, there are more than 7 million fisherfolk, the majority of which are smallscale fisherfolk, living below their respective national poverty threshold, eking out a hand-to-mouth existence.

2.3 Fish for the Poor: A South Asian Experience

The average dietary energy supply (DES) in the Region is 2198 calories per caput per day. This Region has one of the lowest DES in the world, and is below the minimum DES standard

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[1] Under Items 21 and 57 of the State and Union List of the Seventh Schedule of Article 246, 257 and 297.

established by the FAO. In addition, further indications of the nutritional gaps in food supply between South Asia and the northern industrialized countries can be seen in the comparative daily calorie supply per capita index for these countries used by UNDP (1995). Using a north average of 100, with smaller numbers representing a larger gap, the daily calorie supply per capita index for India is 77, for Pakistan 74, for Bangladesh 65, and for Sri Lanka 73. The combination of a high population, increasing population growth, low income levels, large percentage of the population living in poverty, undernourished population, and heavy reliance on fish as a protein supply make the Region one of the most crucial areas in need of food security.

A geographic and demographic profile of the Region is given below in Table 1. Some key indicators of both the regional capacity for fisheries production and need for food security in fisheries include; length of coastline, national and fisherfolk population, GNP per caput income, population growth rate, total fish production, reliance on fish for animal protein supply, and people in poverty.

Table 1. Regional Fisheries Production: Geographic and Demographic Considerations

Country	Length of Coastline	Total Population (1992)	Fisherfolk Population	Population Growth Rate	GNP Per Caput	People in Poverty (1990) (%)		Fish, % of total animal protein	Total Fish Production (1992)	Average growth rate
	(kms)	(millions)	(millions)	(% p.a.)	$	rural	urban	(%)	(1000 MT)	(% pa)
Bangladesh	580	112.7	1.28	2.2	220	51	56	80	966.7	3.4
India	12,700	884.4	5.36	1.8	310	49	38	13	4,175.1	5.8
Sri Lanka	1,340	17.7	0.47	1.2	540	36	15	65	206.2	-0.5
Pakistan	1,046	129.3	*	2.8	420	31	20	4	553.1	5.1
Regional	15,666	1,144.1	*	2.0	373	42	32	40	5,901.1	3.7

* Data not available.
Source: BOBP/FAO

Food security is largely determined by livelihood and social security of and for the poor. Food, social and livelihood security is here discussed in the context of accessibility of fisheries as a source of food for the poor, and global fish supply. More specifically, the discussion is centered on the masses's accessibility to fisheries resources, firstly as a source of food or subsistence, and secondly as a source of employment and income in terms of livelihood and social security, as well as its availability for the people, in particular the traditional smallscale fisherfolk and other rural people who are among the poorest of the poor in their community.

2.4 Women's Role in the Region in Maintaining Food Security in Fish

Women play an important role in the region in providing fish for home consumption, and in the post-harvest sector in moving fish from the producer to the consumer. Often, these services are significant in terms of volume of fish produced and consumed, as well as in the importance to the social structure and security of individual families and local communities in the region. However, many of these services are not valued or are undervalued in the market. Therefore these services are not accounted for in the fisheries statistics and national income accounts. The total fisheries product of the South Asian region is thus underestimated. This undervalue has implications for food security to the extent that the unpaid labor of women in the region decreases the purchasing power and therefore availability of fish to a population most in need.

2.5 Per Capita Fish Consumption

Some unique features of the South Asian Region offer interesting implications for determining fisheries policies to improve the region's food security. While fish have traditionally contributed approximately 40 percent of the total animal protein intake of the Region's population, making it one of the highest percentages in the world, the average per capita fish consumption of the region is relatively low compared with the northern industrial countries and world average (FAO 1992a).

The Region's average per capita fish consumption of 9.9 kg/annum is approximately 40% less than the world average per capita consumption of fish at 16 kg/annum. Per capita consumption varies between countries in the Region, with Pakistan having the lowest of 1.8 kg/annum, India slightly higher at 8 kg/annum (1995), 12 kg/annum for Bangladesh, and 18 kg/annum for Sri Lanka (1994).

The combination of a high dependency of fish as a source of protein in spite of the prevalent reliance on vegetable sources of protein in the region and a low per caput intake of fish could indicate that the diet of a significant amount of the population may be deficient in protein. In fact, there is a protein deficiency in the region (Gopalan 1992). This protein deficiency is due to a combination of factors, including limited accessibility to animal protein sources of a majority of the population, and an increasingly lower quality of protein from vegetable sources . As stated earlier, vegetable sources of protein are important in the region, and surveys conducted by the Nutrition Foundation of India have found an increasing threat to the protein quality from vegetable sources in the region. This deficiency has a greater impact on children in the region as the protein requirements of children are higher than adults. The nutritional quality of many of the legumes has decreased largely due to the effects of the poor environmental quality in the region. As fish provide one of the most common highest quality protein groups consumed in the region, fish will be an increasingly essential part of the diet of the region's population.

In sum, given the cultural preference for fish in many areas of the region and its high contribution of the animal protein consumed in the region, combined with the prevalent protein deficiency in the region, the region holds many opportunities for the development of effective food security policies in fisheries. The need for developing fisheries management policies which promote the long-term security of fish as a food and protein supply in the region is essential.

3. SUPPLY FROM CAPTURE FISHERIES AND AQUACULTURE

3.1 Fisheries Scarcity and Uncertainty

On a global scale, scarcity in fisheries is becoming a reality as evidenced from growing international fishing conflicts and collapse of certain major fisheries around the world. What then can be done to ensure the continued supplies of fish both as a traditional source of food and novelty food item in the Region? On a regional scale and by individual country in South Asia,

Table 2 shows the productivity of marine, inland, and aquaculture fisheries and the average annual growth in each sector.

Table 2. Regional Fisheries Production: Capacity and Growth.

Country	Total Fish Production (1992)	Source of Fish Production (1000 MT)			Average growth rate
	(1000 MT)	marine	culture	inland	(% p.a.)
Bangladesh	966.7	280.1	230.1	686.6	3.4
India	4,175.1	2473.1	1374.8	1702.1	5.8
Sri Lanka	206.2	185.2	4.2	21.0	-0.5
Pakistan	553.1	431.5	12.7	121.7	5.1
Regional	5901.1	3369.9	1621.8	2531.4	3.7

Source: BOBP/FAO

While the region's fisheries production is generally continuing to grow, the resources are severely exploited and current as well as increased production levels cannot be sustained. Therefore the emphasis to maintain long-term sustained production and subsequent food security, will be in integrated fisheries management and the precautionary approach.

Securing future supply of fish for the majority of the region's population will increasingly become more and more complex because of the great uncertainty surrounding the resources. Fisheries resources like any other natural resource have always been subject to great uncertainty not only because of the effects of fisheries practices themselves but also because of the fluctuations in fish stocks due to environmental factors such as upwelling, climate, and pollution.

3.2 Marine Fisheries

India is the largest producer of marine fisheries in the region, and one of the major fish producing countries in the world. India is 9th out of the 20 major countries in terms of total marine catch, and has increased its marine catch from 1.09 million tonnes in 1970 to 2.25 million tonnes in 1989, and 2.5 million tonnes in 1992 (FAO 1992a). Pelagic species targeted include the Indian oil sardine, Indian mackerel and anchovy.

Until recently, nearly 99 % of the catch landed in India have come from nearshore or coastal fisheries (up to 50m depth). The demersal species targeted include croakers, Bombay duck, and catfish. They are mainly landed by small traditional motorized and non-motorized fishing boats. The government has stated that the bulk of the resources beyond 50m depth are not yet exploited even after a decade of the declaration of the Exclusive Economic Zone.

Most interestingly, in spite of the steady increase in fish production, Indian consumers complain about a lack of fish availability in many areas. While fish retail for about Rs50 per kg, it can fetch up to Rs150 per kg during festive season. On average, fish is about 50 % less expensive than red meat; mutton, chicken and beef (Rao, 1995).

Although in volume Pakistan's average annual catch is only 17% that of India, it is the second largest producer of marine fish in the region. Pakistan shares similar target species and capture fisheries practices with India. Targeted finfishes include Indian oil sardine, Indian mackerel, anchovy, and shad.

Penaeid shrimp are an important target species in the region, and India and Pakistan hold the region's major landings of this valuable and largely exported product. The capture of shrimp has historically generated a large percentage of bycatch, and the technology of bycatch utilization and processing has not been accepted or transferred to South Asia. It is currently not economically feasible, although much emphasis is now being placed on this issue and in the future, bycatch could be utilized as another source of fish supply in the region.

The average annual growth rate in the region is 4.55%, with the highest average annual growth in Bangledesh, at 8%, and the lowest in Sri Lanka at less than one percent. Pakistan and India have similar growth patterns at 4.5 and 5.6 percent respectively. The average annual landings of the targeted marine species are given below in Table 3.

Table 3. Annual Landings of Targeted Marine Pelagic and Demersal Species

Species	1985	1990
Indian Oil Sardine	283,857	331,021
Indian Mackerel	99,000	124,000
Anchovy	72,000	111,000
Shad	168,255	224,099
Croakers	146,000	226,000
Bombay Duck	104,000	124,000
Catfish	64,000	94,000
Shrimp	270,456	298,340

Note: Figures are in Volume of metric tonnes.
Source: BOBP/FAO

3.3 Inland Fisheries

As shown in Figure 2, inland fisheries are the second largest source of fish production in the region. India is the region's producer of inland fish, with over 1.7 million metric tonnes landed in 1992. Bangladesh's inland capture fisheries is more than twice its marine catch. It is the third largest producer after China and India. Targeted species include the shad family, many of which are anadromous, spending parts of their life cycles in marine, estuarine, and freshwater. Other important freshwater species in the region include the Cyprinidae, or carp family. Annual growth rate in the region is strong, with the exception of Sri Lanka's production, which is decreasing at the rate of 4.5% yearly. Fisheries production in Sri Lanka has suffered from internal civil conflicts which have decreased fishing pressure. Pakistan holds the region's strongest growth in inland fisheries at 7.5% annually. Inland fisheries holds opportunities for providing a good portion of the region's fish needs and will be an interesting area for managing sustainable fisheries production in the future. Integrated management of inland fisheries will need to consider the severe environmental stresses to the inland resources in the region.

3.4 Aquaculture

Aquaculture is perhaps the highest growth area in the region's fish production, although in terms of volume, production is below marine capture fisheries sector. India and Bangladesh have experienced steady growth rates of 12.8% and 8.5% respectively. A major area of growth in India has been in shrimp aquaculture. In shrimp aquaculture alone, India has invested close to US$ 480 million or Rs 1,500 crores. As a result, cultured shrimp output in India has grown from 15,000 tonnes to 60,000 tonnes, a fourfold increase from 1985 - 1995.

In terms of volume and food supply, carp are the major products of aquaculture in the region. However, the production of shrimp is increasing and countries are shifting to this culture. In fact, the large percentage of growth in the aquaculture sector throughout the region is primarily due to the expansion of the shrimp culture industry. This growth in aquaculture will therefore not necessarily assist food security within the region, but will be distributed as an export commodity. Penaeus shrimp will generally not be utilized locally to provide a more reliable food supply.

Table 4. Annual Production of Key Cultured Species in the Region

Species	1988	1992
Penaeus species	+ 20,707	+ 22,735
Carp	808,872	1,260,653
Osteichthyes	138,257	209,097

Note: Figures are in volume of metric tonnes.
Source: BOBP/FAO

Agriculture has been successful in addressing food security because there is concerted effort at water and land/soil management, including production management. Aquaculture holds similar opportunities as agriculture production, because of the similar nature of management. Aquaculture production can be managed to meet local needs as well as national and international market demands and should be given a high priority in considerations of food security policies in the region.

4. SUPPLY, DEMAND AND AVAILABILITY OF FISH: CURRENT STATUS AND FUTURE PROJECTIONS

4.1 Regional Availability of Fish: Current Status

As noted earlier, a key component of food security is the availability of the commodity to the general population. Table 5 below presents country-by-country and regional indications of the food security situation for fish products in the region vis-a-vis availability to the population and likely shortfalls, by comparing per capita availability, consumption and supply/demand gap or shortfall of fish.

Table 5. Supply, Demand, and Availability of Fish: Current Status in South Asia.

Country	Total Population (1992)	GNP Per Caput (1992)	People in Poverty (1990) (%)		Total Fish Production (1992)	Per Capita Fish Consumption	Per Capita Availability/ Supply*	Per Capita Demand/ Supply Shortfall**
	(millions)	US$	rural	urban	(1000 MT)	(kg/yr)	(kg/yr)	(kg/yr)
Bangladesh	112.7	220	.51	56	966.7	12.0	8.3	3.7
India	884.4	310	49	38	4,175.1	8.0	4.5	3.5
Sri Lanka	17.7	540	36	15	206.2	18.0	14.7	3.3
Pakistan	129.3	420	31	20	553.1	1.8	3.8	+2.0
Regional	1,144.1	373	42	32	5,901.1	9.9	7.8	2.1 - 3.1

* Per capita availability/supply is calculated by (domestic production + imports - exports) ÷ population.
** Per capita demand/supply shortfall is calculated by percapita fish consumption - availability/supply.
Source: BOBP/FAO

As shown in Table 5, the data indicate that South Asia is a fish deficit region. Although the per caput fish consumption is relatively low in the region compared with the world average, the region is unable to meet the needs of the population for fish. Pakistan is the only country in the region with a fish surplus and is currently exporting approximately 10% (in volume) of its fish product. Bangladesh, India and Sri Lanka have similar per caput shortfalls of slightly over 3 kilos per year. While the fish shortfall amount per caput is low, the shortfall per country and in the region is significant given the large population.

In addition, it is interesting to note where the greatest needs exist within the region in terms of food security policy and programme development. Bangladesh is the country with the highest percentage of its population in poverty, the lowest GNP, and the largest per capita shortfall of fish. Yet, Bangladesh currently exports approximately 2.89% of its fish production, to earn a much needed foreign exchange. It is likewise relevant to note that Sri Lanka is importing 28% of its fish supply and still is experiencing a shortfall. While India is one of the major capture marine fish producers in the world, and the highest in the region, its fish shortfall is just slightly less than that of Bangladesh. India is exporting approximately 3.88% of its fish production, most of which is comprised of the high-value target species, including shrimp, squid, pomfret and grouper.

Thus, given the inability of the countries in the region to finance imports and in the case of Sri Lanka, additional imports of fish, the region must meet the shortfalls through its own fish production and long-term planning for the sustained management of its important fisheries resources.

4.1 Regional Availability of Fish: Future Projections

Table 6. Fish for the Region's Protein Supply: Future Projections for the Year 2010

Country	Population in 2010	Average Population Growth Rate	Fish, % of total animal protein	Projected Total Fish Production in 2010	Per Capita Fish Consumption	Per Capita Availability/ Supply in 2010	Per Capita Demand/Supply Shortfall in 2010
	(millions)	(% p.a.)	(%)	(1000 mt)	(kg/yr)	(kg/yr)	(kg/yr)
Bangladesh	167.1	2.2	80	1,263.2	12	7.8	4.2
India	1,221.6	1.8	13	6,554.7	8	5.5	2.5
Sri Lanka	22.0	1.2	65	304.7	18	17.5	.5
Pakistan	213.3	2.8	4	823.4	1.8	3.5	+1.7
Regional	1,624.0	2.0	40	8,946.0	9.9	8.6	1.3 - 2.2

* Future projections of import and export (for the per capita availability/supply projections) were calculated by applying the percentage of 1992 imports and exports of total fish production to the projected figure of fish production n 2010.
Source: BOBP/FAO

Projected fisheries production for South Asia to 2010 assume that the average annual growth rate listed per country (Table 2) will remain constant from 1992 until the year 2000. Therefore, the 1992 -2000 projection is based on the 10 year average growth rate complied from 1982-1992 data. From 2000 until 2010, production will stabilize at the 2000 year annual level. While this assumption is more conservative than continuous growth in production until 2010, this is likely to be an overestimate of the region's future production, given the predictions of fisheries biologists that indicate severe future global declines of the stocks. However, production in the South Asian region has remained relatively stable while fisheries stocks of other regions are facing severe drops in most target species. Therefore, the above assumption represents a conservative best estimate as the current levels of growth in the capture fisheries, which provide the bulk of the fish production, cannot be maintained.

Other considerations which should be noted while viewing the results of Table 6 include the fact that per capita fish consumption is given at 1992 levels and may be underestimates of consumption levels in 2010. Many of the countries in the region are trying to increase the fish consumption of the population through campaigns encouraging fish consumption as a healthy protein source. In addition, as stated earlier, fish consumption will likely rise in the region as consumers look to sources of high quality protein to supplement the decreased protein quality of legumes in the region. Thus, the demand/supply shortfalls could be conservative projections.

Again, as with the current status of the food security in fish as shown in Table 5, the data in Table 6 indicate that South Asia will continue to remain a fish deficit region under the current fisheries management policy should current trends continue. Although the data in Table 6 indicate that the regional average fish deficit will decline slightly from the current status, disparity remains between countries in the region. Projections indicate that Pakistan and Bangladesh may be worse off in the future. Bangladesh will remain the most vulnerable in meeting the needs of its population for fish. India and Sri Lanka may be slightly better off in the future as the shortfall in fish is projected to become more narrow. However, given the conservative assumptions used in the calculations, the projections should be viewed as rather low estimates. Therefore, fisheries management strategies and measures developed in the near future should plan to meet future shortfalls in fish.

5. IMPLICATIONS FOR FOOD SECURITY

All the countries of the region are classified as low income food deficit countries (LIFDCs). Bangladesh and Sri Lanka are two of the LIFDCs with the lowest capacity to finance food imports, yet have 1988-90 averages of 54 and 26 % (food imports/total exports) respectively (FAO 1992a).

Fish consumption varies between countries and within geographical areas of the country. In India for example, only along the western coast in Kerala State and the north eastern coast of West Bengal is fish an important part of the diet of most inland and coastal dwellers. In Pakistan, fish consumption is equally varied, ranging from virtually none in parts of the interior to among the world's highest per capita consumption along the coast of Baluchistan. However, fish plays an important role of the diet of the majority of Sri Lanka and Bangladesh's population.

The region holds one of the major fish producing countries in the world. India is one of the 20 major countries in terms of total marine catch, and has increased its marine catch from 1.09 million tonnes in 1970 to 2.25 million tonnes in 1989.

The region is deficit in fish and projections indicate that the fish deficit will continue in the year 2010 (Tables 5 and 6) under the status quo scenario. Fish contribute nearly half of the animal protein supply consumed in the region, and there is a protein deficiency in the region.

6. DISTRIBUTION

6.1 Rapid Urbanization

By 2025, more than 83 % of the world's population will live in developing countries. This is in contrast to 75 % in 1985. In terms of absolute figures, the number of people living in cities will quadruple from 1 to 4 billion. Regionally, the total population in South Asia will double by 2023 (UNDP 1995). The early years of the 21st Century will see unprecedented urban population growth as the rural poor continue to be attracted out of the countryside. The rural-urban out-migration has been continuing since the middle of the last century. In India, only about a quarter of the population is urban and three-fourths are rural in the past. Thus, this change in demographics will have implications to the food security of the urban poor. Not only will the production capacity of the region in fisheries likely be gradually reduced with the shift in demographics in the region, but the non-market or in-kind exchanges of the rural population which assist the poor in meeting their food requirements likewise reduce, placing more pressure on increasingly sparse urban food supplies.

6.2 Imports - Exports in South Asia

Table 7. Distribution of Imports and Exports in Volume from 1989 - 1992

Country	Imports	Exports	Net Export - Import
	(1000 mt)	(1000 mt)	(1000 mt)
Bangladesh	-	28.0	28.0
India	-	162.1	162.1
Sri Lanka	57.2	3.1	- 54.1
Pakistan	0.1	56.2	56.1
Regional	57.3	249.4	192.1

Source: BOBP/FAO

As indicated in Table 7, the region is a net exporter of fish, although variations exist between countries in the region. Bangladesh currently exports approximately 2.89% of its fish production, to earn a much needed foreign exchange. It is likewise relevant to note that Sri Lanka is importing 28% of its fish supply. India is one of the major capture marine fish producers in the world, and so is not surprisingly exporting the greatest volume of fish and shellfish in the region, approximately 3.88% of its fish production. Fisheries products play an important role in India's export earnings and are comprised of the high-value target species, including shrimp, squid, pomfret and grouper. Conversely, the inland fisheries production contributes mainly to the domestic supply of fish. The South Asian fisheries products are primarily exported to Japan and Europe.

7. SOLUTION OPTIONS

7.1 Protection of Marine Environment

India, Pakistan, Sri Lanka, Bangladesh and Maldives recently adopted a regional action plan to protect and manage their collective marine and coastal environment under the UNEP's South Asian Seas Regional Project. The goals of the Project are geared towards the protection of marine resources and environment which can ensure the future sustainability of fisheries as a vital and strategic source of food and income-generating opportunities for the region's population.

Perhaps the greatest environmental stress in the region is to the inland water resources which support the inland fisheries. As noted earlier, the inland fisheries are almost exclusively used as a domestic product. Therefore, protection of the inland resources including estuaries and riverine systems influencing the coastal areas is crucial to the region's food security in fish and should be a part of action plans developed under any programme (ie, UNEP, FAO's Bay of Bengal Programme, etcetera) as part of an Integrated Coastal Area Management (ICAM) or "watershed approach" to coastal resources protection. The ICAM and watershed approaches takes a holistic view towards coastal resource management and includes land-based sources of marine pollution, in line with Agenda 21, Chapter 17.

As a result of continuing poverty and increasing resource and environmental impairment, one way to ensure that the poor has sufficient nutrition and nutrient requirement is to provide them with physical access to Nature's wild "bounty" or storehouse of food. In modern times as ours, it may not be much. All the same, it can make the difference between going hungry and food gathered from the wild. The poor with little purchasing power can pick, catch or collect aquatic plants and animals from the water bodies in their surroundings. This is the least costly option in ensuring some form of food security to the poor, that is physical access to "food supply" from their surroundings.

7.2 Utilizing Low Food Chain Species

According to Swaminathan (1995), nearly 20 % of the farmland in South and Southeast Asia remains unproductive due to a variety of causes such as salinity, alkalinity, waterlogging and loss of topsoil from erosion. These marginal lands can be productively reclaimed for aquaculture emphasizing species low on the food chain (herbivorous and omnivorous fish). In addition, bycatch utilization should be improved in the region.

7.3 Nutrition Education

Choice of food from available supply of food at the household or local level is critical to meet nutrition requirements. This is where good nutrition awareness can play a role to educate the poor on good nutrition. Fish is a healthy and nutritious food. Its availability to the poor must be secured to the largest extent feasible. It is within the reach of many governments because relative to other protein sources, fish production is less expensive compared to the cost of producing other animal protein.

7.4 Awareness-building and Persuasion

Fisheries management has to start NOW and not be delayed any further. To work, fisheries management be understood and appreciated at the level of the individual, working with each individual fisher at a time. This is where individualizing fisheries management and other fisheries intervention to help their communities will go a long way towards stabilizing and sustaining the fisheries.

Further, it is important that the soft approach as in non-punitive or non-penalizing approach to fisheries management must be developed and promoted. Experience has shown that the hard approach or the punitive approach has not worked. By the soft approach is meant working with them through persuasion and stepping up awareness building that they alone are responsible for their fisheries health. As resource users, they are also resource managers. The government, on its part will have to begin to decentralize and delegate more and more responsibility of fisheries management to the resource users as resource managers. In fact, a few Southeast Asian countries have already embark on such a fisheries management approach.

7.5 Encouraging Women's Participation in Fisheries Management and Equalizing the Value of Women's Activities in Fisheries

Women in the region are good savers and managers of money, and this ability to provide both financially and in-kind for the long-term should be encouraged and utilized by increasing loan opportunities for women especially in rural credit to expand their services in fisheries. Along these lines, the services of women should receive fair market value to increase the purchasing power and therefore availability of fish to a wider population in the region.

7.6 Integrated Management

Effective fisheries resources management requires hard choices with regards to the competing short and long term goals inherent in fisheries management. Governments of South Asia are slowly recognizing they can no longer hold onto the myths of the past in fisheries management; that fish is a cheap protein supply and that fish is still abundant in their national waters. This recognition must be reflected in the development of policy initiatives in fisheries management that promote sustained use of the resources over the long-term and provide for stakeholder or fisherfolk involvement. Integrated management is a means to provide for the long-term sustainable development of the resources while ensuring livelihood security of the resource-dependent fisherfolk, and plan for distributional equity of the fish products.

7.7 Individualizing Community-Based Fisheries Management

Closer observations of and interaction with fisherfolk reveal that to succeed, fisheries intervention to increase fish output and improve fisherfolk welfare must individualize and customize any kind of intervention, including community-based fisheries management system to allow among other rights of the individual, ample opportunities to participate in decision-making affecting the individual's and the community's future well-being. This is because fisherfolk are highly individualized people, motivated by different incentives and respond to different socio-politico-economic stimuli and/or signals, and management systems must be adapted to the unique needs of fisherfolk.

8. CONCLUSIONS

Fish production, either capture or culture like any other productive enterprise in a capitalistic or competitive market economy, is heavily influenced and driven by the profit motive. This is in contrast to a command economy where production is decreed and/or dictated by the government of the day. Profit-driven production system has been partly responsible for some of the woes of many fisheries: overfishing and resource depletion. Mahatma Gandhi's dictum which states that Nature provides for everybody's need but not for everybody's greed should govern exploitation of natural resource systems such as fisheries.

Although fishers complain of smaller catch, they are satisfied when their income has increased. They are thus able to buy the other basic daily necessities with the higher income. In other words, they are able to make ends meet. This implies that securing food supply for certain segments of the fishing population may not be as pressing as long as the price and income elasticities of fish can ensure respectable income for them. However, it is still important that access to fisheries be ensured to the extent possible under present fisheries management regime found in different countries.

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SOUTH EAST ASIA

Demand and Supply of Fish and Fish Products in South East Asia Perspectives and Implications for Food Security

by

Hashim Bim Ahmad
FAO Consultant

CONTENTS

1. REGIONAL CHARACTERISTICS AND ISSUES

Southeast Asian region comprises of ten countries namely, Brunei, Indonesia, Malaysia, Singapore, Thailand, Cambodia, Laos, Myanmar, Philippine and Vietnam. These countries can be categorized into Newly Industrialised Countries (NICs) and non-Newly Industrialised Countries (non-NICs). Countries with strong economic growth like Brunei, Indonesia, Malaysia, Singapore and Thailand are considered the NICs while the rest like Cambodia, Laos, Myanmar, Philippines and Vietnam fall under the non-NICs grouping. The geographical location of these countries are as shown in Map 1.

The fisheries sector plays an important role with regard to employment, generation of income, foreign exchange earnings and supply of protein particularly to poorer sections of rural and urban population in Southeast Asia. At present, fish represents the primary source of animal protein for hundreds of millions of people in the region. The important of fisheries commodities traded in the international market is growing. Fish is one of the fastest growing food commodities entering the international trade and has overtaken other animal protein commodities.

In addition to its important nutritional role, the fisheries sector in Southeast Asia provides employment in capture and culture of fish and other aquatic organisms for millions of people, the majority of whom belong to low income groups. The fisheries sector also provides employment for many more millions of people in supporting and related industries such as fish marketing and processing and boat building. The sector contributes significantly to the Gross National Product of many countries in the region and its economic importance has been growing rapidly over the last few decades.

Intra-regional trade contributes to a significant share of each country's gross national product in Southeast Asia, in which fish and fishery products play an important role. Intra-regional trade takes place with or without any formalized trade agreements. It is a cooperative regional market in which fish trade is encouraged through lower tariffs, removal of quotas and shared resources. Southeast Asia and the Far East are the growing markets for Asian seafood producers which makes the intra-regional trade expansion more viable (Ferdouse, 1994). Southeast Asian fish can always find a market in the region. This region is blessed with the existing as well as newly emerging markets for fishery products.

Fisheries production in the Southeast Asian countries has doubled over the last 20 years, rising from about five million tonnes in 1970 to more than 10 million tonnes in 1990.

The fisheries sector in Southeast Asia is dominated by small to medium-scale producers which when compared to industrial fisheries are better adopted to multi-species fisheries in tropical waters in terms of efficient use of capital and non-renewable resources, provision of employment and generation of income, conservation of natural resources and environment and maintenance of living standards in rural areas.

The largest seafood importer in the world, Japan, is a neighbour to this region which makes Southeast Asia an important supplier for seafood because of the proximity. Nevertheless the NICs like Singapore and Malaysia are equally important as seafood markets for the region. Intra-regional trade in fisheries is very strong simply because most of the supplies come from within the region. Southeast Asia and Asia in general offers better opportunities for fishery trade expansion compared to the other regions.

In addition, major joint ventures within the region are also taking place particularly in aquaculture and seafood processing. With the current growth in economy and the strong preference for seafood, intra-regional trade in fishery products in the Southeast Asian region is expected to be strong in the coming years.

2. DEMAND AND CONSUMPTION

2.1 Apparent Consumption 1970-1990

In Asia, the per caput supply of fish has risen from 8.9 kg/year in 1970 to 12.2 kg/year in 1990. However, there was a significant difference in the per caput supply of fish between developed Asia and developing Asia. Developed Asia includes Japan and Israel, while developing Asia includes the rest of Asian countries. In developed Asia the per caput supply of fish rose from 62.1 kg/year in 1970, to 69.4 kg/year in 1990 while in developing Asian it rose from 6.0 kg/year to 9.7 kg/year (Table 1 and Fig. 1a). Asia is considered a fish-eating continent, therefore the fact that per caput fish and seafood supply for Asia is lower than the global average of 13.3 kg/year in 1990 may be explained for the fact that in West Asia (that includes the Middle East, Turkey, Iran and Afghanistan) the per capita consumption does not exceed 5 kg and fish provides only some 7-8% of the total animal protein supply (Csavas, 1994).

It was observed too that in 1990, even though the per caput fish supply for Asia is lower than the world, the share of fish and seafood in the total animal protein supply for Asia is higher than the world i.e. at 26.3% while the world is at 16.1% (Table 1 and Fig. 1b). This imply that in comparison to the world the Asian population get their protein supply more from fish. Real fish and seafood eating countries however are located in East and Southeast Asia. In Southeast Asia the per caput for fish and fisheries product in 1970 was 16.2 kg/year and this increased to 18.3 kg/year in 1990. While the world per caput was 10.9 kg/year in 1970 and rose to 13.3 kg/year in 1990. The food/fish balance sheet for countries in Southeast Asia in 1990 is as shown in Table 2. All the NICs in South East Asia have their per caput supply of fish and fisheries product well above the world per caput (Table 3 and Fig. 2a). For non-NICs in Southeast Asia, only Myanmar and Philippines have their per caput supply of fish and fisheries product above the world per caput (Table 3 and Fig. 2b). Vietnam, Cambodia and Laos have their per caput supply below the world level. Percentage of fish to animal protein for all the countries in Southeast Asia except Laos was higher than the world level in 1990 with Indonesia having the highest at 63.1% (Table 3, Fig. 3a and Fig. 3b). Laos being a land locked country and low in income has very low supply of fish for the population, thus the low per caput and their protein diet were derived from other animals other than fish.

Analyzing the species composition of food fish consumption in Southeast Asian region (Table 4 and 5), it can be observed that for the NICs the pelagic species are by far the most important species group. In Singapore it can be observed that by 1990 the consumption of shellfish is gaining popularity to the consumption of finfish. There was an increase of more than 50% of the shellfish consumption towards the 90's compared to the 80's. This was highly significant in the consumption of cephalopods and crustaceans which were high value species. However, for Malaysia and Thailand, the consumption of shellfish towards the 90's was decreasing. In Malaysia the consumption of shellfish decreased by 50%. This high value species are exported to Singapore. For the non-NICs countries, there was no available data for Cambodia and Laos. Philippines data showed that pelagic species are by far the most important species group consumed, while in Myanmar and Vietnam the unspecified marine species group is the most important in terms of species consumption.

During the period of the early 80's, and towards the 90's, there has been a shift towards eating less fresh fish in the NICs of Southeast Asia like Malaysia, Singapore and Thailand. Table 6 and 7 gives the per caput supply by main product type between 1980 to 1982 and between 1988 to 1990. However, the non-NICs of Southeast Asia like Myanmar, Philippine and Vietnam were showing an increase in the popularity of eating fresh fish. In Singapore there was a marked increase in the per caput supply of frozen shellfish and in Thailand there was a marked increase in the frozen finfish per caput supply. A more detailed analysis in Thailand, Malaysia and Singapore would reveal also a shift from relatively cheap to more expensive fish and sea food species concurrently with increasing per caput income (Csavas, 1994).

2.2 Factors Influencing The Demand And Consumption Of Fish And Fishery Products

Generally, the per caput supply of fish in the region has risen over the past 20 years while in the same period the share of fish in animal protein intake has declined. This indicates that total animal protein intake by the people in the region has increased. With strong economic growth being experienced in some of the countries in the region, many consumers are becoming more affluence and are able to afford other protein substituents besides fish.

The decline of the share of fish in animal protein intake in the region can also be attributed to the fact that increasing supplies of fish could not keep up with population growth and that fish has been replaced by other animal protein food such as chicken which became available at more competitive price.

The overall demand for fish from the region is expected to rise with vast market potential created by the NICs within the region like Singapore and Malaysia as well as from outside the region such as Hongkong, Korea and Taiwan.

With the sophistication and modernisation of the processing and preservation technology in the region, new fisheries products are created and at the same time with increasing affluence, consumer preference will change in favour of these processed products such as frozen fillet, fish balls, fish cakes, etc. which are easy to use in the preparation of meals. With this, it is expected that the quality of fishery products will increase and thus there will be little difference between products which are for domestic market and those for export.

2.3 Expected Demand In 2010

In order to predict future trends, it is important to know whether the demand for fish will increase with increasing affluence of the consumers or whether there is a tendency to diversify animal food consumption which will result in a decline in fish consumption. Judging from the trend observed in the past, there is a clear evidence that per caput supply in the Southeast Asian region is rising and will continue to be so in the next two decades with increasing purchasing power.

The annual population growth in the region was 2.31% for the period 1970-1980 and declined to 2.13% for the period 1980-1990. If the same trend with a decline of 0.18% per decade is to be observed for the next 20 years, it is predicted that population for the region in the year 2010 will be 641.9 million.

Per Caput Fish Supply (kg/caput/year)

Southeast Asia	1970	1990	Growth 1970-1990
NICs	14.4	16.7	16.0%
Non-NICs	18.8	20.6	9.6%
Total	16.2	18.3	13.0%

Even though per caput fish supply in 1990 for some countries such as Singapore, Thailand, Vietnam and Laos had declined compared to 1970, there was an overall increase of 13.0% in per caput fish supply in the region with NICs having a higher growth than the non-NICs. Generally, NICs have a higher per caput supply compared to non-NICs. The reason for the higher average per caput supply for the non-NICs compared to NICs is due to the fact that Philippines, which had the highest per caput supply in the region, is being grouped under the non-NICs. It is expected that the same annual growth rate of 0.61% for the period 1970-1990 will continue up to the year 2010 as strong economic growth is likely to persist within the region. Coupled with the fact that Southeast Asia is a fish-eating region. With increasing affluence, consumers will tend to eat more fish because of its nutritive and health values. The small annual growth rate is chosen as it represents a more realistic figure because demand is constrained by supply availability. Therefore, with such growth rate, the forecasted per caput fish supply in the region will be 20.7 kg in the year 2010. The expected demand for fish in the region will thus be around 13.3 million tonnes in 2010.

3. SUPPLY FROM CAPTURE FISHERIES AND AQUACULTURE

3.1 Capture Fisheries

The total landings from capture fisheries (marine and inland) for Southeast Asian region in 1992 was 9,555,266 tonnes (Table 8). That was 26.02% of the total landings of capture fisheries in Asia. The NICs (Brunei, Indonesia, Malaysia, Singapore and Thailand) landed 6,214,480 tonnes of fish and the non-NICs landed 3,340,786 tonnes of fish in 1992. That was 65.04% and 34.96% respectively of the total Southeast Asian landings for capture fisheries. Thailand ranked highest in Southeast Asian region in terms of its total capture fisheries landing i.e. by 30.15%. That was followed by Indonesia 28.80%, Philippines 16.06% and the rest of the countries landed approximately 24.99%, of the total capture fisheries of Southeast Asia. On the average, there was an increase in the landings of capture fisheries over the years between 1987 to 1992.

In 1987 the total Southeast Asian region catches from capture fisheries was shown to be 8,238,265 tonnes and this increased to 9,555,266 tonnes in 1992. This is an increase of 15.99%. Major fishing nations in NICs grouping i.e. Thailand and Indonesia had shown an increasing trend over the years. Malaysia on the other hand had stabilized its landings at around 550,000 tonnes. The other countries in the NICs i.e. Singapore and Brunei which contributed approximately 0.12% of the Southeast Asian capture fisheries landings on the whole has shown a decreasing trend. Being affluence nations Brunei and Singapore offerred better incentives in other sectors, other than fishing and rely on their fisheries import. Non-NICs, meanwhile were showing an increasing trend in their catches except for Laos which is a land locked country and contributed approximately 0.15% of the total catches of Southeast Asia and this came from inland capture fisheries.

The Southeast Asian region is surrounded by the Eastern Indian Ocean, FAO Fishing area 57 and Western Central Pacific Ocean, FAO Fishing area 71. Other Asian countries which bordered the Eastern Indian Ocean are Bangladesh, India, Japan and Republic of Korea while Western Central Pacific Ocean are bordered by China, East Timor, Japan and Republic of Korea.

The total marine fishes landed from the Eastern Indian Ocean, in 1992 was 3,297,164 tonnes while from Western Central Pacific was 8,182,787 tonnes. The main species group caught in Easten Indian Ocean in 1992 were red fishes, basses and congers followed by herring, sardine and anchovies group; shrimps, prawns group; jacks, mullets and sauries group ;and tunas, banitos and billfishes group. The main species group caught in Western Central Pacific Ocean in 1992 on the other hand was tunas, bonitos and billfishes group followed by jacks, mullets and sauries group; herring, sardines and anchovies group; red fishes, basses and congers group; and shrimps and prawns group.

The total landings from Eastern Indian Ocean increased by 623,494 tonnes from 2,673,670 tonnes in 1987 to 3,297,164 tonnes in 1992 while the total landings from Western Central Pacific Ocean increased by 1,327,658 tonnes for the same period i.e. from 6,855,129 tonnes in 1987 to 8,182,787 tonnes in 1992. The same 5 groups of species ranked highest in terms of landings in the Western Central Pacific between 1987 to 1992. However, for the Eastern Indian Ocean, there appeared to be changes in stock from 1987 to 1992. Red fishes, basses and congers groups; and shrimps and prawns group's stock appeared to be more abundant in 1992 as comparedto 1987 (Table 9).

3.2 Aquaculture

Aquaculture in many Southeast Asian countries is dominated by fish species low in the food chain like milkfish, although countries with higher living standards culture increasing amounts of high-value carnivorous fish like barramundi and grouper.

The total production from aquaculture in Southeast Asian region in 1992 was 2,083,128 tonnes (Table 10). That was approximately 17.79% of the total aquaculture production of Asia in 1992, the NICs production was 1,130,532 tonnes compared to non-NICs at 952,596 tonnes i.e. 54.27% and 45.73% respectively of the total Southeast Asian production. Philippines, one of the non-NICs had the highest aquaculture production in 1992 among the Southeast Asian countries i.e. at 737,501 tonnes (35.40%), that was followed by Indonesia producing at 689,747 tonnes (33.11%) and Thailand producing at 359,040 tonnes (17.24%). The rest of the Southeast Asian countries produced among them 296,840 tonnes of aquaculture product i.e. 14.25% of the total aquaculture production of the Southeast Asian region. Table 10 shows the aquaculture production of the Southeast Asian countries from 1987 - 1992. Philippines present aquaculture area is about 126,333 ha comprising 7,155 ha of mariculture, 114,502 ha of brackishwater culture and 4,676 ha of freshwater culture. The main species cultured in 1992 was milkfish, *Chanos chanos* with production of 171,116 tonnes.

Indonesia present aquaculture area is about 458,000 ha comprising 290,933 ha of brackishwater ponds, 53,800 ha of freshwater ponds and 113,000 ha of paddy fields. During the mid-80s, shrimp culture developed rapidly and intensified, attracting a wide range of entrepreneurs to enter the business (Karundong,Sudari and Pamiro; 1994). The production of *Penaeus monodon,* the second major species in 1992 was 125,150 tonnes. The main brackish water species of importance is *Chanos chanos* with production of 142,820 tonnes in 1992. Meanwhile, mariculture has been developed recently, especially for molluscs, sea cucumber and seaweed culture. Some parts of Sumatra Island and the eastern part of Indonesia hold potential for mariculture development. Fresh water culture areas on the other hands mainly located on Java Island and the production is marketed exclusively for local consumption. However, the sector plays an important role in providing a source of animal protein for people who live far from the coastline.

Aquaculture production in Thailand is influenced mainly by geographical factors and its long tradition of fish culture. It has a huge flood plain, a long riverine stretch (nearly 120,000 km), 300,000 ha of natural lakes, 255,000 ha of reservoir and 31,000 km sq. of paddy fields. This type of geographical location results in huge brackishwater areas along Thailand's 2,600 km shoreline; about 100,000 ha of these brackishwater area are suitable for coastal aquaculture (Kongkeo, 1994).

Thailand has become the top producer of cultured shrimp by adopting the intensive culture system since 1991. In 1992, Thailand produced 172,300 tonnes of *Penaeus monodon.* Thailand is favourable for shrimp culture because of the suitable climatic conditions, soils and water temperature, availability of wild broodstock, long traditional experience in aquaculture, sea food processing and trade, good infrastructure and transport facilities, and locally produced farm equipments. During the disastrous 1993 shrimp production drops in China and Indonesia, Thailand was able to increase its production to nearly 170,000 tonnes to make up for the shortfall in world supply. The sharp increase in shrimp prices in 1993, driven mainly by the high demand in the world market, spurred shrimp farmers to further boost their production.

3.3 Maximal Utilization Of Catches

In the region, a wide variety of fish species and products are available to the consumers. They are produced and presented in various forms : fresh, frozen, canned, cured, fermented etc. A very high percentage of fish landed is consumed locally in the fresh form. Quality of fresh fish in most domestic markets in the region is far from satisfactory. However, significant progress is being made in both domestic and export oriented processing and marketing sectors. In many markets especially in the NICs groups of Southeast Asian countries, consumers are increasingly becoming aware of quality as evidenced by the rise in the demand for quality fish and fishery products in these region. Table 11 shows the production of fisheries commodities for 1988 and 1992 for the Southeast Asian region. This is classified into 7 types of fisheries commodities. Under the fish; fresh, chilled and frozen, it can be noted that the NICs group of countries produced the main bulk of the production. The major species items are snapper, grouper, seabass, tuna and other marine fish which are in frozen form. Other frozen item is surimi. Frozen snapper, grouper, seabass and tuna mainly produced by Thailand and Philippines. Other countries produced mainly other frozen marine fish.

Under the fish; dried, salted or smoked; the production observed to be tunas; dried, salted; freshwater fish; dried and salted; and smoked sardines and sprats; and other smoked fish from Philippines. There were also smoked mackerel from Thailand and smoked fish from all the other Southeast Asian countries. The traditional methods of drying, salting, steaming and fermenting are still popular in the region. However, advanced technology is being introduced and practised in the NICs .

Crabs, shrimps and prawns; squids, octopus and cephalopods frozen; sea cucumber, jelly fish, cuttle fish, shrimps, prawns, dried or salted are among the production under crustacean, mollusc; fresh, frozen, dried and salted. In keeping with the expansion of export markets for tunas and shrimps there had been a rapid increase in freezing and cold storage facilities in certain part of the region. Skipjack tunas are being canned in Indonesia, Philippines and Thailand; while other tunas are canned in Malaysia, Philippines and Thailand. Mackerel are canned in Thailand. Miscellaneous fishes are being canned in Myanmar, Singapore and Thailand. Malaysia, Philippines, Cambodia, Thailand and Vietnam produced substantial amount of fermented fish. While Malaysia, Myanmar and Cambodia produced fish paste. In Malaysia, fish meat , fishballs, fish cakes, fish sausages etc. are also being produced. All these items fall under the fish, crustacean and molluscs products and preparation whether or not in airtight containers. Innovative packers have successfully introduced a wide range of convenient items in the international markets. Battered and breaded fish and shellfish, microwaveable products and ready-to-cook meals are some of the products processed and produced with technology transfer through joint ventures in the NICs. Indonesia is the only country in the Southeast Asian region which produced fish oils and fats from the body of fish other than fish liver.

Indonesia, Malaysia, Thailand and Vietnam produced oily fish meal. Thailand has the highest production of fish meal in Southeast Asia at 280,000 tonnes in 1992. In 1990 there were 104 fishmeal plants in operation in Thailand as against 92 plants in 1985. The expansion of fish meal production is mainly due to increasing domestic need for fish meal as an essential ingredient in the production of shrimp feeds. A substantial quantity is also exported.

3.4 Future Supply Of Fish And Fishery Products - Scenario 2010

More than 80% of the consumed fish in Southeast Asian region comes from capture fisheries. However, the contribution of aquaculture to total production had been increasing from 15% in 1987 to 18% in 1992 (Fig. 4). Total production of fish in Southeast Asia increased by 21% for the period 1987-1992 from 9,638,681 tonnes in 1987 to 11,638,394 tonnes in 1992 (Table 12).

Capture fisheries recorded an increase of 16% for the same period while production from aquaculture rose by 49%. However, the annual growth rate of 3% over the period for capture fisheries is not expected to continue growing by mid-1990s. Capture fisheries in the region is not expected to increase considerably in the future as the catch of most countries in the region is almost entirely within the EEZs and with some countries already harvesting at maximum sustainable level. In order to increase future supply, countries in the region will have to engage in distant-water fishing.

With little potential for increase in production of capture fisheries due to the present high level of exploitation, the future supply of fish in the region will depend mostly on aquaculture. Aquaculture production in the region constituted about 15% of global production in 1992. Aquaculture was one of the fastest growing food production subsector registering on annual growth rate of 8.3% for the period 1987-1992. If is anticipated that aquaculture in the region may keep growing up to the year 2010. However, this will require increased efficiency in present culture practices. Improvements in culture practices will require new approaches that take account of the social, economic and environmental constraints.

In order to meet the demand of 2010, supply will have to grow at the rate of 2.5% annually. Therefore, it is expected that production will have to increase at a rate higher than this. Growth of 3% in capture production in the region for the period 1987-1992 is not going to persist and is expected to level off by mid-1990s. Hence, based on past trend, production from capture fisheries in the region is predicted to peak at about 10.4 million tonnes. In fact, growth in global capture production had already shown sign of levelling off in the 1990s. The global growth rate of 9.6% over the past decade for aquaculture production is anticipated to keep growing at a similar pace until and beyond the turn of the century (Csavas, 1994). However, a high growth rate is not expected for the Southeast Asian region as aquaculture in some major producing countries in the region has already shown sign of environmental problems. A lower growth rate, maybe half the present growth rate of the region, is more likely to sustain up to the year 2010. Therefore, taking a growth rate of about 4%, the total aquaculture production in the region is predicted to be about 4.3 million tonnes by the year 2010. With such prediction and after taking into account non-food uses, food fish supply in the region by 2010 will be about the same as the expected demand of 13.3 million tonnes.

The fish processing industry in the region will expand as consumer preferences change in favour of processed products. Products from this industry will cater towards the local as well as export markets. Production for export market will mainly be higher value-added products. Consumers are increasingly becoming aware of quality as evidenced by the rise in the demand for quality fishery products. Processing industries must, therefore, cater the needs of the consumers and be more market-oriented as well as be prepared to innovate to confront changing demands in both the domestic and export markets. This requires additional investment in the industry to improve existing facilities and techniques for the production of value-added products. Improved processing and packaging will boost both the domestic as well as export marketability of products and, therefore, expand trade and earnings, provide domestic employment and build skill levels. Capital investment for fish processing in the region varies widely depending on the process and technologies involved. Traditional processing methods require low investment and this investment is usually made by local private entreprenuers. While high-investment modern processings are mainly carried out by big multinational companies.

4. DISTRIBUTION PATTERNS AND INTERNATIONAL TRADE

In most countries in the region, the bulk of fish landed is consumed locally. The landings are often supplemented with imports to satisfy local demand. However, Brunei and Singapore still depend heavily on imports as local supplies are limited.

Traditional intermediaries in the region still play an important role in domestic fish marketing operations and in providing credit facilities. Traditional networks vary from country to country depending on the kind of product which is being traded. These networks have some common features i.e. intermediaries like wholesale merchants, agents, assemblers and traders are linked to each other by kinship ties and that their social and professional roles are inherited. With increasing commercialisation and regionalisation of fish marketing and processing, the traditional networks of market intermediaries are expected to change their way of functioning including the physical and financial unit channel flows between producers, wholesalers, retailers and consumers. In the long term, traditional functions such as the provision of working capital advances is expected to be taken over by financial institutions. Domestic fish marketing and processing are expected to increasingly take advantage of external supplies of fish and other aquatic organisms as a result of economic liberalisation within the region, including the liberalisation of imports and exports, foreign exchange regulations and controls, etc.

Fish and fishery products in the region are marketed in various forms namely fresh, frozen, canned, cured, fermented, etc. The successful distribution and marketing of fresh fish depend upon the proper functioning of a closely integrated system of production, transport and distribution. Distribution has to be closely coordinated through the establishment and use of rapid systems of communication and transport as this will ensure high quality end-product. As with many other perishable food products, fish and fishery products nowadays are marketed in attractive and colorful packs with modern methods of marketing through supermarket chains and self-service stores where convenience and quality play an important role. In many urban areas throughout the region, pre-packed fresh fish and fish products are available in whole, dressed, filleted, smoked or dried.

With strong economic growth in the region and increasing liberalisation in trade through lower tariffs and removal of quotas, intra-regional trade in fisheries is expected to remain strong in Southeast Asia. Coupled with the fact that countries in the region are suppliers of fishery products in the world market, trade with countries outside the region, especially other Asian countries are likely to increase. Far East Asian countries such as Japan, Hong Kong, Korea and Taiwan serve as important seafood markets for the region.

Exports of fishery commodities from Southeast Asian countries totalled US$6.5 billion in 1993 and this constituted about 16% of the fishery products traded in the world market. In the same year, its imports of fishery commodities totalled US$1.9 billion giving a trade surplus of about US$4.6 billion for the region. In 1993, Thailand overtook USA as the world's leading exporter of fishery commodities with exports valued at US$3.4 billion. Japan is the main market for Thai fishery products while Malaysia and Singapore continue to be its major markets for fresh/chilled fishery products. Exports to Japan in 1993 accounted for about 35% of the country's total export value.

Indonesia is among the top 10 exporter of fishery products in the world with exports totalled US$1.4 billion in 1993 or about 3.4% of the world's fishery trade. Japan is its leading market accounting for more than 50% of its total export value in 1993 while markets in the Southeast Asian region constituted almost 16%.

Japan, the world's main importer of fishery commodities, imported about 3 million tonnes of seafood valued at US$14.2 billion in 1993 and 5 countries in Southeast Asia i.e. Thailand, Indonesia, Philippines Vietnam and Malaysia were among its top 20 suppliers.

Experts of fishery products from the region is expected to rise as many countries in the region have put in a lot of efforts to boost exports through product development and market diversification. However, many major importing countries have started to impose strict quality standards for fish and fishery products. In order to comply with the food safety demands of the importing countries, many countries in the region have formulated programmes involving the inspection of fishery products based on the Hazard Analysis and Critical Control Points (HACCP) principle.

region, there was an increase in the demand for fish and this was met by a more intensive exploitation of aquatic resources.

In order to fulfill nutritional, social and economic obligations, countries in the region have recognized the need to introduce management measures to ensure sustainable and responsible fishing and fish culture practices. This requires a number of changes to be made in the fisheries sector in the region which includes the level of fishing effort, adjustments in the size of fishing fleets, diversification and changes of fishing gear, modification of culture practices, technologies, introduction of environmentally friendly and sustainable fish production. Besides this, preservation and processing technologies has to be modified to take into account aspects such as food safety and quality. Alternative income generating activities, vocational training programmes and support measures for the poor fishing communities will have to be introduced.

The implementation of economic liberalisation policies and financial sector reform aiming at enhancing efficiency and viability of financial institutions has led to the decline of institutional credit to the fisheries sector in the region. Hence, there is an urgent need to assist financial institutions in adapting market oriented fisheries credit policies and procedures.

The countries in the region has to step up effort in strengthening fish resources information as well as fish marketing information for policy planning purposes as well as to come up with market strategy and promotion for the region. This can be carried out through training and development of human resources on information system and to set up global fish market price network. So much so that exchange of information can easily be carried out among the countries in the region. Countries in the region should also cooperate in the development of fish quality control and inspection for the domestic market as well as for international market.

8. CONCLUSIONS

Fish is a major source of animal protein in the Southeast Asian region and a wide variety of products is available. Due to rapidly growing human population and purchasing power, the overall demand of fish for the region is expected to increase. This is particularly so with strong economic growth being experienced in the region. However, the increase demand will put pressure on the limited supply caused by extremely high level of exploitation of resources. Closer cooperation in terms of fisheries management has to be fostered among the countries in order to manage the resources on a sustainable basis and to increase benefits from existing resources. Information exchange within the region has to be enchanced as to tackle relevant regional fisheries issues at hand in a more definite terms and also to facilitate future planning for the fisheries sector in the region. Intra regional trade is likely to stay strong with increasing liberation in trade. At the same time, trades with countries outside the region is expected to increase.

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MAP 1 : SOUTHEAST ASIA

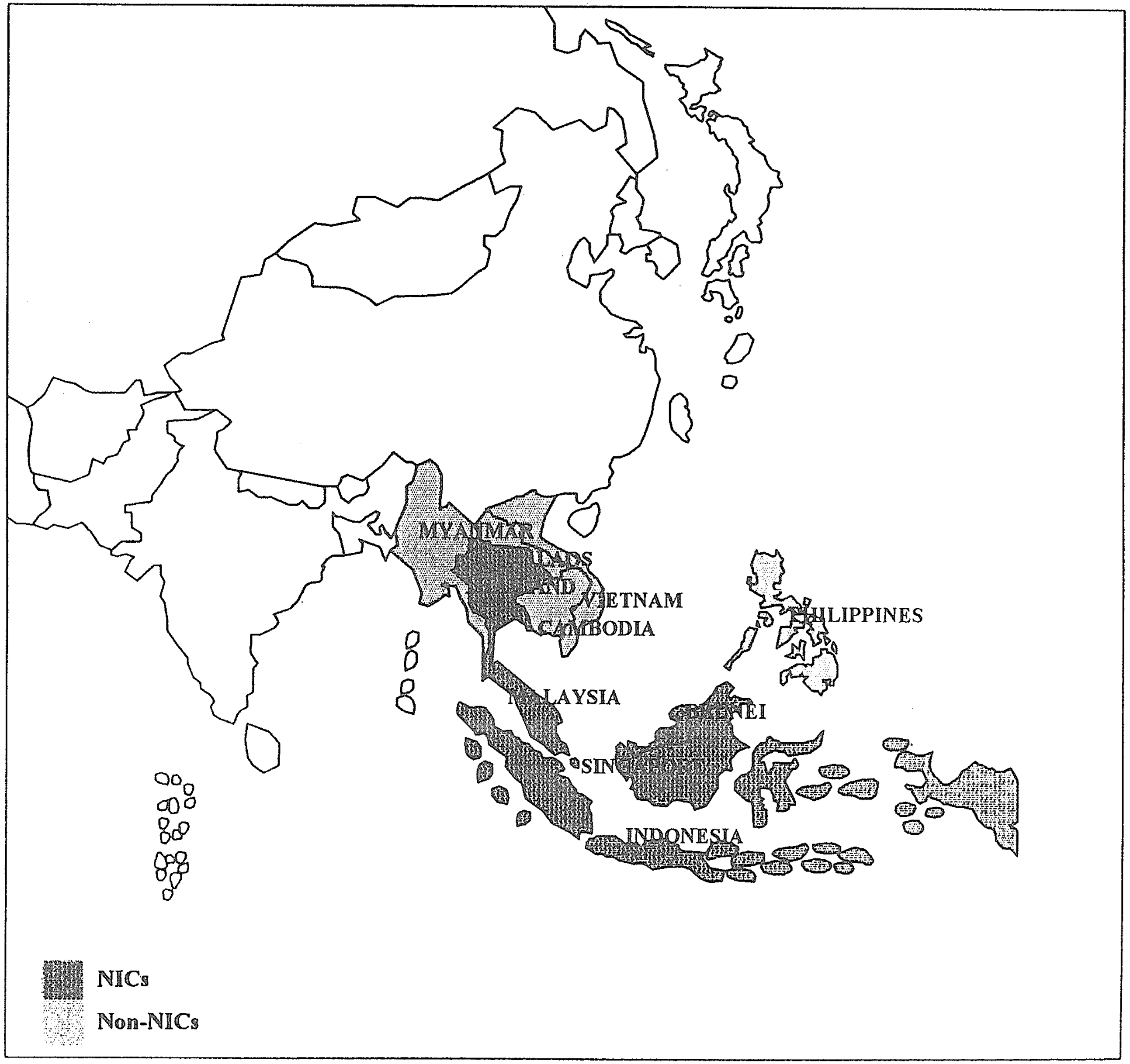

Figure 1a: Per Caput Fish Supply By Country Status In Asia

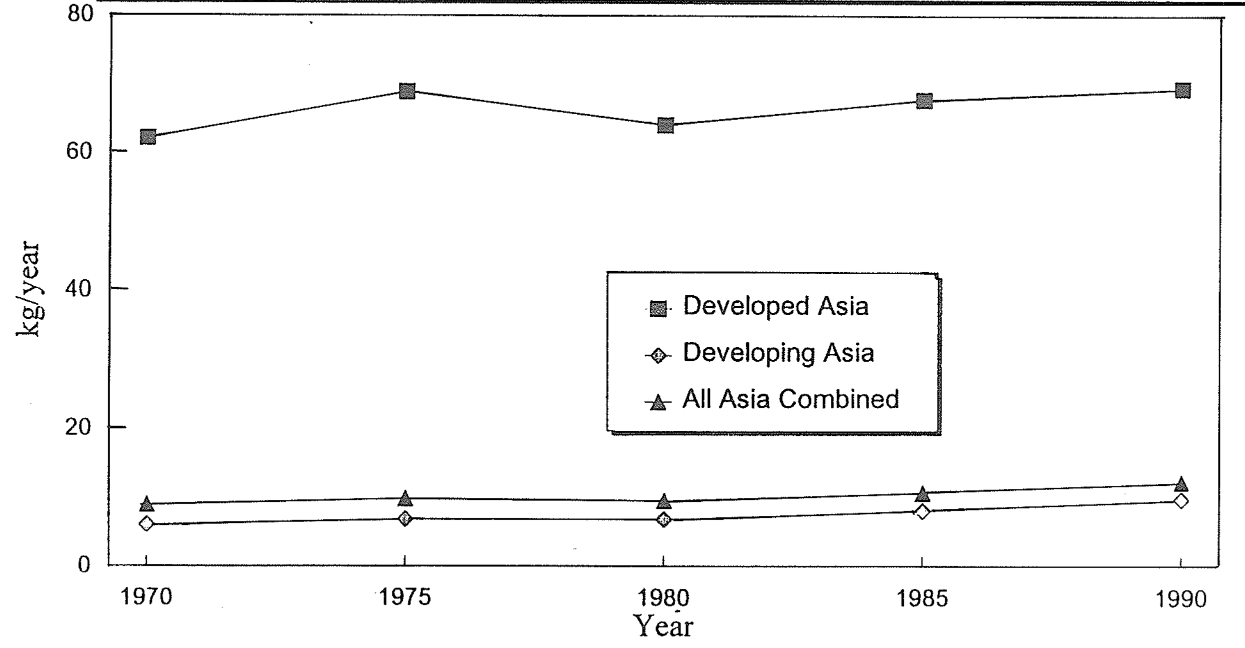

Figure 1b: Percentage Of Fish/Animal Protein Intake By Country Status In Asia

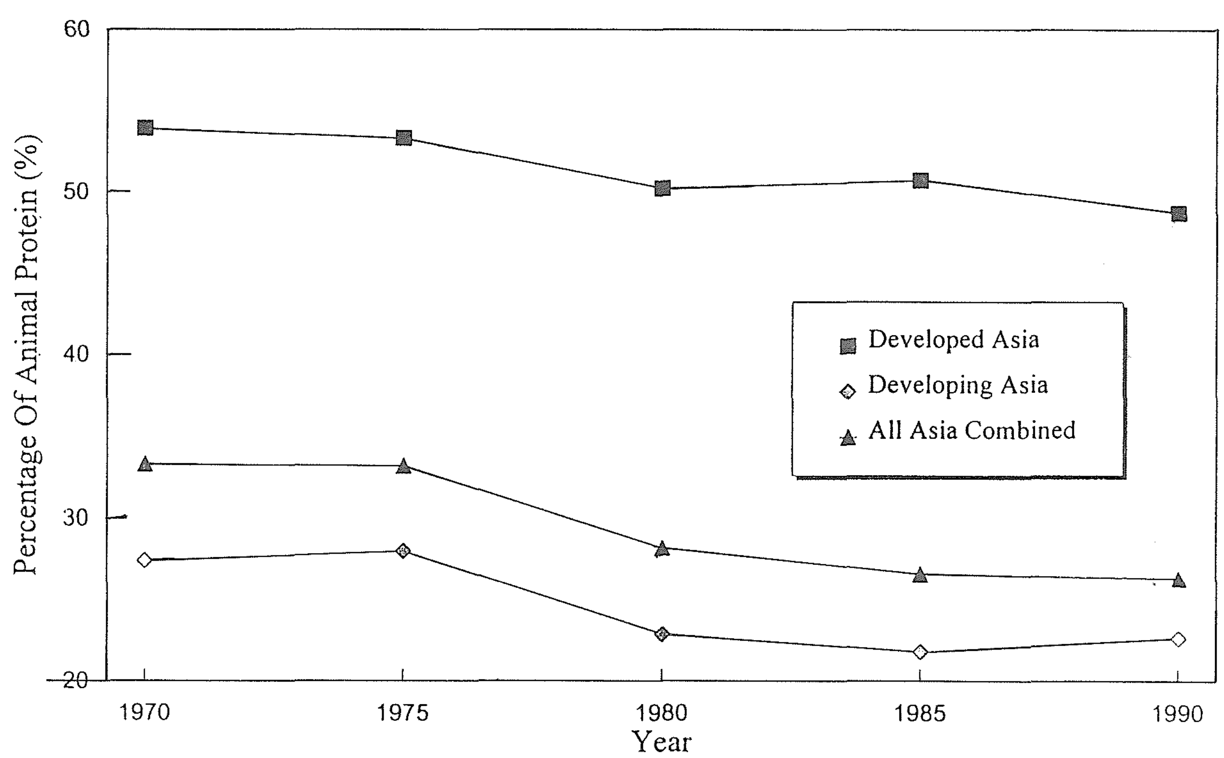

Figure 2a: Per Caput Fish Supply By NICs In Southeast Asia

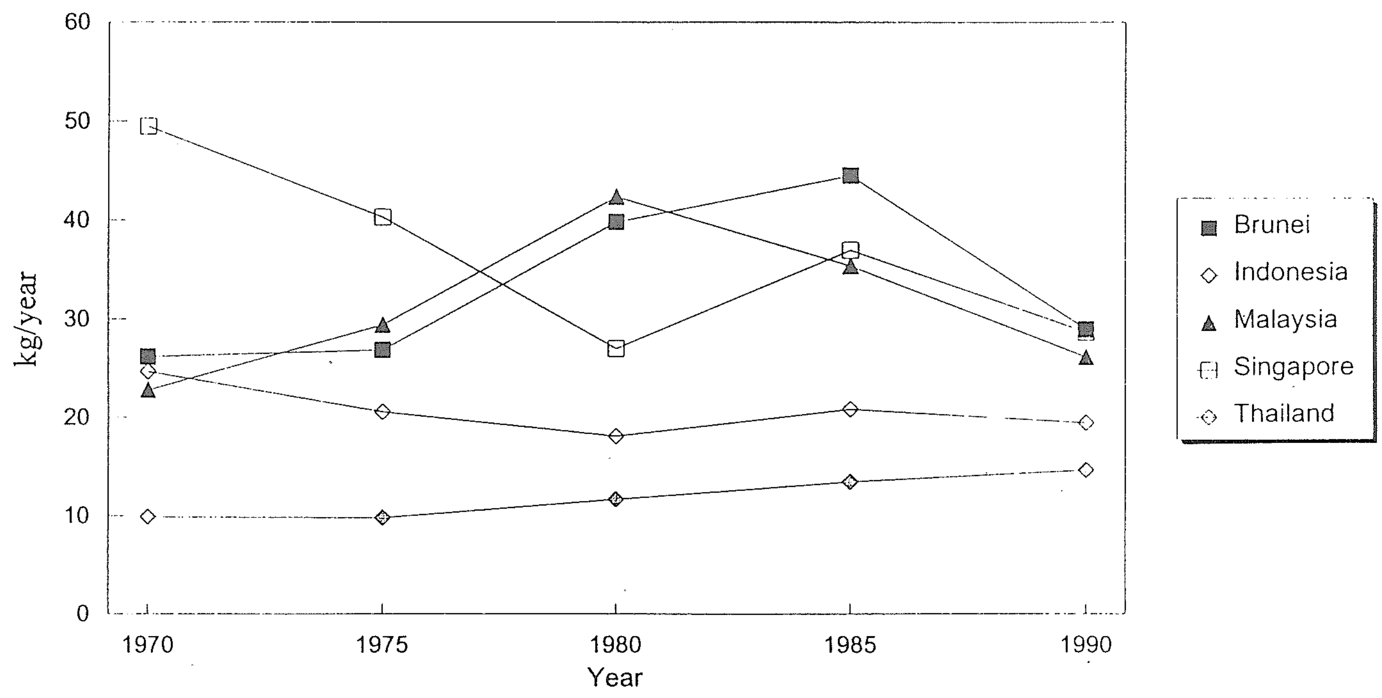

Figure 2b: Per Caput Fish Supply By Non-NICs In Southeast Asia

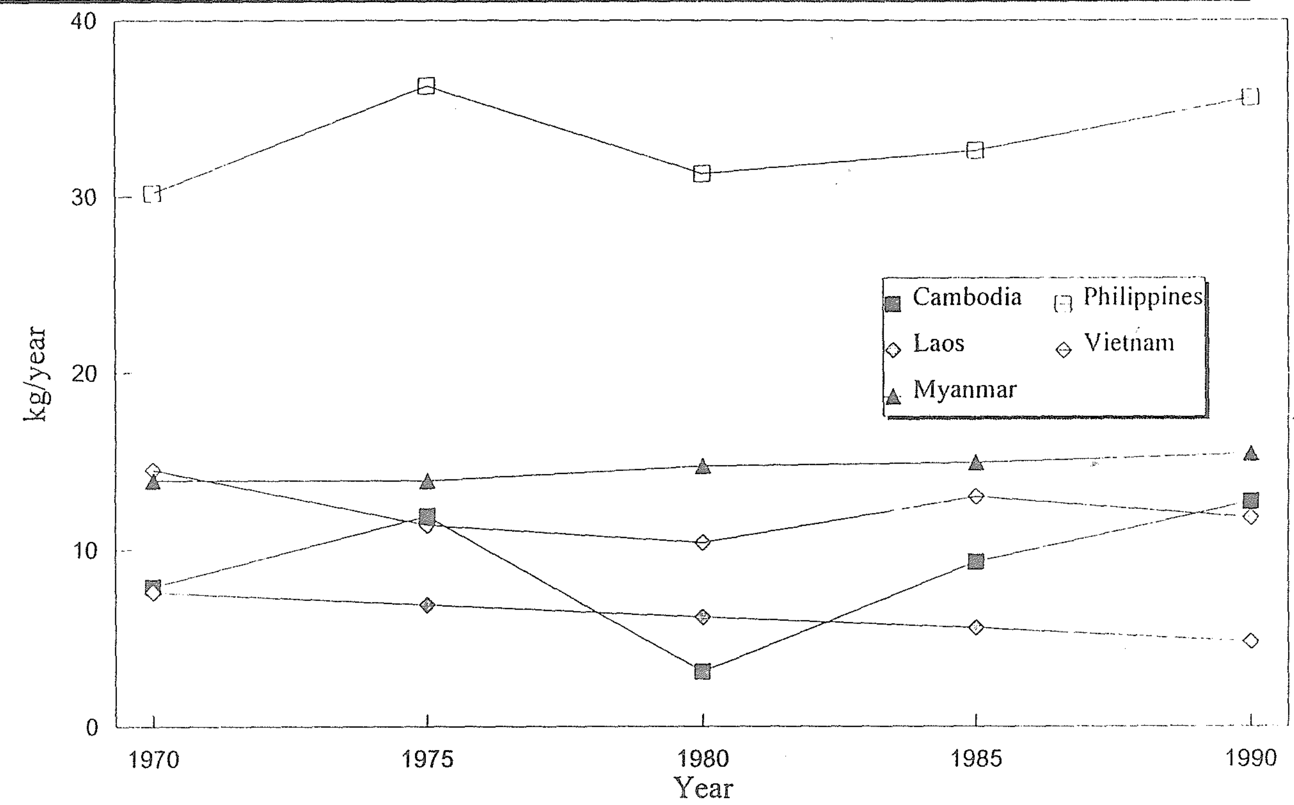

Figure 3a: Percentage of Fish/Animal Protein Intake By NICs In Southeast Asia

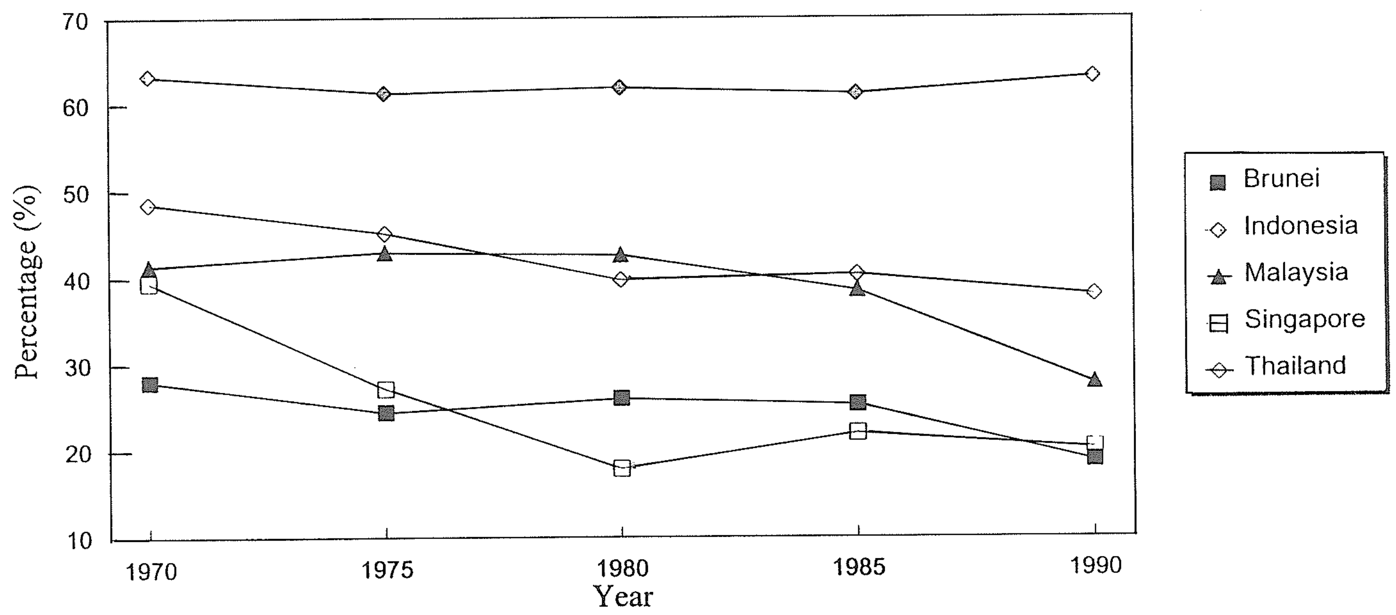

Figure 3b: Percentage of Fish/Animal Protein Intake By Non-NICs In Southeast Asia

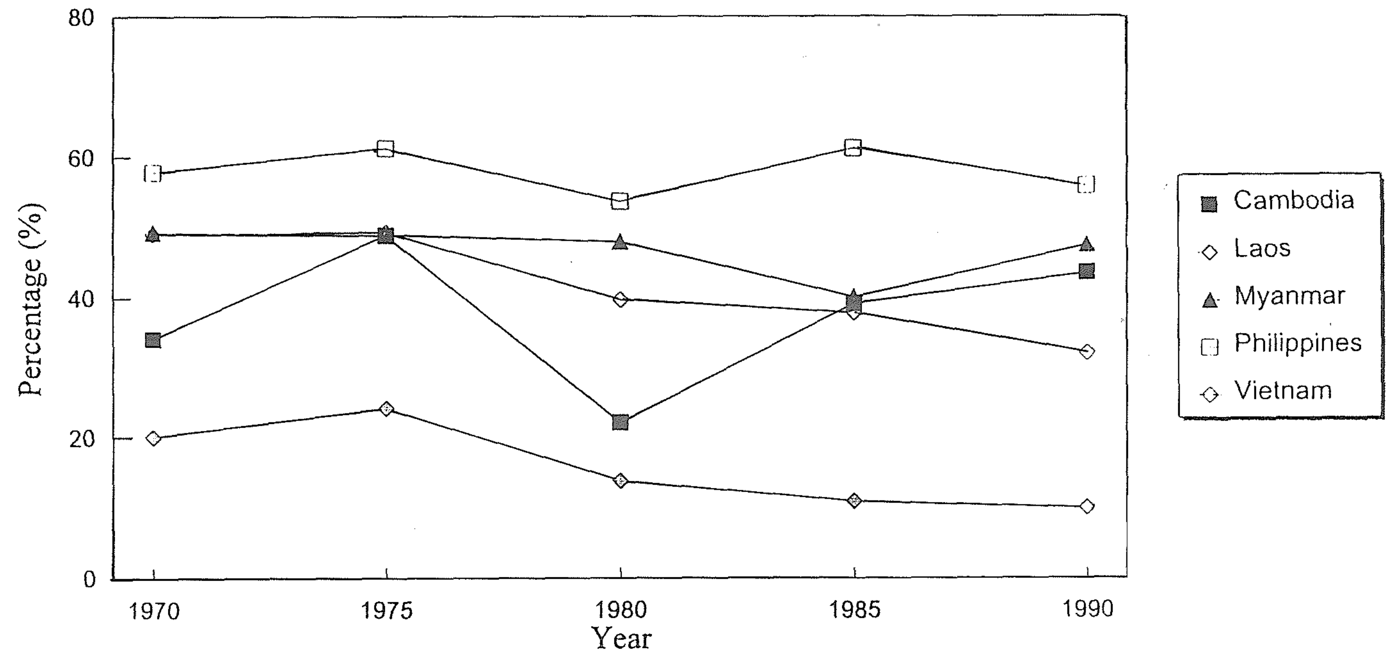

Figure 4: Capture And Culture Fisheries Production In Southeast Asia 1987 - 1992

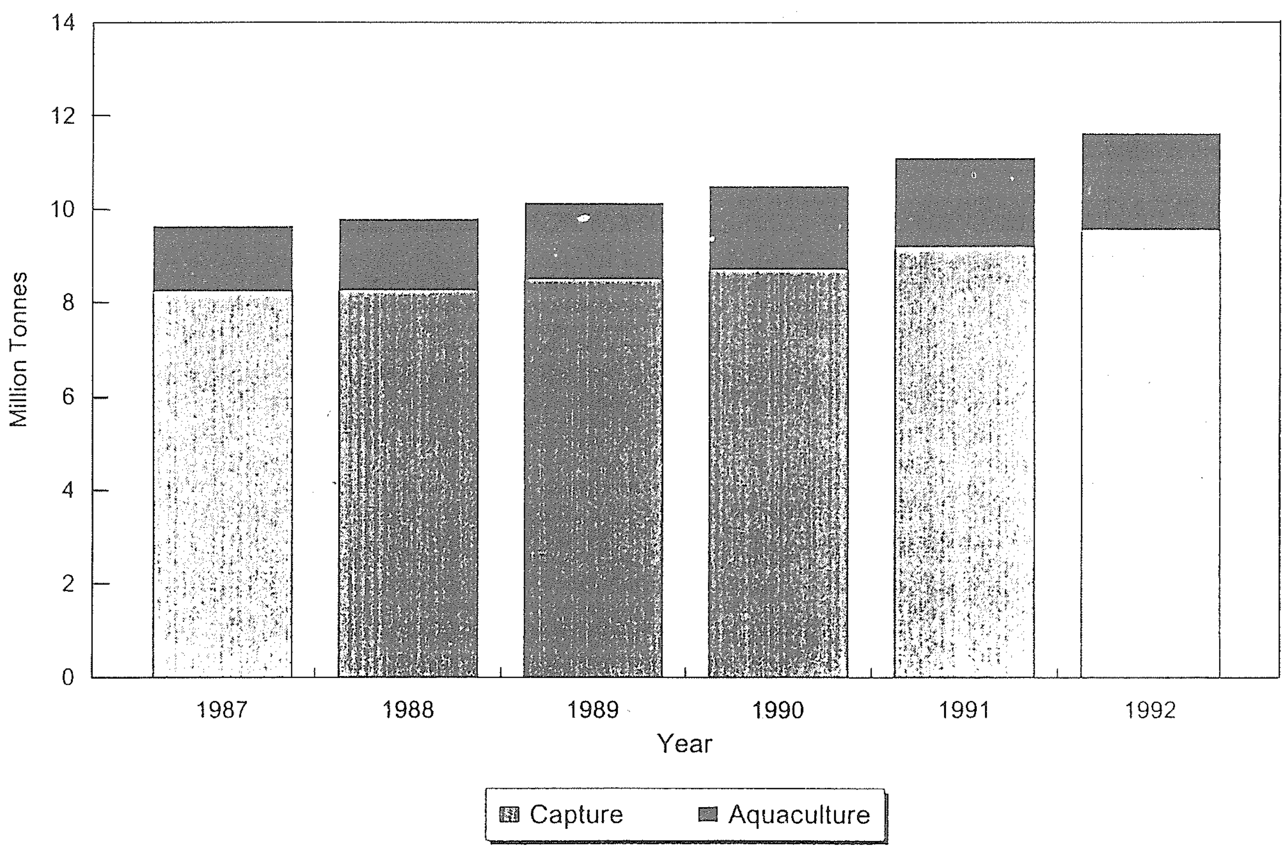

Table 1 : Asia Per Caput Supply of Fish and Percentage of Fish/Animal Protein Intake (1970 - 1990)

Area \ Year	1970	1975	1980	1985	1990
Developed Asia					
(i) Per Caput supply (kg/yr)	62.1	68.9	64.0	67.7	69.4
(ii) % In Animal Protein	53.9	53.3	50.2	50.7	48.7
Developing Asia					
(i) Per Caput supply (kg/yr)	6.0	6.8	6.8	8.0	9.7
(ii) % In Animal Protein	27.4	28.0	22.9	21.8	22.6
All Asia					
(i) Per Caput supply (kg/yr)	8.9	9.8	9.5	10.6	12.2
(ii) % In Animal Protein	33.3	33.2	28.2	26.6	26.3

Note : Developed Asia : Japan and Israel
Developing Asia : The Rest
Source : FAO

Filename : T1

Table 2: Average Food/Fish Balance Sheet For Countries In Southeast Asia In 1990

Country	Production (tonnes)	Non Food Uses (tonnes)	Imports (tonnes)	Exports (tonnes)	Stock Changes (tonnes)	Food Supply (tonnes)	Population (1,000)	Per Caput Supply (kg/year)
Non-NICs								
Cambodia	105,000	0	-	-	0	105,000	8,246	12.7
Laos	20,000	0	0	0	0	20,000	4,139	4.8
Myanmar	743,818	96,696	0	7,200	0	639,922	41,675	15.4
Philippines	2,208,823	0	153,651	143,586	436	2,219,320	62,413	35.6
Vietnam	850,000	1,650	0	64,366	0	783,985	66,693	11.8
Total Non-NICs	3,927,641	98,346	153,651	215,152	436	3,768,227	183,166	20.6
NICs								
Brunei	2,307	0	5,669	260	0	7,716	266	29.0
Indonesia	3,080,450	20,335	8,299	353,036	250	2,715,623	184,283	14.7
Malaysia	602,539	205,487	267,892	208,618	12,507	468,834	17,891	26.2
Singapore	13,316	4,200	233,137	170,341	6,266	78,177	2,723	28.7
Thailand	2,598,616	1,010,907	497,027	1,027,028	29,312	1,087,016	55,702	19.5
Total NICs	6,297,228	1,240,929	1,012,024	1,759,283	48,335	4,357,366	260,865	16.7
Total SEA	10,224,869	1,339,275	1,165,675	1,974,435	48,771	8,125,593	444,031	18.3

Source : FAO

Filename : T2

Table 3 : Southeast Asia : Per Caput Supply of Fish and Percentage of Fish/Animal Protein Intake (1970 - 1990)

Country \ Year	1970	1975	1980	1985	1990
Brunei					
(i) Per Caput Supply(kg/yr)	26.2	26.9	39.8	44.5	29
(ii) % In Animal Protein	28	24.5	26.1	25.4	18.9
Indonesia					
(i) Per Caput Supply(kg/yr)	9.9	9.8	11.7	13.5	14.7
(ii) % In Animal Protein	63.3	61.3	61.9	61.2	63.1
Malaysia					
(i) Per Caput Supply(kg/yr)	22.8	29.4	42.4	35.4	26.2
(ii) % In Animal Protein	41.4	43.0	42.7	38.6	27.9
Singapore					
(i) Per Caput Supply(kg/yr)	49.5	40.3	27	37	28.7
(ii) % In Animal Protein	39.5	27.2	18.0	22.1	20.4
Thailand					
(i) Per Caput Supply(kg/yr)	24.7	20.6	18.1	20.9	19.5
(ii) % In Animal Protein	48.5	45.2	39.8	40.4	38.0
Cambodia					
(i) Per Caput Supply(kg/yr)	7.9	11.9	3.1	9.3	12.7
(ii) % In Animal Protein	34.1	48.9	22.2	39.2	43.6
Laos					
(i) Per Caput Supply(kg/yr)	7.6	6.9	6.2	5.6	4.8
(ii) % In Animal Protein	20.1	24.2	13.9	11.0	10.1
Myanmar					
(i) Per Caput Supply(kg/yr)	13.9	13.9	14.7	14.9	15.4
(ii) % In Animal Protein	49.3	48.9	48.0	40.1	47.6
Philippines					
(i) Per Caput Supply(kg/yr)	30.2	36.3	31.3	32.6	35.6
(ii) % In Animal Protein	57.9	61.3	53.7	61.3	55.9
Vietnam					
(i) Per Caput Supply(kg/yr)	14.5	11.4	10.4	13.0	11.8
(ii) % In Animal Protein	49.1	49.3	39.7	37.9	32.1

Source : FAO

Filename : T3

Table 4: Three Years Per Caput Food Fish Supply By Major Species Group In Southeast Asia - NICs
(Quantity in kg/year)

Country	Freshwater Diadromous	Demersal	Pelagics	Marine unspecified	Total fin fish supply	Crustacean	Mollusc	Cephalopods	Aquatic animals	Total Shellfish
Brunei										
1980-1982	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1988-1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indonesia										
1980-1982	3	1.4	5.2	1.2	10.8	0.8	0.2	0.1	0	1.1
1988-1990	3.6	1.8	6.9	1.2	13.5	0.9	0.2	0.1	0	1.2
Malaysia										
1980-1982	1	5.4	13.3	11.1	30.8	3.9	4.7	1.1	0.3	10
1988-1990	1.5	5	7.8	8.2	22.5	3.7	0.2	0.6	0.5	5
Singapore										
1980-1982	0.6	3.4	14.4	3.1	21.5	2.2	3.9	1.1	0.1	7.3
1988-1990	0.8	0.9	9.5	2.2	13.4	4.9	5.1	5.7	0.1	15.8
Thailand										
1980-1982	3	1.7	6	1.6	12.3	3	2.9	0.8	0.8	7.5
1988-1990	3.4	1.5	8.9	0.5	14.3	1.8	3.2	0.9	0.1	6

Source : FAO

Filename : T4

Table 5: Three Years Per Caput Food Fish Supply By Major Product Types In Southeast Asia - Non NICs (Quantity in kg/year)

Country	Freshwater Diadromous	Demersal	Pelagics	Marine unspecified	Total fin fish supply	Crustacean	Mollusc	Cephalopods	Aquatic animals	Total Shellfish
Cambodia										
1980-1982	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1988-1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Laos										
1980-1982	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1988-1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Myanmar										
1980-1982	2	0	0	12.2	14.2	0.3	0	0	0	0.3
1988-1990	1.2	0	0	13.8	15	0.3	0	0	0	0.3
Philippines										
1980-1982	5.8	5.4	16	0.2	27.4	1.1	4	0.6	0	5.7
1988-1990	5.7	5.4	18.6	0.3	30	1	3	0.6	0	4.6
Vietnam										
1980-1982	3.2	0	0	6.4	9.6	0.9	0.3	0.2	0	1.4
1988-1990	3.8	0	0	7.8	11.6	0.4	0.3	0	0	0.7

Source : FAO

Filename : T5

Table 6: Three Years Per Caput Food Fish Supply By Major Product Types In Southeast Asia - NICs
(Quantity in kg/year)

Country	Finfish Fresh	Shellfish Fresh	Fin Fish Frozen	Shellfish Frozen	Fin fish Cured	Shellfish Cured	Fin fish Canned	Shellfish Canned	Fin fish Preparation	Shellfish Preparation
Brunei										
1980-1982	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1988-1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indonesia										
1980-1982	5.8	1.1	0	0	3	0	0	0	0	0
1988-1990	8.1	1.2	0	0	3.9	0	0	0	0	0
Malaysia										
1980-1982	23.2	8.2	0.1	0	1.2	0.3	1.5	0.1	0.4	0
1988-1990	14	3.8	1.5	0.2	1.4	0.2	0.6	0	0.5	0.1
Singapore										
1980-1982	13.1	4.4	0	0.2	0.7	0.2	3.3	0.4	0.2	0
1988-1990	4.2	0.7	3.2	9.2	0.3	0.6	2.4	0.2	0.6	0
Thailand										
1980-1982	6.1	5.4	1.2	0.1	1.6	0.5	1.1	0.1	0.3	0.1
1988-1990	5.7	3.8	7.1	0.1	0.6	0.5	0	0	0.1	0.3

Source: FAO

Filename : T6

Table 7: Three Years Per Caput Food Fish Supply By Major Product Types In Southeast Asia - Non NICs (Quantity in kg/year)

Country	Finfish Fresh	Shellfish Fresh	Fin Fish Frozen	Shellfish Frozen	Fin fish Cured	Shellfish Cured	Fin fish Canned	Shellfish Canned	Fin fish Preparation	Shellfish Preparation
Cambodia										
1980-1982	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1988-1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Laos										
1980-1982	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1988-1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Myanmar										
1980-1982	3.9	0.1	0	0	1.5	0.1	0.1	0	2.6	0
1988-1990	4.1	0.2	0	0	1.5	0.1	0	0	2.6	0
Philippines										
1980-1982	20.4	3.1	0.1	0	3.8	0.1	0.5	1.3	0.4	0.2
1988-1990	22	1.7	2.1	0	3.8	0.1	0	1.3	0.4	0.3
Vietnam										
1980-1982	4.9	0.8	0	0	1.4	0.1	0	0	0.2	0.1
1988-1990	5.9	0.4	0	0	1.7	0.1	0	0	0.2	0.1

Source : FAO

Filename : 77

Table 8 : Southeast Asia : Landings of Capture Fisheries, 1987 - 1992
(Quantity In Tonnes)

	Country \ Year	1987	1988	1989	1990	1991	1992
NICs	Brunei	2,651	2,039	2,316	2,385	1,688	1,714
	Indonesia	2,128,243	2,295,115	2,426,574	2,444,359	2,644,279	2,751,823
	Malaysia	572,395	565,511	554,815	556,104	559,885	570,622
	Singapore	14,800	13,271	10,650	11,459	11,054	9,201
	Thailand	2,604,599	2,423,278	2,440,052	2,494,444	2,614,154	2,881,120
Non-NICs	Cambodia	67,360	82,059	75,806	105,320	111,710	103,480
	Laos	14,000	21,000	20,008	18,000	17,000	14,000
	Myanmar	680,365	698,874	726,816	736,731	764,995	795,575
	Philippines	1,427,748	1,410,899	1,469,462	1,537,336	1,623,988	1,534,452
	Vietnam	726,104	753,300	778,300	808,000	846,000	893,279
	Total NICs	5,322,688	5,299,214	5,434,407	5,508,751	5,831,060	6,214,480
	Total Non-NICs	2,915,577	2,966,132	3,070,392	3,205,387	3,363,693	3,340,786
	Total S.E.A	8,238,265	8,265,346	8,504,799	8,714,138	9,194,753	9,555,266

Source : FAO

Filename : T8

Table 9 : Southeast Asia : Nominal Catches of 5 Major Species Group By Major Fishing Areas

	Group of Species	1987	% of Total	1992	% of Total
Fishing Area 57					
Indian Ocean , Eastern	35 herring, sardine and anchovies	245,460	9.18	239,055	7.25
(Indonesia, Malaysia, Myanmar	33 Red fishes, basses and congers	237,286	8.87	323,306	9.81
Thailand)	34 Jacks and Mullets and Sauries	196,197	7.34	210,851	6.39
(Bangladesh, India, Japan	36 Tunas, bonitos and billfishes	180,189	6.74	196,150	5.95
Rep. Korea and Other Asia)	45 Shrimp, prawns	155,663	5.82	218,292	6.62
	Total (all species group)	2,673,670		3,297,164	
Fishing Area 71					
Pacific, Western Central	35 herring, sardine and anchovies	684,159	9.98	981,114	11.99
(Brunei, Cambodia, Indonesia,	33 Red fishes, basses and congers	656,908	9.58	721,213	8.81
Malaysia, Philippines, Singapore,	34 Jacks and Mullets and Sauries	825,927	12.05	1,113,744	13.61
Thailand and Vietnam)	36 Tunas, bonitos and billfishes	1,325,235	19.33	1,672,152	20.43
(China, East Timor, Japan, Rep. Korea and Other Asia)	45 Shrimp, prawns	373,824	5.45	571,392	6.98
	Total (all species group)	6,855,129		8,182,787	

Source : FAO

Filename : T9

Table 10 : Southeast Asia : Aquaculture Production, 1987 - 1992
(Quantity In Tonnes)

	Year / Country	1987	1988	1989	1990	1991	1992
NICs	Brunei	2	2	2	2	1	17
	Indonesia	456,727	500,090	521,832	599,824	607,507	689,747
	Malaysia	46,937	46,910	54,833	47,877	60,145	79,378
	Singapore	1,855	1,969	1,965	1,857	2,000	2,350
	Thailand	174,492	219,101	260,181	291,939	353,597	359,040
Non-NICs	Cambodia	2,640	4,741	6,282	6,080	6,090	7,670
	Laos	6,000	7,000	8,000	10,000	12,000	16,000
	Myanmar	5,493	5,673	6,947	7,087	4,241	4,425
	Philippines	560,970	599,464	629,325	672,266	692,507	737,501
	Vietnam	145,300	146,700	151,700	152,000	174,000	187,000
	Total NICs	680,013	768,072	838,813	941,499	1,023,250	1,130,532
	Total Non-NICs	720,403	763,578	802,254	847,433	888,838	952,596
	Total S.E.A.	1,400,416	1,531,650	1,641,067	1,788,932	1,912,088	2,083,128

Source : FAO

Filename : T10

Table 11: Production of Fishery Commodities, 1988 and 1992
(Quantity in tonnes)

Country	Year	Fish Fresh Chilled and Frozen	Fish dried salted or smoked	Crustacean Mollusc fresh, frozen Dried, Salted	Fish products preparation whether or not in Airtight containers	Crustacean & Mollusc products & preparation whether or not in Airtight containers	Oil and fats Crude or refined of aquatic animals origin	Meals, Soluble and similar animal feeding stuffs of Aquatic animal origin	Total
Brunei	1988	-	-	-	-	-	-	-	0
	1992	-	-	-	-	-	-	-	0
Indonesia	1988	15,620	712,374	67,023	9,000	960	3,300	1,874	810,151
	1992	194,200	417,520	129,105	55,800	7,060	3,300	18,635	825,620
Malaysia	1988	7,810	25,831	10,510	17,462	4,153	-	43,556	109,322
	1992	2,000	7,600	3,800	15,300	4,030	-	39,400	72,130
Singapore	1988	5,820	-	3,632	1,746	-	-	2,120	13,318
	1992	13,768	-	4,930	1,649	-	-	-	20,347
Thailand	1988	349,307	65,027	187,402	274,781	95,107	-	237,156	1,208,780
	1992	368,700	58,500	241,150	340,600	109,500	-	280,000	1,398,450
Cambodia	1988	-	4,816	151	6,081	-	-	-	11,048
	1992	-	3,179	81	4,176	-	-	-	7,436
Laos	1988	-	-	-	-	-	-	-	0
	1992	-	-	-	-	-	-	-	0
Myanmar	1988	3,800	55,845	2,046	101,311	-	-	-	163,002
	1992	22,600	62,800	8,100	114,000	-	-	-	207,500
Philippines	1988	13,014	218,595	5,127	60,659	99,394	-	-	396,789
	1992	9,776	248,867	7,340	74,025	123,082	-	-	463,090
Vietnam	1988	1,179	13,756	-	97,477	18,977	-	10,134	141,523
	1992	20,122	9,506	-	154,684	33,795	-	25,470	243,577
Total 1988		396,550	1,096,244	275,891	568,517	218,591	3,300	294,840	2,853,933
Total 1992		631,166	807,972	394,506	760,234	277,467	3,300	363,505	3,238,150

Source : FAO

Filename : T11

Table 12 : Southeast Asia : Nominal Catch by Countries (Capture Fisheries and Aquaculture)
(Quantity In Tonnes)

	Year / Country	1987	1988	1989	1990	1991	1992
NICs	Brunei	2,653	2,041	2,318	2,387	1,689	1,731
	Indonesia	2,584,970	2,795,205	2,948,406	3,044,183	3,251,786	3,441,570
	Malaysia	619,332	612,421	609,648	603,981	620,000	650,000
	Singapore	16,655	15,240	13,616	12,306	13,054	11,551
	Thailand	2,779,091	2,642,379	2,700,233	2,786,383	2,967,751	3,240,160
Non-NICs	Cambodia	70,000	86,800	82,088	111,400	117,800	111,150
	Laos	20,000	28,000	28,000	28,000	29,000	30,000
	Myanmar	685,858	704,547	733,763	743,818	769,236	800,000
	Philippines	1,988,718	2,010,363	2,098,787	2,209,602	2,316,495	2,271,953
	Vietnam	871,404	900,000	930,000	960,000	1,020,000	1,080,279
	Total NICs	6,002,701	6,067,286	6,274,221	6,449,240	6,854,280	7,345,012
	Total Non-NICs	3,635,980	3,729,710	3,872,638	4,052,820	4,252,531	4,293,382
	Total S.E.A	9,638,681	9,796,996	10,146,859	10,502,060	11,106,811	11,638,394

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SOUTH PACIFIC ISLANDS

Demand and Supply of Fish and Fish Products in the South Pacific Islands Perspectives and Implications for Food Security

by

R. Gillett, FAO Consultant

CONTENTS

1. INTRODUCTION

1.1 Background

This document has been prepared to provide background on food fish demand and supply in the Pacific Islands region. This information is for input to the Main Conference Document for the International Conference on Sustainable Contribution of Fish to Food Security, to be held in Kyoto, Japan, from 4 to 9 December 1995.

The objective of the paper is to identify Pacific Island characteristics and issues relating to fishery aspects of food security, examine regional perspectives on demand and supply of fish and fish products, and identify options for interventions by governments and institutions for increasing the fishery contribution to the food security situation.

1.2 Regional characteristics and issues

The Pacific Islands region consist of 22 countries and territories located in the tropical central and western Pacific. Although the total land area of the 270 high islands, and more than 2500 small low islands in the region is quite small, the sea area encompassed by the 200-mile extended economic zones is in excess of 30 million square kilometres. Three sub-regions exist: Melanesia in the west, Micronesia in the north, and Polynesia in the east. The current population of the Pacific Islands region is 6.8 million of which 62% reside in Papua New Guinea.

The inshore fishing areas of most countries is quite small, and usually limited to lagoons, reefs, and a steep slopes. The offshore ocean areas are characterized by great depths and clear water. With the exception of Papua New Guinea, virtually no continental shelf exists in the region.

Historically, the inshore areas have provided Pacific Island residents with the vast majority of fish for domestic consumption. The catch is comprised of a large number of species. The offshore areas now produce about ten times the catch, which is mainly tuna caught by industrial fishing vessels from outside the region and consumed in developed countries. Although the Pacific Islands produces only about one percent of the world's fish catch, about half of the global tuna for canning comes from the region. Two large and two small tuna canneries are located in the Pacific Islands. These canneries have a total throughput of approximately 250,000 tonnes of raw tuna. Almost all of the canned product is exported, mainly to North America and Europe.

In general, the inshore areas are heavily fished and often show signs of over-exploitation, especially close to urban areas. A major management issue is the erosion of traditional fisheries management without effective alternative arrangements. Reported statistics on inshore production are usually not very reliable, especially for the subsistence fisheries.

In the offshore areas, research on the target species of tuna over the past 20 years suggests that increased catches could be sustained. There is, however, a strong desire by the countries of the region to increase economic benefits from the fishing activity, including increased access fees from the foreign fleets, increased onshore activity by the foreign fleets, and greater local participation in the fishing. The offshore catch statistics are considerably more accurate than that for the inshore areas. Fish and fishing are tremendously important to the people of the Pacific Islands. Much of the nutrition, welfare, culture, recreation, government revenue, and employment are based on the region's living marine resources. The continuation of current lifestyles, the opportunities for future development, and food security are all highly dependent on fishery assets.

In general terms, the region exports tuna and other high value species while importing canned and inexpensive frozen fish. The relatively large catch from the industrial fishing operations does not make a major contribution to the food supply of the region. With the exception of Papua New Guinea and Fiji, freshwater fisheries have only a minor role. However, due to the small size of the population of central and eastern Pacific islands, per capita contribution of freshwater fish to food supply is important. Present levels of aquaculture food production are small and confined to only a few countries. However, increases in production since 1980 have been reported in several islands such as Fiji, Hawai, New Caledonia, French Polynesia and Papua New Guinea. With respect general food security, the major issues are:

- There is a high dependence on imported food;
- The region is subject to a high incidence of natural disasters which often have large negative effects on the supply of locally-produced food;

  - Cash remittance by Pacific Islanders residing overseas forms an important source of national income and hence ability to purchase food
  - Chronic food security problems are most common in urban areas while acute food security problems are greatest in isolated locations
  - Starvation is virtually unknown in the region but malnutrition occurs, usually from lack of a balanced diet

Fisheries plays an important role in many aspects of food security in the Pacific Islands region. The high per capita consumption of fish (on some islands as high as 250 kg per year) attests to the importance of fish as a source of animal protein.

In many cases the most likely alternative is imported food, which would further increase the already large foreign food dependence and hence vulnerability to factors beyond the control of countries in the region.

The high rate of population growth for most countries Pacific Island countries, taken in conjunction with the limited nature in the inshore fishery resources, is likely to result in lower per capita supplies of local fish in the future.

In addition, urbanization, degradation of coastal areas, destructive fishing techniques, and a breakdown of traditional authority over fishing areas are having a damaging effect on inshore fishery resources. Implementing appropriate management of the small-scale fisheries to assure their sustainability is one of the most pressing concerns.

Natural disasters, including tropical cyclones, storm surges, drought and volcanic eruptions are common in the region. In some of these events fisheries suffer substantially while in others fishing is an option for disaster relief by providing a ready source food and/or cash. Canned fish from outside the region is often provided as alleviation for the food shortages accompanying natural disasters. It has been observed that relief efforts can encourage reliance on imported food.

There are several additional Pacific Island fisheries issues of importance to the role of fish in food security. The prevalence of ciguatera fish poisoning, especially in Micronesia and Polynesia, results in the non-acceptability of many species for food. The difficulties of marketing fishery products from isolated islands in urban centres where the commercial demand exists will continue to challenge governments. It is likely that in the future additional attention will be paid to the effects of global climate change on the region's fisheries, the interaction between industrial and small-scale fisheries and greater use of the region's tuna as food within the region.

2. DEMAND AND CONSUMPTION

2.1 Consumption 1970-1990

Relative to other regions of the world, the estimation of fish consumption in the Pacific Islands is difficult. Reported quantities of fish production and consumption in the region are frequently erroneous[1]. Reasons for this include lack in some countries of mechanisms for estimating catches, low priority given to accurate reporting of known information, inconsistency of inclusion/exclusion of industrial catches, the difficult-to-monitor nature of subsistence fisheries which produces most of the food catch, and the widely dispersed or isolated landing areas.

The difficulty of obtaining accurate information on fish imports, especially canned fish, further compounds the difficulties. Little of the catch from the industrial fisheries enters the food systems of the region[2]. Of the one million tonnes of tuna caught in the Pacific Islands area, about a quarter is processed in regional canneries, but only about one percent of the canned product is consumed in the region.

In the prevailing situation in the Pacific Islands, the most accurate method of estimating consumption may be to disregard the offshore industrial catches and obtain the best information available on coastal fisheries and population.

Accordingly, in Table 1 population data from SPC (1993) is used in conjunction with information in Dalzell and Adams (1994) who use a variety of annual reports, technical reports, nutritional surveys and knowledge of the region to estimate the coastal fisheries production for the 22 countries.

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1 For example, data reported to FAO indicates that per capita fish consumption in American Samoa is about the same as that in Burkina Faso, and that landings in the Marshall Islands are an order of magnitude less than estimated by the South Pacific Commission.

2 Notable exceptions to this would be in the Solomon Islands where local sales of frozen tuna from the industrial pole/line fleet are significant and amount to about 2.4 kg per capita. It should also be noted that unofficial "leakage" from the industrial fishery to domestic consumption is difficult to estimate but probably substantial at transshipment points and canneries.

Table 1: Information on Coastal Fisheries Contribution to Domestic Fish Supplies

Country	Subsistence Fisheries Production (t)	Commercial Fisheries Production (t)	Total Fisheries Production (t)	1990 Population	1990 Per Capita Fish Supply from Coastal Fisheries (kg)
American Samoa	215	52	267	47,200	5.7
Cook Islands	858	124	982	17,000	57.8
Federated States of Micronesia	6,243	637	6,880	108,500	63.4
Fiji	16,600	6,653	23,253	732,000	31.8
French Polynesia	3,691	2,352	6,043	196,300	30.8
Guam	472	118	591	133,900	4.4
Kiribati	9,084	3,240	12,324	71,800	171.6
Marshall Islands	2,000	369	2,369	46,200	51.3
Nauru	98	279	376	9,400	40.0
New Caledonia	2,500	981	3,481	169,900	20.5
Niue	103	12	115	2,200	52.3
Northern Marianas	2,825	141	2,966	44,600	66.5
Palau	750	736	1,485	15,200	97.7
Papua New Guinea	20,588	4,966	25,554	3,727,200	6.9
Pitcairn Islands	8	0	8	100	80
Solomon Islands	10,000	1,150	11,150	320,000	34.8
Tokelau	191	0	191	1600	119.4
Tonga	933	1,429	2,362	94,400	24.5
Tuvalu	807	120	927	9,000	103.0
Vanuatu	2,045	467	2,512	147,500	17.0
Wallis & Futuna	621	296	917	13,700	66.9
Western Samoa	3,281	208	3,489	160,300	21.8
Total	83,913	24,330	108,242	6,068,000	17.8

To obtain per capita total fish consumption from the above information, allowances must be made for imports, exports, and other factors.

With the exception of beche-de-mer and shell (trochus, pearl-shell, greensnail), exports from the coastal fisheries in most countries are small, with the deep-slope bottomfish fishery in Tonga being a special case (approximately 150 tonnes per year). For the purpose of estimation, it can be assumed that exports from coastal fishery production are less 5,000 tonnes per year for the whole region and would therefore be very small on a per capita basis.

All countries of the region import substantial amounts canned fish and some countries import much smaller quantities of frozen whole fish for consumption. Papua New Guinea and Fiji import mackerel for canneries serving the domestic markets. Although it is difficult to determine the amount of fish imports for the region, fish imports for domestic consumption for every Pacific Island country would be greater than exports from the coastal fisheries. National per capita fish consumption would therefore be in all cases greater than the per capita production from coastal fisheries given in Table 1.

A recent study in (FAO 1995) provides detailed information on Fiji and shows that the amount of canned fish consumed is about 9.4 kg per capita per year. In Papua New Guinea, industry sources indicate the amount of canned fish consumed is about twice that of domestic coastal fishery production or about 14.4 kg per capita. The available nutrition literature (summarized in Coyne et al., 1984) suggests that a reasonable approximation of a regional average for imported canned fish consumption would be about 10 kg per capita.

Adding 10 kg to the per capita coastal production figures in Table 1 could therefore be used to produce a crude estimate of per capita fish consumption. Disregarding the special cases of American Samoa and Guam[3], the per capita consumption ranges from 16.9 kg for Papua New Guinea to 181.6 kg for Kiribati. Excluding Papua New Guinea which is quite distinctive from the other Pacific Island countries, the regional average is about 45 kg per capita.

45 kg per year is substantially higher than the world average of 13.32 kg. The consumption rates of the atoll countries of Kiribati (181.6 kg) , Tokelau (129.4 kg), and Tuvalu (113.0 kg) are amongst the highest in the world.

According to Laureti (1992) fish protein represents 38.7 percent of the total animal protein intake in the region which much greater than the world average of 16.1 percent. On many small Pacific Islands the only source of animal protein is fish.

The South Pacific Commission has published estimates of coastal fisheries production in the region on three occasions. The results are not strictly comparable due to different methodology, but general trends should be valid. The results from these three SPC studies are given in Table 2.

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3 American Samoa is the location of two very large tuna canneries resulting in a large per capita consumption of canned food which Coyne et al. (1984) estimated be 56.6 kg per year in the 1970s. Guam is a United States territory and has a large military and tourist population. It is therefore likely that the per capita imports of fishery products are many times greater than the assumed 10 kg regional average.

Table 2: Historical Estimates of Coastal Fisheries Production

Source	Period	Coastal Fisheries Production (t)	Population of Region	Per Capita Fish Supply from Coastal Fisheries (kg)
Van Pel (1961)	1960	31,420	3,150,000	10.0
Crossland and Grandperrin (1979)	Late 1970s	55,130	4,410,000	12.5
Dalzell and Adams (1994)	Early 1990s	108,242	6,068,000	17.8

Because fish consumption in the Pacific Islands has a strong relationship to coastal fisheries production, per capita fish consumption has probably followed a trend similar to that of the per capita production in Table 2. That is, substantially increasing during the last three decades.

In a recent study (FAO 1995) it was shown that in Fiji the per capita consumption of fish over the 15 year period 1979 to 1993 increased from 37.4 kg in 1979 to 38.4 kg in 1993. The amount of imported fish remained stable; the increase was probably due to domestic catches.

2.2 Factors influencing demand

Major factors influencing demand for fish are population, urbanization, real income, price, dietary preference, and natural disasters.

As most of the fish is consumed on a subsistence basis, population is by far the largest determinant of fish demand. Between 1970 and 1990 the population of the region grew by 2,222,000 people which is equal to an annual growth rate of 2.3 per cent, high relative to the world average of 1.8 per cent.

A population movement from outer islands to towns and cities is a dominant feature in most Pacific Island countries. According to World Bank data, the average urbanization rate across the regional was 17 per cent in 1970 but had increased to 24 per cent in 1990.

Although city dwellers have more difficult access to fishery resources, urbanization does not necessarily decrease fish demand, but rather shifts demand to the products of commercial fisheries, especially imports. For example, a dietary study in the Solomon Islands (Jansen and Wilmott 1973) showed that the overall intake of fish products did not change substantially with movement from the outer islands to the capital, but the canned fish component significantly increased. Increase consumption of canned fish in urban areas may also be a reflection of the convenience nature of cans; in the urban environment with increasing demands on time due to paid employment, precooked ready-to-eat canned fish is a time saver.

Another important factor in the demand for fish, especially in the urban environment, is real income and the price of fish relative to this income. World Bank/IMF data shows that the per capita GDP, a measure of real income, actually decreased in the region by .3 per cent between 1970 and 1990.

In general, Pacific Islanders have a strong tradition of eating fish and this preference for fish often dominates over economic considerations, especially in Micronesia and Polynesia. Fresh fish will frequently be purchased even though it is more expensive than the alternatives, often imported mutton flaps, turkey tails, or canned meat.

Natural disasters in the Pacific Islands, most often tropical cyclones, characteristically create a greater dependence on imported food, much of which is canned fish. In the period 1960 to 1989 the Cook Island, Fiji, Solomons, Tonga, Vanuatu, Western Samoa, and Papua New Guinea suffered 15, 34, 14, 15, 32, 10 and 2 tropical cyclones respectively (Chung 1991). Although there is no evidence that the incidence of disasters is increasing, for various reasons the amount of damage from each event and the subsequent disaster relief is growing. The high incidence of cyclones in Fiji in 1985 is thought to be responsible for canned fish imports increasing 22 per cent over the previous year.

2.3 Demand projections 2010

Because the demand for fish in the Pacific Islands is strongly linked to population, changes in population should correspond to some extent to changes in demand. According to SPC (1993), between 1990 and 2010 the population of the region will increase from 6,068,000 to 8,871,060 or 46 per cent. This would result in a demand for fish of 166,776 tonnes in 2010, or 58,535 tonnes more than at present.

This demand increase will be tempered to some degree by real income and price, especially by that portion of the population living in urban areas. World Bank/IMF data indicates that the annual growth of GDP per capita in the period from 1990 to 2010 will be a modest 1.7%. The National Centre for Development Studies (1994) predicts that urbanization will occur in the region at an increasingly rapid rate. For example, in Papua New Guinea the urban population will increase from the present 16 per cent to 48 percent in 2010. During the same period in the Solomon Islands the proportion of people living in cities and towns will double to 32 per cent.

3. SUPPLY

3.1 Marine capture fisheries

In terms of volume and value, the region is dominated by the industrial tuna fisheries. About 930,000 tonnes of tuna was caught in the Pacific Islands in 1993. 80 per cent was taken by the 180 purse seiners operating the region, with most of the remainder being caught by pole/line (7%) and longline gear (13%). The vast majority of the catch is harvested by vessels from Asia and the United States. The catch composition is skipjack (59%), yellowfin (32%), bigeye (5%), and albacore (4%).

The catch decrease in recent years does not appear to be indicative of over-fishing. In June 1993, by region-wide agreement, all purse seine fleets were required to cease transshipment at sea, resulting in reduced catches. Large scale research on the target species of tuna over the past 20 years does not suggest that a condition of overfishing is occurring. On the contrary, scientists from the South Pacific Commission believe that present yellowfin catches could probably be doubled and skipjack further increased.

Large fluctuations in catch levels in particular countries can be expected when El Nino conditions occur. In general, during those years, the purse seine fishery shifts from the area to the north of Papua New Guinea to east into Kiribati.

Although dwarfed in volume by the offshore tuna fisheries, the coastal fisheries provide almost all the non-imported fish supplies to the region and hence have a crucial role in food security. Dalzell and Adams (1994) estimate that, of the 108,242 tonnes of fish supplied by the coastal fisheries, 76 per cent is from the subsistence fisheries, with the remainder from medium and small scale commercial operations. They indicate that the commercial catch is made up of reef and deep slope fish (43% of total weight), coastal pelagics (18%), trochus/greensnail/pearlshell (9%), crustaceans (8%), beche-de-mer (7%), and estuarine fish (6%). Subsistence fisheries involve a large variety of species. For example, Zann (1992) reports that in Western Samoa the subsistence fisheries make use of 500 species.

3.2 Inland capture fisheries

Inland capture fisheries are only of major importance in the larger islands of Melanesia. In Papua New Guinea two major river systems, the Sepki/Ramu and the Fly/Purari, are quite extensive and provide most of the estimated 8,300 tonnes of freshwater fish caught annually. Future catches in the country can be expected to be much greater due to the introduction of exotic species to the rivers which have very limited fish diversity.

In the smaller countries, freshwater fisheries are of limited importance although it must be mentioned that re-stocking practices in existing inland lakes seem to be increasing. A notable exception is the freshwater mussel (*Batissa violacea*) fishery in Fiji which produces over 1,500 tonnes annually and is one of the most important subsistence and commercial fisheries in Fiji.

3.3 Aquaculture

Aquaculture does not contribute significantly to the food supply in the region. The most successful operations are for pearl oysters, a non-food species. Marine Shrimp culture in Fiji and Tahiti produces about 11 tonnes and 75 tonnes respectively for local markets while New Caledonia produces around 700 tonnes for local and export markets. Although tilapia culture has been attempted in most countries of the region since the 1950s, it has had mixed success; tilapia provides substantial food in Papua New Guinea (but it is mainly caugth in rivers, lakes and damms) Fiji (61 tonnes in 1993) and Guam (149 tonnes in 1993) but is ignored or considered a pest in many other countries. Although with limited impact, some stock enhancement efforts are being conducted in the region both in marine and inland waters.

3.4 Less waste

Improvement of fisheries management in coastal areas and retention of discards in the industrial fishery are mechanisms for the reduction of fish wastage.

The breakdown of the traditional systems for management of inshore fishery resources, without alternate effective arrangements to take their place, is arguably the greatest fishery problem of the region. In traditional times, villages in most island groups of the region exerted substantial control over the marine resources in adjacent areas. These coastal communities frequently excluded or limited fishing by other groups in their area. Because of this arrangement, the groups holding the fishing rights had a strong interest in carefully managing the resources for their long-term future. The success of this type of traditional system in preventing over-harvesting is well documented and it is generally accepted that in previous times the system functioned satisfactorily. Many of the formerly effective traditional marine management systems in the Pacific Islands have broken down. Reasons for this include reduced authority of village leaders, population increases, commercialization, introduced technology, and doubts over the biological rationale of traditional management action. The development of effective management mechanisms for the small-scale fisheries, although an immense task, is urgently required in the region.

In the purse seine and longline tuna fisheries, non-target species are captured and the usual practice is to discard them at sea because those low-value species take up space in the fish holds which could otherwise be used for prime fish. In the past there has been a reluctance by many government in the region to encourage the offloading non-target species due to the negative effect it may have on the development of small-scale fisheries. In the future, as many of the small-scale fisheries become fully developed and as demand for fish exceeds local supply, justification will mount for utilization of the by-catch of the tuna fisheries.

Because ciguatera fish poisoning results in significant wastage, a breakthrough in research on in this field could have a positive effect on the supply of fish. This would be most applicable for the island groups in the east where the incidence of ciguatera is highest.

3.5 Supply scenario 2010

As mentioned in Section 3.1, it is thought that there is considerable biological potential for increasing the present tuna catches of the Pacific Islands. There is, however, a strong desire by the countries of the region to increase economic benefits from the fishing activity. According to the Forum Fisheries Agency (FFA), the 1,600 foreign fishing vessels operating in the area generally pay only a modest access fee of between 3 and 5 percent of the value of the catch. The FFA has been spearheading efforts by Pacific Island countries to obtain additional benefits from the tuna resources. Due to the considerable solidarity of countries in the region, the measures which have been adopted, although increasing total income from the resource, should prevent any major expansion of tuna catches levels for the foreseeable future.

Major increases in food supplies accessible to medium and small-scale fisheries are unlikely due to the fully exploited nature of most of the resources, tuna being a prominent exception. Due to the nature of tuna fishing, the yields from medium and small scale tuna fishing has not been great. The situation could change if, for example, developments occur affecting fish aggregation devices (FADs) or small scale longlining.

On the other hand, there is the possibility that, with high international prices, exports of fish from coastal fisheries could increase. It is likely that, with lack of effective management, destructive fishing, coastal zone degradation, the yields from coastal fisheries in many areas could actually decrease between now and 2010.

There is the possibility that aquaculture could contribute substantially to the future food supply of the countries in the region, but the probability of this occurring will have to be associated more to the a growing awareness of governments at a policy and technical level than to past performance.

The coastal resources in Papua New Guinea are quite distinct from those in the region in general. It appears as though they are substantially underexploited and yields many times the present 25,000 tonnes could be possible.

4. DISTRIBUTION INCLUDING INTERNATIONAL TRADE

About one quarter of the tuna caught in the region is processed at one of the four canneries located in the Pacific Islands. Much of the other canning grade product is transshipped, with the canneries in Thailand receiving most of the fish. The final destination is mostly the United States and Europe. The sashimi grade tuna production, a relatively small portion of the Pacific Island tuna catches, targets the Japanese market, where it now accounts for 25 per cent of fresh tuna imports.

The production from the subsistence fisheries of the region is consumed very close to the point of landing. Some processing (drying, salting) occurs to increase the shelf life, but the vast majority of the catch is consumed soon after capture.

The small and medium scale commercial fisheries characteristically supply cities and towns close to the point of capture. Most of the finfish exports are done by airfreight, primarily to Hawaii, Japan, and Australia. The non-perishable exports (sharkfin, beche-de-mer) are usually shipped by surface to Asia for further processing.

With regards to fish imports into the Pacific Islands, although Japan formerly exported most of the canned fish to the region, that position is now occupied by Thailand. Frozen imports, usually mackerel and jack mackerel, for both direct consumption and domestic canning, originate from mainly New Zealand, California and Chile.

5. FISH CONSUMPTION 2010

In view of the population increases expected and the limited coastal resources of most of the countries, the most likely situation is that fish consumption per capita from coastal resources will decline. If this occurs there are two consequences: either there will be greater consumption of non-coastal fish resources (tuna or imports) or total fish consumption per capita consumption will decline.

Indictations on the ability to pay for increased fish imports are not promising. The World Bank (1995) states "Past patterns of growth and development in the Pacific Island Member Countries do not appear to be sufficient to provide a progressive improvement in living standards in the future." Similarly, the National Centre for Development Studies (1994) concludes "Rapid population growth is not a cause for concern if it is matched by similar levels of economic growth. But for most of the Pacific island countries real per capita income declined in the 1980s and if low rates of economic growth continue, they could decline in the next two decades."

6. IMPLICATIONS FOR FOOD SECURITY

The most probable scenario is that an increasing dependency on non-local foods and a decreasing diet quality will cause the food security situation in the Pacific Islands region to deteriorate.

The dependency on imported food is already great in the many Pacific Island countries. For example, the Fiji Times of June 13, 1995 reports "The shipping service to Tokelau has been suspended. The Australian owned shipping line servicing the territory was refused a passenger license because it no longer met the required standards. There are reports of food shortages, the situation is not yet critical." It is likely that situations such as this will become increasingly common in outer islands as food sufficiency decreases.

Malnutrition in the region at present is mostly caused by an imbalanced diet. As fish consumption per capita from coastal resources declines, the replacement food will probably be of inferior quality, further eroding the quality of the diet.

7. POSSIBLE POLICY INTERVENTIONS

The critical importance of coastal fisheries and the urgent need for their effective management is well known to the governments of the region. Substantial progress on this issue has not occurred for various reasons. In view of the notion that population alone could cause a large decline in per capita fish food availability, there is even more urgency for management progress. Highest priority should be given to developing mechanisms to prevent over-fishing and the accompanying drop in food production. Local fishing communities must be intimately involved in the development and implementation of these measures. Village-level awareness programmes on the benefits of fisheries management are essential.

In addition to over-fishing, another important factor leading to lower catch levels is the increasingly rapid degradation of coastal marine environments by causes such as destructive fishing, mangrove removal, shoreline development, siltation from logging, pesticides, and sewage. Again, this is well known to Pacific Island governments but much greater consideration to the food-related consequences of such degradation is needed when policy decisions affecting coastal environments are made.

An improvement in the quality of information on coastal fisheries production would allow for a more effective monitoring for management purposes. In addition to the enhancement of national statistical systems, higher priority should be given to both accurate reporting of data to regional/international agencies and to scrutinizing reported data in order to make the information relevant to food security issues. Governments in the region may become more interested in regional fishery statistics if the proposed FAO Pacific Islands statistical area were to be adopted.

To maintain per capita consumption levels, governments should consider greater utilization for local food of the catch from tuna fisheries. This could occur either by requiring retention of non-target species, encouraging local sales by the industrial fleet of a portion of the fish which are normally delivered to canneries for shipment out of the region, or encouraging tuna fishing activity by small and medium scale commercial operations.

This fairly bleak scenario in which coastal fisheries productivity and the supply of food fish is viewed from population perspective may not be fully appreciated by those in the fisheries sector. Efforts should be made to sensitize fishery managers of the implications of the likely conditions in 2010.

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SUB-SAHARAN AFRICA

Demand and Supply of Fish and Fish Products in Sub-Saharan Africa Perspectives and Implications for Food Security

by

A. Bonzon
FAO Fisheries Department

CONTENTS

1. REGIONAL CHARACTERISTICS AND ISSUES

The fisheries of the Region had developped significantly over the past decade. Fish contributes an important part in the diet of many African communities, and nearly 8 million people are carrying out direct activity in the sector. Earnings from the exports of fishery products exceed expenditures on imports. Despite subtantial increases over the past years in domestic production both from marine and inland fisheries, imports remained however larger than exports in volume terms. Overall, it is more and more difficult to keep pace with increasing demand. Indeed, consumption is stagnating approximately around at 8 kg per caput, although the share of fish protein continues to grow in the total animal protein supply.

Sub-saharan Africa marine fisheries production is characterized by three main features having direct impact on supply. First, although steadily decreasing, almost half (45% in 1990) of marine production is harvested by Foreign fleets, mostly in the Atlantic Ocean. Second, an increasing volume of domestic marine production, mainly from industrial fisheries, is exported outside the Region. 75 to 85% of it, is exported in a single market: the European Union. Third, the Western portion of the continent (i.e: from Mauritania to South Africa included) ensure nearly 70% of total marine domestic production. Inland fisheries contributes 45% of total domestic landings of the Region.

The Region is confronted to a challenging situation whereby demand is rapidly increasing, production seems to have reached a plateau and imports are more and more constrained as a result of macro-economic difficulties. However, this situation is far to be homogeneous throughout the Region. Major differences are between the Eastern and the Western part of the Continent, and, within the latter between the Northern and Southern part which are caracterized by abundant resources and low population densities while the Gulf of Guinea sub-region has opposite features.

2. DEMAND AND CONSUMPTION

2.1 Consumption 1970-1990

2.1.1 **Per caput consumption**

Currently (1990) the greater part of the domestic fish production is utilized as local food (some 4 million tons/years). About 0.5 millions tons of the foreign fleet catches harvested in African waters are exported to countries of the Region for human consumption. In addition, 1.4 million mt of fish is imported. Leaving aside non food uses, the average per caput fish supply was reported to be 8,4 kg for the Region in 1990.

In this respect, three different periods could be identified since 1970. From 1970 to 1975, per caput consumption fluctuated in average at about 7.9 kg/caput as production increased and the trade balance was globally stable. From 1976 to 1982, imports boosted and the average supply increased up to 8.8 with a peak to 9.4 in 1982. It started declining thereafter at an average of 8.2 during the period 1983-1990 as the ratio gross imports/per caput declined from 4 to 2.7 between 1982 and 1990.

Thus, despite significant increases in domestic production over the period, per caput supply remain at best stable; with increasing difficulty to maintain enough imports (30% of the supply in 1990) to cope with population growth. However, it should further be noted that: per caput supply is below 2 kg in countries such as Ethiopia, Eritrea, Burkina Faso, Niger, Lesotho, Rwanda, Sudan and Swaziland but is above 20 Kg in countries such as Angola, Congo, Gabon, Gambia, Ghana, Sao Tomé, Senegal and Sierra Leone. Moreover, per caput supply has steadily increased over the period in countries such as Senegal, the Gambia, Ghana, Madagascar, Tanzania or Uganda. Per caput supply is about 3 time more in Western than Eastern Africa.

Recent trends toward decreasing per caput supply are mainly attributable to the combinaison of two main factors: population growth rate (about 3% per annum) has become higher than the growth rate of landings which are not exported, and as a consequence of current economic hardship in the Region, the volume of imports necessary to keep pace with increasing demand is not secured anymore.

2.1.2 **Protein intake**

Vegetable proteins traditionally accounts for the bulk of african dietary intake (about 80%); and this will probably remain so in the medium term. In many part of the region, fish is the single most important component of the animal protein supply. It accounted on average 24% in 1990 (this compares to 20 % in 1970). However, this is not evenly distributed. It represents about 37% in the Western portion of the region, 10% in the Eastern part and 21% in landlocked countries. More precisely, in Congo, Equatorial Guinea, Ghana, Sao-Tome and Principe, fish represents over 60% of animal protein intake; between 40 and 60% in: Angola, Gambia, Liberia, Malawi, Senegal and Togo, but only less than 10% in countries such as: Bostwana; Burkina Faso; Cape Verde; Djibouti; Ethiopia; Kenya; Lesotho; Niger; Rwanda; Somalia; Sudan; Swaziland; Zimbabwe.

2.1.3 Species composition in supply

As far group of species is concerned the rather stable proportion of freshwater fishes in global supply during the last decade could be noted: 44% in 1970; 34% in 1980; 36% in 1985; 36% in 1990. Concerning marine species only, pelagic species represented 45% of global marine fish supply in 1970, 51% in 1980, 50% in 1985, 46% in 1990.

With regard to the type of product in global supply, as said above, salient point seems to be the rather stable proportion of fresh fish consummed (42% in 1970; 42 % in 1980, 49 % in 1990) in the global supply of finfish (In sub-saharan Africa, recorded supply of shellfish remains marginal at 1.7% of the total). It has approximately doubled in volume between 1972 and 1990 while, the consumption of frozen fish has almost being multiplied by ten between 1971 and 1990. Consumption of canned products (in live weight equivalent) is steadily decreasing since 1981 while, on the overall period (1970-1990) consumption of cured finfish remains stable.

2.3 Factors influencing supply and demand

2.3.1. Population growth

With a rate of about 2.9% per year the region has the highest population growth rate in the world. Forecasts are that the population will grow from its 1990 level of 525 million to 700 million in 2000 and 915 million in 2010. It is however expected that growth rate will stabilize by the year 2025 and start declining thereafter. In the context of the present review this factor is obviously the most important.

2.3.2 Economic situation and expected GDP growth

The present economic hardship confronting sub-saharian Africa is well known and does not need long development. In short, economic development will hardly boost fish demand in the short/medium term. It could indeed be pointed out that:

- External debt of sub-saharian Africa has been multiplied by 2,5 over the last fourteen years (84 billion USD in 1980, 211 billion UDS in 1994);

- Regional per caput GDP growth rate is not only smaller than population growth rate with consequent declining per caput GDP (USD 738 in 1980; USD 611 in 1990 at 1980 constant price) but it is expected to stand at about USD 695 only in 2010;

- The Region (O.8 billion USD in 1993) share of direct foreign investments in developing countries has dropped from 9,4% in 1985 to 1,8% in 1993 while for example this rate increased from 30 to 56 % for Eastern Asia and the Pacific Region during the same period;

- It is estimated that the Region represents 1% of world trade against 3,8% in 1970, etc..

It should be however emphasized that reasons for this situation are quite different from country to country (ranging from war to non sustainable economy). Aggregated figures at the level of the continent tends therefore to strongly biase forecasts. Indeed, despite alarming trends for the Region as a whole, it is believed that for many countries if suitable conditions or institutional willingness are organized (e.g, as in Namibia or in Madagascar) tangible progresses could be made in developing the fishery sector sometime in few years.

It should be kept in mind that in a general context of economic dificulties, the fisheries sector appears somewhat an exception. It generates a substantial amount of much needed foreign exchange with a positive trade balance for the Continent of 640 million $ in 1992 (South Africa excluded) from net exports amounting to 1.4 billion USD. For the sub-saharian African Region alone, performences are less impressive: export balance, still positive, amounted to only 120 million UDS for a total value of exports estimated at USD 755 million in 1992.

The export market is caracterized by its dependency on the E.U (partly as a result of the Lomé Convention). In this context, it is estimated that the reduction of tariff barriers agreed upon by the U.E in the context of the Uruguay Round would not have immediately a negative impact on the countries of the Region because all of them are ACP countries. It will however indirectly decrease the competitiveness of African entrepreneurs, particularly with regard to species such as crustaceans (27% of the value of fish export from the Region in 1993) and Tuna (34% of export value).

Apparently, until recently the correlation between fish food consumption and economic growth did not seem to be obvious. This may stem from an overall stability of fish prices (which need to be better assessed) coupled with high elasticity of demand for this commodity and a steady increase of domestic production over the period considered. As a consequence, per caput GDP decrease since the mid-1970s does not seem to have markedly influenced fish consumption levels until 1988 when volume of imports have started to decline. In view of the modest GDP growth expected for the next 15 years, imports are likely to be further constrained and as price of fish is expected to increase, demand (in volume) will hardly be more (probably less) than current supply inflated by population growth rate. A consequence is that demand will continue to be mainly for low value species (i.e small-pelagic) while most of the demersal production will remain export oriented.

2.3.3. Distribution including international trade

Export

The good performance of the Region in term of export value, over the past decade, was largely based on exports of crustaceans, in particular fresh or frozen shrimp. Decreasing catch rates in most of the shrimp capture fisheries, increasing competition from cultured shrimp product from the far East and indices of stabilizing demand for the products of the Region on the major import market (i.e the European Union) are factors which should be looking at with concern. More recently, improvement in competitiveness are to be noted in the countries belonging to the FCFA zone, following the 1992 devaluation of that currency. But this could vanish rapidly with the implementation of the provisions of 1994 GATT Protocole or the renegociation of the STABEX mechanism under the E.U/ACP Lomé Convention.

Compensations from fishing rights granted to foreign fleets (especially for Tuna and shrimp) also represent a substantial source of revenues in hard currency for coastal States concerned. This is to be taken into consideration when estimating the role of the fishey sector in the economy as these compensations could be theoritically used to imports important volumes of cheaper fish products or for developing local fisheries.

Imports

In quantity terms, Sub-saharan Africa remains a net fish importer. Countries like Nigeria, Côte d'Ivoire, Cameroon, South Africa, Angola, and Zaire rely heavely on imported fish in order to supplement domestic production. They represent alone over 70% of total fish imports of the Region. While imports of low value fresh and frozen fish are steadily increasing since 1985, imports of other type of commodity, including canned products, remain fairly stable. However, since recent years, imports of fish for human consumption (both in quantity and value) is stabilizing around one million tons (which compare to 210 000 tons in 1970) and even show a slight decrease since 1990. On the contrary, during the 80's, imports of fish meal and fish oil have increased slowly also remaining negligeable. In countries such as Cameroon and Congo for which imports are higher than national production, but also in Nigeria, Sierra Leone and Zaire, reduction or stabilization of imports have significant impact on supply.

Intra/regional trade and domestic distribution

The volume of intra-regional fish trade in the Region is difficult to assess because of the importance of "informal" transactions and "reexport" of smoked fish according to price fluctuations between neighbouring countries. In 1991, INFOPECHE estimated that only about 15% of the Region import requirements of fish were satisfied through intra-regional trade. In particular, a substantial inter-regional trade in frozen fish has developped between Northwest Africa, where resources are relatively abundant and population densities low, and the Gulf of Guinea countries where population densities and fish demand are high. Alltogether, it is estimated that around 1.2 million tons of frozen fish is now being traded annually within the Region. As a result of the devaluation of the FCFA, frozen small pelagics from Mauritania and Senegal should become more attractive for countries of the Region which do not belong to the FCFA zone.

Globally, high transport and stockage costs, poor status of handling practices, limited distribution network and a lack of harmonization and/or proper enforcement of fish trade regulations are among the major constraints to the development of intra-regional fish trade in the Region. In practice, tariff barriers and other restriction to imports (e.g quotas), even within geographical limits of sub-regional economic groupings, remain very strong, creating bottlenecks to fish distribution and hampering trade flux and more balanced supply. Hence, in many part of sub-saharan Africa, particularly in the hinterland there is a problem with the transport of fish to market, even when demand is high and prices relatively good. This is the case for instance with the distribution of catches from the inland areas of Congo, Ethiopia, Sudan, Central Africa and Mozambique.

In the near future, competition with low priced fish such as frozen marine small pelagics is likely to become of a growing concern in the southeastearn part of the region, in particular for small-scale fishfarmers. This is already the case, with the recent development of an efficient distribution network of marine small/pelagic from Namibia toward the other SADC countries.

2.2.4 Alternative products (meat)

Trends (in volume) related to meat production and consumption, the main substitute to fish, are fairly similar to those concerning fish products over the past decade in the Region. Per caput meat consumption has been fluctuating around 14 kg/y during the 70's, and started declining steadily thereafter down to 13 kg in 1990, although domestic production has steadily increased up to 1990, imports (in volume) tends to decrease - as for fish products- , and exports remain stable. This seems to indicate that globally the same factors have until recently influenced both fish and meat demand. This differs widely at country level. In some countries (e.g Nigeria, Côte d'Ivoire, Congo) there is a clear consummer preference for fish products while in other countries (e.g Ethiopia, Chad, Mauritania) the contrary occurs.

2.2.5 Prices

Historical time series on ex-vessel, wholesale and retail fish prices have not yet been compiled for sub-saharan Africa as a whole. In addition, the importance of "unformal market channels", the instability of many monetary systems and economies (currency devaluation, multi-tiered exchange rates, huge inflation, etc..) make it difficult to interpret fish prices in real terms over long period and hardly allow for serious analysis on fish price formation at aggregated level. However, it can be noted that with the general liberalization of economies, almost all the countries in the region have now abandoned administratively fixed fish prices which objective where to provide cheap food for urban consummer. The consequence is that the market tend to better reflect the real value of catches.

It is generally stated that fish for local consumption is the cheapest animal protein available and that although prices have increased over time, as have virtually all commodities, fish tends to maintain its favorable differential compared to other animal protein commodities. More recently, in countries having faced drastic devaluation (Nigeria, Ghana, Madagascar, as well as in countries belonging to FCFA zone) fish prices have risen sharply, although where/when wages have also risen demand remains strong.

However, the general decrease of public subsidies is likely to contribute to increasing costs and consequently increased prices on the local market and decrease competitiveness on the export market. This will be amplified in case of currency devaluation not only because 75% of fishing inputs in the Region are sought to be imported but also because imported product (such as small-pelagic are paid in hard currency).

2.2.6 Urbanization

Average urbanization rate is reported to be 27.6% in the Region in 1990. This compares with a rate of 18.7% in 1970 and 23% in 1980. This is an important parameter as fish demand and distribution is very unequal between urban and rural areas in most countries of the Region. In coastal states virtually all capitals and/or major urban population concentrations are situated on the coast (few exceptions are Antananarive, Brazzaville, Yaoundé, Johanesburg, Karthoum, Nairobi). Most of the domestic marine catches and a high proportion of imported fish hardly gets beyond coastal cities partly because of the higher demand and purchasing power of urban population.

Production from major inland water bodies follow the same pattern, i.e reaching the main inland urban centers which are often situated near the concerned waterbody (e.g Maidiguri, Djamena, Mwanza, Bujumbura, Kampala etc..). As a consequence deep rural populations (estimated to be grossly 74% of total population in 1990 and expected to be approximately 70% in 2000 and 64% in 2010) situated neither near the sea nor large freshwaterbodies have the lowest supply of fish except from nearby small waterbodies or from subsistance aquaculture. In the current context (in particular worsening transport/road networks in many countries) this situation is likely to be maintained over the medium to long term.

Another aspect is the apparent trend for artisanal marine fishermen to become urban based (nearer to larger and more lucrative markets, services, etc..). If such a trend (which has not been properly assessed) is to continue, this imply further spread of rural fish supply deficit, and further increase of the urban supply.

2.2.7 Tradition

Sub-saharan african populations are generally described as strong fish eater. Official data on production seldom include self-consumption at the level of commercial fishers household nor subsistance fishing figures which are believed to be substantial in the Region. Indeed, fish is an important food item in many countries, in particular in West Africa where it is eaten almost daily in the tradititonal sauce accompanying the thick starchy staple food based on millet, maize, yam, cassava, plantain, etc.

However this has to tempered when looking at protein intake figures by country (see 2.1.2). Nevertheless, examples demonstrate that when important quantities of fish at "good" price become available in traditionally low consummer countries, dietary habits tends to adapt very quickly (e.g in Ethiopia, Madagascar). Between, 1970 and 1990, there were only very few significant changes (e.g Cape Verde decrease by half or Bostwana increase by four) in the fish protein intake figures by countries. However, Western Africa could be said to be more fish eater than meat eater while the contrary occur in Eastern Africa.

2.2.8 Competition fish meal-food fish

Sub-saharan Africa is not a fish meal producer. However, demand does exist. Fishmeal and fishoil imports have slighly increased since the second half of the 80's. For the time being, with the exception of negligeable amount of small-pelagic species (dagaa) from Lake Victoria being processed for the pouldry industry, there is no indication of likely competition of the two type of commodities. However, the urbanization could reverse this situation with growing demand for pouldry and consequently increasing demand for fish meal.

2.2.9 Other factors likely to influence supply

Export from small-scale fisheries

Trends toward a greater participation of artisanal fisheries in the export of fresh marine demersal products from the Atlantic coast, crustaceans from the Indian Ocean as well as Nile Perch from Lake Victoria seems to consolidate steadily. This stems from research of more lucrative markets than the local one. At present, the main constraints to that development are the difficulties for individual fishers to mobilize reasonables volumes and ensure quality standards comparable to those of industrial fisheries. This trend might have in the medium term and in specific locations, a significant impact on traditional local supply, particularly, as in the case of Guinea the development of small-scale export oriented fisheries has become a major objective of the National Development Plan.

Replacement of small-pelagic species supplied by Eastern European Nations

Following the partial withdrawal of the operation of the East European fleet off the West african coast (Morocco excluded), total production of small-pelagic species is estimated to have dropped by 72% between 1990 (about 1 million tons) and 1992 (369 000 tons). Although these species are a fundamental asset for the supply of cheap animal protein to the low income group of the population, there are indication in one hand that the main consummers in the Region will have difficulties to afford higher prices reflecting real costs of production. In the other hand, (with the notable exception of Namibia, operating through joint venture), it appears difficult to substitute in the short/medium term the fleets from Eastern Europe which were operating in a different economic context, with the support of huge subsidies. Aside important investments in fleets, shore facilities, etc, such a substitution would first require first higher prices on local market and/or a drastic decrease of operation costs of the fleet (including freezing costs), and eventually important subsidies, at least at the earlier stage of the activity. These are conditions which do not seem likely to occur in a near future taking into consideration current trends on the international market for small pelagics and the overall context of depressed private investments in the Western portion of the Region.

The operations of canoes operating purse seine seem to be more profitable than those of the industrial domestic vessel. This is illustrated with the case of Senegal and Congo where small-scale fisheries tends to replace the industrial pelagic fisheries. However, in those countries as well as in other West Africa countries the important increase of production costs -largelly imported- , (as a result of recent devaluation or, as it is the case in Ghana or in Cameroon, as a result of decreasing subsidies and fiscal rebate), profits of the artisanal, including small-pelagic fishery, are reported to have dropped considerably.

Decreasing private investments and official development aid

In addition to decreasing direct private investments (in particular from foreign sources), the Official Development Assistance (ODA= net disbursements in loans and grants from official sources) also tends to charply declined. A total of UDS 935 million (current price) of ODA has been directed into African fisheries (including North Africa) between 1985 and 1990. Compared to the overall ODA receipt by African countries, fishery external assistance has declined from 1.4% in 1985 to 0.4% in 1990. At that time it represented about 6% of the gross estimated value of fish production in the Continent.

Although, it is difficult to predict what will be the evolution of ODA, the large demand for public assistance in Eastern Europe, or the probable reduction in real term of EFD/EU support to ACP countries are indications that ODA directed to the fishery sector in the Region will hardly increase in the next future.

Impact of GATT

Globally, the further liberalization of trade promoted under the 1994 Marrakech Protocol to the GATT will likely translate in the short term into more advantages for those who already have the necessary infrastructure and know how to rapidly adapt to new demand and accrued competition. This is clearly not the case of the Region.

It has been said that about 80% of exports from the Region find their way to the E.U market. From January 1995, a new E.U System of Generalized Preferences (SGP) has been established as a complementary instrument to the GATT 1994. This new system is likely to accelarate the erosion of the existing tariff preferences granted to the ACP countries (of which all sub-saharan countries are part of) under the Lomé Convention and the SGP, particularly with regard to the preferential margin enjoyed until recently for crustacean such as frozen shrimp, lobster as well as for cuttle fish.

Social conflict

The spreading of social conflicts and civil wars in many part of the Region, with increased displacement of population and refugees has an obvious impact on fish consumption. For examples, recently developed fisheries such as the Lake Kivu (70% of Rwanda fish supply) will have to be reorganized from scratch after recent events; it is estimated that Zaire currently consumes 150 000 tons of fish provided under Food Aid Schemes, a source of supply never really secured; large ares of Lake Chad are, since a decade or so, almost unpraticable for fishing purposes.

2.3 Tentative estimates of demand projections for 2010

U.N projections for population growth indicate that the region will have 700 million inhabitants by the year 2000 and 915 million by the year 2010. Assuming that current per caput supply can be maintained apparent total fish food demand would reach 5.950 million tons in 2000 and 7.780 million tons in 2010. Compared to current supply (4.4 million in 1990) this represents respectively gaps in the range of 1.55 million and 3.38 million respectively.

3. SUPPLY

Total production from marine (including from foreign fleets) and inland waters in subsaharan Africa has steadily increased over the period 1970-90, reaching a peak at 8 million mt in 1988. From 1980 through 1990 average production was about 7 million tons. It has stabilized thereafter around this level, with marine fisheries contributing over 70%. It should however be emphasized that inland fisheries contributes 45% of total domestic landings of the Region.

3.1 Marine capture fisheries

Sub-saharan Africa marine fisheries production is characterized by three main features having direct impact on supply. First, although steadily decreasing, almost half (45% in 1990) of marine production is harvested by Foreign fleets, mostly in the Atlantic Ocean. Second, an increasing volume of domestic marine production is exported outside the Region. 75 to 85% of it, is exported in a single market: the European Union. Third, the Western portion of the continent (i.e: from Mauritania to South Africa included) ensure nearly 70% of total marine domestic production.

Foreign fleet catches off the Region were reported to be in the range of 3 million in 1990 (including catches from the Moroccan EEZ). Current production decrease is attributable mainly to: full-exploitation of most high value bottom fish sought by long distance fleet, reduced fishing for small-pelagic species by East European nations and a growth in joint venture arrangements with more foreign vessels being based locally. This has apparently no tangible impact on the destination of these catches, i.e they remain globally export oriented. It could be noted, however, that foreign exchange generated through the allocation of fishing rights to long distant fleets seems to increase in absolute term while foreign catches are stagnating or decreasing. This "monetary surplus" could theoritically be translated for countries concerned into higher quantity of imported low value species or, into some sort of institutional (e.g research, implementation of management schemes) support for facilitating more cost effective development of domestic fisheries with the view, in the medium term, to generating more revenues from domestic exports fisheries or in some instance more landings to supply the local market.

In 1990, domestic marine catches in the Region (South Africa excluded) were estimated at about 2.4 million tons of which 45% were harvested by local industrial fleets. Most of industrial activities are export oriented; on the contrary, until recently, almost all the artisanal catches were targetted for the local markets. Artisanal fisheries ensures 72% of marine landings within the Eastern portion of the Region and about 52% on the Western coast.

With few exceptions, it is recognized that the economic performances of both the foreign (with the exception of the Tuna fishery) and domestic industrial fleets are low and the financial situation of many fishing enterprises in the Region is fragile. This is attributable in large part to overcapacity, in particular for vessels targetting cephalopods and shrimps and more generally demersal species, i.e to the lack of proper management of those fisheries. In GRT term, it is reported that the domestic industrial fleet has doubled over the period 1980-90, also this growth mainly concerns West Africa. Overall, the small-scale sub-sector seems to have improved in efficiency during the same period with globally higher catch rates/canoe. In view of the economic situation of the marine sector (in particular, the status of the resources), it is becomming urgent in many countries to seek for more economic efficiency by ensuring an optimized access to the resource between foreign and domestic industrial fleets in one hand and industrial and small-scale fleets on the other hand.

Overall, total marine domestic catches seem to have reached a plateau over the last years. However, this situation is not evenly distributed. Countries like Ghana, Senegal or Madagascar continue to record steadily increases while others, and for various reasons, show declining production trends.

Demersal species accounted for about 12% of total domestic catches in 1990 with six countries (Ghana, Nigeria, Senegal, South Africa, Mauritania and Namibia) ensuring over 70% of landings. In general, most of bottom fish species as well as cephalopods and crustaceans, are intensively exploited or overfished. This situation applies both to the Eastern (with the exception of Somalia, Eritrea and in lesser extend Madagascar) and Western coasts. Overall, high value demersal fisheries do not offer any substantial potential for further development. However, the implementation of more efficient management regimes for those fisheries could contribute increasing economic revenues and in some instances catches.

In general the small pelagic species off the Western coast are recognized to be moderately exploited and therefore constitute an important reserve of low value commodity, for which demand is far to be met in the Region. Almost 70% of these stocks are harvested by Ghana, Senegal and Namibia and by some specialized foreign vessels from various origins. From the economic point of view, as said above, it appears difficult to substitute the fleet from the Eastern European countries. Small pelagic species are not abundant off the Eastern coast and do not offer further potential for increased production (with some localized and limited exceptions e.g in Somalia, Eritrea, and probably on the Eastern coast of Madagascar).

Some 400,000 t of tuna, bonitos and large pelagics are caught in the Region. It is essentially harvested by European and Asian interests within vertically integrated international schemes including processing and distribution channels. However, a growing share of tuna catches are attributed to Senegal, Ghana, and Côte d'Ivoire. In country like Ghana, a part of the processed/canned product has to remain in the country to contribute to local supply. If such practice spread, it could represent an additional contribution to local supply, although rather marginal in volume.

3.2 Inland Fisheries

There has been a net increase in inland fish production during the last decade or so, from a level of around 1.3 million mt in 1980 to one of around 1.9 million mt in 1990. Throughout the period starting in 1985 and ending in 1990, the rate of increase was over 3.5%/year. Kenya, Nigeria, Tanzania, Uganda, and Zaire are Africa's top freshwater fish producing countries, contributing 70% of total harvests, i.e african freshwater production is relatively localized. Lake Victoria alone produces a quarter of total African inland production.

With the exception of few tons of Nile being exported, the overall inland production is consummed in the Region, contributing nearly half of the local supply, imports excluded.

Most fresh waters now show signs of intensive exploitation. Indeed, the current production of the larger lake systems[1], which represents over 50% of total landings, is very close to their aggregated average potentials. In general, because the demersal/inshore stocks of the large lakes are already subject to heavy fishing pressure, it is only the lightly exploited pelagic offshore stocks which could sustain higher pressure (e.g on Lake Tanganyika). Globally, there would seem to be little scope for a significant expansion of supply from large lakes, with the exception of L. Chad, L. Cahora-bassa, L. Tana.

Additional catches could possibly be extracted from the large foodplains (e.g in Mali, Sudan, Central Africa Rep.), assuming that the knowledge on how the overall (bio-socio-economic) system work is improved. For the time being, production of large floodplains is quite unpredictable, being caracterized by important fluctuations of the production as a result of climatic variations (i.e 20 years of severe drought in the Sahel; 5 years in Southern Africa). For example, the Niger Delta foodplain in Mali produced 40 000 tons in 1990 against 80 000 tons early 70's; the production of Lake Chad followed similar pattern.

Nevertheless, inland fisheries could theoritically withstand substantial increases in production, from the combination of reservoirs, small natural lakes and riverine fisheries in remote areas. Translating this potential in additional supply for local markets will be a long term undertaking. It would require important investments, notably the provision of basic storage and marketing infrastructures, feeder roads, etc.

As a result, to the extent that production/supply from inland waters can be increased in a sustainable manner, it is likely to derive from three sources: (a) some of the more remote small-medium lakes and rivers; (b) the lower value small pelagic lake fisheries; and (c) small water bodies that are now either underexploited or capable of having their productivity enhanced.

[1] i.e :Lakes: Cahora-bassa, Chad, Edward, Kariba, Malawi/Nyassa, Mobutu/Albert, Mweru, Tanganyika, Victoria, Volta.

3.3 Aquaculture

Aquaculture in Sub-saharan Africa currently accounts less than 1% of world production, despite substantial external support (US$ 72,5 million between 1974 and 1984). Nevertheless, aquaculture production has almost doubled over the last half decade -- from 11,500 mt in 1985 to nearly 20,000 mt in 1990 (32 00t in 1993). This is still far below its estimated theoritical potential of over 2 million mt per year.

Leading fish culture producers include Kenya, Nigeria, Madagascar, South Africa, Tanzania and Zambia representing in 1990, 80% of the production of the Region. Freshwater fish, usually tilapia species, make up over 80% of total aquaculture harvests.

Nearly all African fish farming is carried out by subsistance rural operators in small freshwater ponds as a secondary activity to agriculture. Extensive to semi-intensive cultural systems are developing but they generally produce limited fish yields which are mostly consumed directly, bartered or sold locally. Actual trends in development include a gradual privatization of fingerlings production, stocking of small water bodies and an increased use of brackish-marine waters. Indeed, in the short-medium term, most realistic possibilities for aquaculture-like development rests with indigenous production or enhanced practices (such as acadja brush park) and through carefully selected introduction and stocking of species in small waterbodies and reservoirs. In peri-urban areas where markets are readily available, entrepreneurial and rent-seeking behaviour need to be further developped for aquaculture to have a significant impact on fish food supply.

Commercial shrimp culture for export is also developing in few countries including Madagascar (330 t, in 1993), Mozambique, Guinea and Kenya. It is expected to become a substantial source of revenues in the longer term, if its competitiveness on the international market could be proven. Seaweed farming probably offers interesting potential in some locations as recently demonstrated in Zanzibar.

3.4 Other possible sources of supply for the local market

3.4.1 Increased production

From capture fisheries

As mentionned earlier, alltogether under-exploited capture fisheries are still relatively important in sub-saharan Africa (marine and inland small-pelagic; deep-water crustacean, large rivers (e.g Congo, Oubangui, Ogooué, Nile) and remote medium lakes (e.g Ethiopian Rift Valley lakes, L.Cahora Bassa, L. Rukwa, L.Turkana) but the economic profitability/marketing opportunity for fuller exploitation has still to be demonstrated in many instances.

Theoritically, it could be estimated that in the short-medium term an additional 150-300 000 mt from river and lake fisheries could be further generated without environmental damage from those fisheries. As said earlier, foodplains fisheries could in many instance physically support increased fishing effort but monitoring and managing those type of fisheries are difficult challenges, probably over the financial capacities of most countries concerned.

The development of small-scale coastal pelagic fisheries also offers interesting prospects.

From Aquaculture

Since 1986, aquaculture production in sub-saharan Africa gives signs of take off with production reaching 32 000t in 1993, while the volume of external assistance devoted to its development is steadily decreasing. In 1992, the value of aquaculture production from the Region was estimated to be about 71 million US$ (this is approximately the value of 200 000 tons of imported small-pelagic species).

Over the past 20 years the major problem for aquaculture development seems to have been local market price of other fish products, in particular the lack of competitiveness of cultured fish with the subsidized/imported low pelagics species. Hence, technical skills and know-how would appear to be a secondary difficulty.

Nevertheless, the real economic potential for aquaculture development in Africa has probably been overassessed (it is oftenly reported that 30% of the Region is suitable for subsistence fish farming, and that about a third of that area is believed suitable for commercial aquaculture). Freshwater aquaculture for local consumption tends to develop vigourisly only under particular conditions of which the following two are the most relevant in the context of the Region, i.e on one hand, high population density coupled with high demand for fish -as in the case of Nigeria, Egypt, Italy, China, Vietnam- and on the other hand depletion of natural stocks/supply of species of high demand. In this situation, the objective of producing a supply of cheap animal protein for the rural poor in remote areas thus becomes self-defeating in the context of maintaining per caput supply in Africa. On the contrary, the culture of high-priced species in peri-urban areas coupled with production enhancement, microfisheries in small water bodies and species introductions/stocking including where suitable rizipisciculture (in stead of pond aquaculture) would probably ensure the bulk for sustainable and significant progress of Aquaculture in the Region.

Indeed, the aquaculture sector in the Region is globally better geared than capture fisheries to respond in the medium term to important increases in demand for fish. This will be supported by the rarefaction of additional supply from capture fisheries, constrained imports and the likely rise of fish prices in the Region.

In the present context and up to the year 2010, assuming that production will continue at least to double every five years (as between 1986 and 1992) additional supply is likely to be approximately 80 000 t in 2000 and 320 000 t in the year 2010.

3.4.2 Reduced post harvest losses

It is generally reported that physical post/harvest losses in sub/saharan Africa are still estimated to be in the range of 10 to 20% of artisanal production (or 100-200 000 mt/year for marine fisheries alone). Recent investigations shows that they are much less than often quoted, may be around 5% of total artisanal production. What is high, is the "economic" post-harvest losses when product quality goes down (freshness, insect infestation, breakage, oxidation, etc.). Hence the price goes down as well, but this fish is consummed by the poorest section of the population.

3.4.3 Reduced discards from industrial fishing

A tremendous amount of by/catch, particularly from the demersal and crustacean fishery is rejected at sea. Shrimp by-catch in sub-saharan African (Teutscher, pers. comm.) is (over) estimated to be at around 1 million tons of which probably only 10 to 15% is landed; by-catch in other industrial fisheries (e.g cephalopods) may be in the order of 0.5 million tons of which very little is landed. Through the introduction of more selective gear (e.g as in the Malagasy shrimp fishery), the implementation of by-catch quotas thru specific regulations or the developement of collecting systems at sea by local fishermen, landings of by-catch are likely to increase while overall by-catch may decrease. Although, the great difference in value between target species and discarded species makes profitability of by/catches salvage a major obstacle, cost effective solutions are already implemented in the Region, e.g. the demonstration of the profitabiliy of shrimp by/catch collection by artisanal canoes in northern Madacascar or the sucessfull introduction of by/catch fee in the Namibian demersal fisheries.

3.4.4 Improved fisheries management

In view of the current fishing effort on capture fisheries, substantial increases of production should not be contemplated; what should be envisaged in most coastal and lake fisheries is a courageous rationalization of the exploitation, i.e by strengthening fisheries management.

One of the major constraints for proper fisheries management and sector (including supply) development (both in term of exploiting untapped resources and in term of maximising revenues) in sub-saharan Africa derive from the deficiency of the institutional base (fisheries administration, research, banking conditions) for supporting the industry. In a context where many countries of the Region are implementing Structural Adjustment Programmes with related drastic cuts in public budgets (including for human resources), it become urgent to clarify sectoral priorities. This might require in many instance a full assessment of means, objectives and approaches as a prerequesite for enhanced institutional efficiency.

Marine industrial fisheries might be easier to manage than the diffuse small-scale fisheries, and there is a clear short term priority to be given to the management of the high value fisheries (i.e demersal, crustacean and cephalopods) not only because of their role in generating much needed foreign exchange but also because they are presently those for which fishing pressure and economic waste are more obvious. Namibia offers a recent example of enhanced institutional support base (particularly the resource management side of it) with immediate economic benefit for the sector and the country and the country as a whole.

Freshwater fisheries in Africa are almost entirely artisanal. Aggregated number of inland artisanal canoes for the continent stands grossly at about 230 000 units. This compares to the indicative estimate of about 160 000 units in the mid-1980s. Such an apparent growth seems to be confirmed by the estimate that the number of canoes in six of Africa's major lakes of the Rift Valley has increased by 40% from 1979 to 1989. As fishing effort increase to respond to increasing demand the need for managing inland fisheries is becoming more and more accute. Immediate objective will be to avoid the colapse of stocks and avoid the costs attached to their rehabilitation. However, management needs and priorities vary widely according to the type of fisheries concerned.

3.4.5 Improved Storage and Distribution

The introduction or spead of new or traditional technologies could have a significant impact on supply. For example, in the case of small pelagic fish which is caracterized by seasonal glut situation whereby price goes down and fishermen reduce or stop their fishing effort, while often surpluses are used as fertilizer; canning or freezing not being profitable on the basis of seasonal gluts, a technology which combines low investment with high capacity such as bulk salting followed by pressing (e.g the Brazilian technology) may have a significant impact. More availability of ice also improves supply of fresh fish to urban markets; this apply also to cheap small-pelagic species.

In addition to the general limitations (see 2.2.3) on intra-regional trade, an other constraint for many countries, is the small size of their national market (i.e of the demand for domestic products), due to limited population (22 countries have less than 5 million inhabitants) which do not provide an incentive for large investments either at the sea or on shore, even when untapped stocks exist (e.g Gabon; Eritrea; Equatorial Guinea). For those countries, reinforced fisheries policy at the level of existing Custom Unions and economic groupings (e.g ECOWAS, UDEAC, PTA) is likely to contribute substantially to the emergence of sub_regionally oriented fishing, processing and marketing enterprises. This could incidentally allow for technological improvements (thru more resarch & developement) thru economies of scale and enlargement of traditional markets.

3.5 Supply scenario 2010

3.5.1 Fish consumption 2010

Resource wise, an assessment of the theoritical potential for fish food production in the Region indicates that, globally, the physical potential to meet demand by the year 2010 at current per caput supply level, exists. This is based on a global production figure of nearly 7.5 million tons in 1990 (discards and subsistance fisheries excluded but foreign catches included), and assumption that aquaculture production will have reached 280 000 tons by the year 2010 (i.e by maintaining its present growth rate). This is of course a fiction unless it is provided that a full africanization of the marine fleet can occur and that a substantial part of foreign exchange earnings from exports of high value species is effectively utilized for importing cheaper food fish as necessary as diversion of exports do not seems realistic in view of foreign exchange requirements in the Region.

It could further be noted that: even under the most attractive scenario, beyong 2005 the demand would be higher than the potentiel (about 8 million tons) of capture fisheries.

Taking into consideration that many countries in the region have policies to increase per caput fish consumption and assuming that per caput supply is increased by 5% per year (2% more than population growth rate) over the 1990 level, demand would skyrocket to 7.036 million tons by 2000, 8.55 million by 2005 and 10.9 million tons by the year 2010.

This compares to current supply of about 4 million tons.

3.5.2 Implications for food security

In view of the above, it could be assumed, more realistically, that demand in the near future could only be met by expansion of productivity enhancement in small water bodies, special effort for the development of aquaculture, increase in landings of small-pelagics (both marine and inland), continuation of foreign fleet relocalisation in the Region, and last but not least, increased imports. Other rather marginal gains could be obtained by implementation of sound fisheries management regimes, reduced discards from industrial fisheries and betterment of post harvest handling practices and distribution networks.

Implications for food security are difficult to identify as globally the resources are theoritically suffisant to almost meet demand. In this context much depends on the political willingness (and for many countries, the provision of necessary assistance) to rapidly arrive at an orderly and optimal exploitation of African fisheries resources for the benefit of local population. As a start, there is a need for a better recognition of the social, economic and nutritional role of fisheries in the Region.

It can also be noted that, at macro-economic level, most of the countries in which the demand for fish will become very high in the near future - (i.e mainly the gulf of Guinea Countries: Zaire, Congo, Gabon, Cameroon, Nigeria) have theoritically the possibilities to utilized part of the oil (or diamond) rent to ensure necessary imports of fish for their population. However, 42 countries in the Region have been identified as low-income-food-deficit countries (LIFDCs). In many of these countries fish has an important role in people's diet as well as, as a source of incomes and it might be therefore expected to play a greater role in the combat against poverty and malnutrition.

4. POSSIBLE POLICY INTERVENTIONS

In addition to policy interventions already suggested throughout the document, the following two orientations would seem to be prioritary in the short term in the context of maintaining reasonable level of supply.

Enhanced fisheries management and related institutional base

Overfishing and fleet surcapacities by both domestic and foreign operations have brought the issue of resources management to the forefront. In only a relatively few cases will additional effort result in substantial increases of catches over the longer term. There still some fisheries which are underutilized, but their exploitation cannot compensate adequately for over-utilization of other stocks. In most instance, the effective introduction of management measures will not translate in substantially higher production but in higher catch rate and higher economic return on investment. It will help avoiding in some case the (economic) collapse of the concerned fleet/fisheries or the cost of fisheries rehabilitation. This is however crucial for most export oriented fisheries, in particular shrimp, which currently hardly generate benefits while having to face higher competition on their traditional markets. In this context, the most effective scenarios with regard to foreign fleet activities should be better assessed from an economic stand point.

Development of small-scale marine and inland fisheries

From an economic point of view, many small-scale fisheries in the Region are the most efficient in term of the quantity of fish produced per unit of energy input and of capital invested. Modernization of fisheries gears (echo sonders, modern purse seine, multimonofilament set gillnet, etc) could in many instance increase many time fishing capacity and at a relatively low cost, assuming measures (e.g organisation of productor, institutional credit/affordable interest rate, etc,.) are made available to facilitate more insertion of the small-scale fisheries within the formal economy and a better sharing of the resources with the industrial fisheries. This means that strong supports in favour of developing advanced (or semi-industrial) artisanal sub-sector is required. Such fishery will in many instances (e.g in Madacascar, Angola, Guinea, Sierra Leone, Somalia) fill the gap between the small-scale sector and the sophisticated off shore fishery, as it is already the case for example in Ghana, Mauritius or Morocco. The likely impact of such development on local supply still need to be more carefully assessed, fisheries by fisheries. Such an assessment could be part of excercices aiming at formulating management plans. The next step/cahllenge in this sub-sector remains to increase economic efficiency while retaining the overall labour intensive nature of the activity.

To secure reasonable return on investment in a context of rapidly increasing operating costs, small-scale fisheries should, however, be operated under management frameworks which allow operators revenues to maintain a minimal investment capacity. This would require, starting with smallwater bodies (medium bays, medium lakes and reservoir, lagoons, etc) to limit access and introduce community based zoning systems. This could lead to increased catches roughly in the range of yyy mt per annum.

WESTERN EUROPE

Demand and Supply of Fish and Fish Products in Western Europe Perspectives and Implications for Food Security

by

D. Insull
FAO Fisheries Department

CONTENTS

1. REGIONAL CHARACTERISTICS AND ISSUES

1.2 Characteristics

The group of countries described here consists of the following: Austria, Belgium and Luxembourg, Denmark, Faroe, Finland, France, Germany, Greece, Iceland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. They are a widely diverse group, with differences with regard to fish consumption and cultural attitudes to fish and to national fisheries, and with regard to fish supplies and the role of fish in their international trade.

The countries are all members of OECD but GDP *per caput* varies to a very marked extent between the richest countries, such as Switzerland and the Scandinavian countries, at one extreme, and relatively poorer countries, such as Greece and Portugal, at the other. In general, however, common features of the group are that people have, at the minimum, an adequate supply of food and level of nutrition.

Four countries are significant net exporters of fish. They are: Denmark, Faroe, Iceland and Norway. The remainder are, in varying degrees, net importing countries, the most important in volume terms being France, Germany, Italy, Spain and the United Kingdom. Five countries are important (over 50 000 t./year) aquaculture producers. They are: France, Germany, Italy, Norway and Spain.

Levels of development - in fishing technology, processing, distribution and merchandising - vary considerably between groups of countries. In general, as might be expected, the overall level of development of a country's fish sector (including processing, marketing and merchandising) is correlated with the level of development in the economy as a whole and, particularly, with the level of development of the food sector.

1.3 Issues

In general, until the 1980s, governments' policies within the fisheries sector had a bias towards development of the sector, rather than to dealing with the problems of resource allocation. More recently, there has been a greater emphasis on fisheries management in governmental policies.

Much attention has been paid within Europe to ensuring that consumers have safe fish products available to them. European Commission Regulations have been introduced which specify minimum requirements for product produced within the European Union and imported into it.

The issue of by catch and discards is of concern to the European Commission and to some, particularly, of the national governments. Regulations to deal with the issue are, as yet, directed primarily to requiring that certain accidental bycatch is not landed. Some governments and the European Commission are funding projects on fishing gear selectivity and research is being undertaken on fishermens' attitudes to the use of selective gears to minimise bycatch. As yet, it appears that the issue of bycatch revolves around the financial advantage or disadvantage which may accrue to operators.

2. CONSUMPTION AND DEMAND

2.1 Consumption

2.1.1 Trends in consumption

Total apparent fish consumption in Western Europe increased from about 6.8 million t. in 1970 to 8.8 million t., landed weight equivalent, in 1990, the average annual *per caput* consumption increasing over the same period from 19.40 kg. to 23.26 kg., landed weight equivalent.

The trend shows some decline in the early 1970s from a high of 19.40 kg, attributable to a relatively sharp fall in consumption in the Nordic countries in 1972 and a small decline in the consumption of the other European countries taken as a group, in the following year. Beginning in the mid-1970s, however, there was a significant fall in consumption, associated with the economic shocks following the increases in the price of oil in this period. Average annual *per caput* consumption began to recover in 1980 and continued to increase through the 1980s, reaching 23.26 kg in 1990. Although complete data are not available, the available evidence suggests some decline in annual average *per caput* consumption in the early 1990s, associated with the recession in Europe in this period.

2.1.2 Sub-regional and country differences in consumption

The total consumption figures and those for *per caput* consumption quoted above apply to Western Europe, as a whole. They mask, however, considerable differences between sub-regions and between countries.

One major variation occurs with regard to the differences between the Nordic group of countries and, broadly, those in the remainder of Europe. In the former group, average annual *per caput* consumption has remained within the band of 30-32 kg, other than a fall to 28 kg, referred to above, in 1972. This group, therefore, is one where average annual *per caput* consumption is very high by world standards and which is a fully mature market. The relatively high *per caput* consumption figures in the Nordic countries in conjunction with the much greater population of the remainder of Western Europe - 359 million in 1990 compared with 18 million in the Nordic group - means that the *per caput* consumption figures for Western Europe but leaving aside the Nordic countries, are just slightly lower than for Western Europe including the Nordic countries - in 1990, 22.8 kg, compared with 23.26 kg. In Western Europe, therefore, other than in the fully mature Nordic group market, consumption is showing a rising trend.

Other differences are between countries. At one extreme, average annual *per caput* consumption in Iceland, at over 90 kg, is 13 times that of the Netherlands. Another difference is revealed in the concentration of consumption, largely accounted for by national populations. The five largest consuming countries, France, Germany, Italy, the United Kingdom and Spain - accounting for 77 per cent of the population - together account for 75 per cent of total consumption in volume terms. Other differences, of course, lie in national species and product preferences.

2.1.3 Relative price and expenditure changes

The real price of fish has increased in the period under review faster than red meat while those of pork and chicken have declined. As both the quantity of fish consumed and the price of fish increased, it follows that consumer expenditures on fish increased in real terms in the period under review.

The increase in *per caput* consumption, together with the increase in real expenditure on fish, indicate a shift in demand towards fish relative to meat.

2.1.4 Species preferences

Demersal fish - primarily, cod, hake, saithe, and pollock, with others, such as red fish, haddock and whiting being of importance in certain countries only - are the main group of species consumed in Western Europe, amounting to about 3.25 million t. annually in recent years. However, the market for demersals has increased relatively slowly in recent years - by 16 per cent between 1980 and 1990 - the small change being associated with restrictions on supply.

Pelagic species constitute the second largest group with just under 2.0 million t. entering the market in 1990. Tuna, almost all of it entering into the market in canned form, accounts for the major part of this group, the remainder consisting mainly of sardines, herring and mackerel. The market for pelagics expanded by 19 per cent between 1980 and 1990, expansion being limited by demand which, for many pelagic species products, is relatively price and income inelastic.

Demersal and pelagic species, which together account for about 60 per cent of the market, have shown relatively small increases in sales in recent years and reducing market share of an increasing market. The groups taking increasing market shares are crustaceans - primarily shrimp, cephalopods, and salmon and trout.

The third group of species entering the market in volume terms is crustaceans, mainly shrimp. About 700 000 t. entered into the market in 1990, an increase of just under 50 per cent on a decade earlier. The underlying preference in the north European market is for cold water shrimp and, in the south, for warm water species, although the latter is being marketed increasingly in the north European countries. Throughout the European market, catering outlets account for the greater part of sales.

Aquaculture-based species, notably salmon, trout, seabass and seabream, and carp are an important part of fish supply. Production in 1992 amounted to about 500 000 t. Production of molluscs accounted for a further 597 000 t. Demand for farmed salmon and trout particularly has expanded as their prices have fallen in response to increasing production and retail competition.

Imports of cephalopods in 1990 amounted to over 400 000 t. in 1990, a doubling since 1980. Consumption has increased most rapidly in traditional markets for cephalopods, such as Italy and Spain which, together, accounted for almost 90 per cent of European supplies. In addition, there have been relatively large increases in small markets, such as Germany and the United Kingdom.

The picture which emerges is one in which, overall, there has been a significant increase in the consumption of fish in the period 1970-1990. This development has been associated with a relatively small increase in the quantity of demersal species entering the market, almost all of which are taken from fully or over-exploited stocks and for which price increases have reflected this fact. There have been, however, significant increases in the quantities sold and in market share obtained, of aquaculture-based products - notably salmon, trout, seabass, seabream and molluscs, and, from outside Europe, of shrimp - and of cephalopods and tuna, for which there remain under-exploited stocks.

2.1.5 Product form preferences

In general, fresh and chilled products are losing market share to frozen products. In the retail segment of the market, frozen ready-to-cook fish meals have taken market share from traditionally presented fresh products and in the catering sector, the use of frozen fish is becoming more widespread in those country markets which have relied primarily on fresh fish in this sector. Canned tuna, has maintained or increased market share in all the European country markets.. Smoked fish - particularly salmon - has also increased market share, a trend which, again, reflects consumers' requirements for a fish product requiring minimal or little preparation. Salted fish has lost market share. In part, this latter trend may be associated with the preparation time required to prepare the product for eating and, in part, by its relatively large increase in price, which has reflected the increased scarcity of the raw material. In this period, also, surimi-based products have established a small but increasing market share.

The overall picture which appears, therefore, is that in which value-added convenience fish products are taking an increasing market share and are a major factor in the shift of demand towards fish which has been noted above (2.1.3).

2.2 Factors Influencing Demand

2.2.1 Economic factors

There have been a number of surveys which have found that fish consumption and expenditure on fish tend to increase with income. It would also seem likely that consumption and expenditure are linked to the economic expectations of consumers. The decline in average annual *per caput* consumption in the recessionary period of the second half of the 1970s has been noted above (2.1.1) while the same decline has been evident in the recession in the first half of the 1990s.

The conclusion is that while incomes are, in general, buoyant, consumers will demand more fish products; when incomes are under threat, there is a marked predisposition for demand to shift to lower priced competitive products, such as chicken.

2.2.2 Demographic and associated socio-economic factors

In most West European countries, populations are relatively stable or increasing very slowly. Commensurately, populations are tending to age. The implications for the demand for fish are three-fold. First, relatively little increase in demand may be expected to be derived from increase in population. However, second, surveys have shown that consumption of fish tends to increase with age. It might, therefore, be expected that demand will increase as a result of this factor. Third, the effect of this factor is likely to be enhanced by the increase in personal wealth and higher disposable incomes of a larger proportion of older people in Europe.

2.2.3 Retail outlets

In the period under review there has been a marked change in the retailing of fish expressed by the increasing dominance of the supermarket chains.

In three of the largest country markets, France, Germany and the United Kingdom, supermarket chains accounted in 1992 for 50 per cent, 30 per cent and 38 per cent, respectively, of all chilled fish entering the retail market, For frozen fish, the market share was, as might be expected, greater, being 70 per cent, 66 per cent and 72 per cent, respectively. In the other countries, supermarkets are taking increasing shares of the total retail market for fish.

The implications of this increasingly important role of the supermarkets are an enhanced level of innovation in new products, improved presentation, a higher level of exposure to potential buyers and, in general, improved quality at the point of sale. These factors are enabling fish to compete equally with substitute products and are instrumental in fish achieving a greater market share compared with competitive products.

The trend towards increasing sales through supermarkets can be expected to continue. The trend in the longer term, towards 2010, is likely to be particularly strong in those countries where, as yet, the development of a larger consumer market for frozen ready-to-cook meals is lagging compared with elsewhere in Europe (for example, Spain) and where, as yet, the merchandising of chilled fish through supermarkets is not well developed (for example, Italy).

2.2.4 Restaurant and catering outlets

In Europe, catering outlets (schools, hospitals, work places) account for 55 per cent of the "eating out market", compared with 31 per cent in the U.S.A. and 28 per cent in Japan. These outlets, which are continuing to expand in number, tend to serve relatively low cost but generally acceptable products derived from frozen white fish blocks.

The commercial restaurant segment of the sector (restaurants, hotels, ethnic restaurants and fast food outlets) is expanding at a faster rate than the catering sector. The range of fish products required by this diverse range of outlets is considerable, offering opportunities, particularly, in the sale of products derived from aquaculture, and for cephalopods.

2.2.5 Consumers' perceptions of fish

In the 1980s and early 1990s, two issues have become increasingly important to fish consumers. These are the positive health attributes of fish and, second, the safety of fish as food, including the issue of pollution.

There is an increased awareness of the health benefits associated with eating fish. Many fish are low in cholesterol, generally low in fat, and are a good source of high quality protein. These attributes have been promoted in generic and brand advertising and in the media.

Based on their market research of consumers' perceptions of seafood, advertisers promote the cleanliness and purity of the waters from which fish is obtained. It would thus appear that, unlike in North America, where consumers' concern with ocean pollution may have a negative impact on the demand for fish, in Europe, in general, consumers so far associate fish with a clean environment.

An important issue relating to demand for fish in Europe is its safety. As consumers become more aware of potential dangers, the issue is likely to become more important unless the industry is able to satisfy consumers that its products are safe. The implementation of European Commission Regulations dealing with this issue has been instrumental in modernising fishing and fish processing premises and practices in the European Union and in countries exporting to Europe. The main objective of the Regulations has been to assure the safety of the products entering the European market, placing much of the responsibility in the producers. In this connection, the influence of large supermarket groups in bringing about higher safety standards in the industry has been and continues to be of critical importance.

So far relatively absent in Europe, is consumers's concern with the marine environment, particularly the killing in by-catch of marine mammals, turtles and other endangered species, militating against fish consumption, as has been a conspicuous feature in the U.S.A.

In general, consumers' perceptions of fish are positive and likely to contribute to increased demand.

2.2.6 Processed and value-added products

Referred to above (2.2.3 and 2.2.4) is the increasing importance of the food industry in driving demand. Using the shift in consumers' preferences towards fish and harnessing it with the increasing requirements for easy-to-prepare food, the role of fish in diet is being changed in that products derived from fish are eaten more frequently than traditionally presented fish would have been.

2.3 Demand in 2010

As noted above (2.1.2), the Nordic countries are a fully mature market. Average annual *per caput* consumption, therefore, is not expected to change significantly. If it is assumed that average annual *per caput* consumption is 32 kg., the projected population increase will have the result of raising total demand at constant prices by about three per cent, to 624 000 t.

In the remainder of Western Europe, the consumption trend 1970-1990 projected to 2010 shows demand at constant prices increasing by 17 per cent, to 9.585 million t., implying an average annual *per caput* consumption of 26 kg.

For Western Europe as a whole, projected demand in 2010 is 10.2 million t, an increase of 1.44 million t., or 16 per cent.

In addition, there are a number of unquantifiable factors to be taken into account, expressed through the continuing shift of consumers' expenditure into fish products. These factors are likely to increase in significance in the forecasting period. Taking these into account, would suggest demand at constant prices to be, at a conservative estimate, at or above the projected estimate quoted above. The range of demand at constant prices is, therefore, put at 10.0-11.0 million t.

3. FACTORS INFLUENCING SUPPLY

3.1 Domestic Landings

Average annual landings of fish for direct human consumption in 1988-90 amounted to 7.2 million t.. Most of the demersal stocks fished by European fleets are considered fully or over-exploited, with only the Arctic cod stock in a reasonably buoyant state as a result of reduced exploitation during the 1980s and a good 1983 year class. Small pelagics, notably mackerel in the Western approaches, Atlanto-Scandian and Baltic herring, and sardine and anchovy in the Mediterranean are under-exploited but, as yet, have limited current and/or potential for direct human consumption.

Looking to the future, it might be reasonably expected that there might be some recovery of stocks in the longer term as a result of improved management which will result in increased supply. Some species may respond better to effective management than others while the impact of management will be also influenced by the present status of the stock being managed. By 2010, it may be possible to increase cod landings by up to 30 per cent. All told, effective management may result in an increase in landings of 10-15 per cent, say by 700 000-1.0 million t. a year

3.2 Domestic aquaculture

As noted above (1.5), the growth of aquaculture production in Europe has provided for the supply of a number of species of fin fish and molluscs at "affordable" prices, and has had a significant impact on the total consumption of fish. Total production from aquaculture in 1992 was 1 066 000 t., the main country producers being France (251 000 t.), primarily molluscs and trout, Spain (171 000 t.), mainly molluscs and trout), Italy (165 000 t.), mainly molluscs and trout, Norway (125 000 t.), mainly salmon, and Germany (90 000 t.), mainly carp.

Over half of aquaculture production - about 597 000 t., is of molluscs (see 2.1.4). The greater part of this production is of shell which, to a very a large extent, does not pass into consumption; this latter quantity is of the order of 60 000 t. The second largest component is of diadromous fishes - salmon and rainbow trout. These account for 314 000 t., the largest producers being Norway and the United Kingdom. Cultivated marine fishes mainly seabass and seabream - account for about only 20 000 t., the two largest producers being Greece and Italy. The balance of production - about 135 000 t., is of carp and other fishes.

In recent years, aquaculture production in Europe has undergone a revolution because of the success with farmed salmon and, to a lesser extent, with trout. So far, seabass and seabream have not enjoyed the same success. Fragmented production coupled with an absence of marketing has probably been a major factor in this situation.

There is considerable potential for increased potential for coastal aquaculture production, although a proportion of this may be at higher marginal costs of production. Coastal sites are available for at least a doubling of production while off-shore production may offer further potential for the production of diadromous species. The extent of a significant increase in production will be dependent on price. It would seem likely, however, a doubling of production is potentially available, to, say, 2.0 million t.

3.3 Under-utilized species

Under-utilized species include conventional but under-utilized species, primarily consisting of small pelagic species, and unconventional species, such as grenadier, sabre and orange roughy.

Reference has been made above (1.5) to small pelagic species. Full utilization of these species has been limited by the available market for direct human consumption.

For unconventional under-utilized species, despite considerable efforts to encourage their exploitation over the last two decades, there has been limited success. This has been due to the often relatively high costs in fishing for these species in conjunction with limited market opportunities. Not surprisingly, when fishermen have found a market for a previously underutilized species - and which is, therefore, unmanaged - it quickly becomes over-exploited. An example is the Greenland turbot fishery in the North-west Atlantic, while the orange roughy fishery shows every indication of proceeding in the same direction. Many, if not most, of under-utilized species to which attention has been directed, are deep-water species with relatively slow rates of reproduction. Thus, when- or if - they are commercially fished, there is a likelihood that they will become fully exploited relatively quickly unless effective management is already in place.

Other than utilizing such fish for direct consumption, as for the Greenland turbot and orange roughy, and has been done traditionally, to a considerable extent, with small pelagics, there is the possibility of using under-utilized species as a raw material for reconstruction into a product which already has an established market, such has already been done with great success with Alaska pollock. This type of development, however, is dependent on low-cost production of the raw material. Deep-water under-utilized demersal species are unlikely to offer this potential because of their cost of production. Attention of manufacturers has turned to the use of small pelagics in the production of surimi. The resultant product has to be used in the manufacture of other products and the use of small pelagics in this way is, at present, limited.

3.4 International Trade

In 1988-90, average annual exports amounted to 5.6 million t., with a proportion of these exports being intra-European. The largest country exporters were Norway, the Netherlands, Iceland, and Denmark. Exports were of both food fish and fishmeal.

Average annual imports in the same period were 6.36 million t., with a proportion of these imports being intra-European. The major importers were France, Spain, Germany, the United Kingdom and Italy. Fish products of major importance imported from outside Europe included frozen and canned tuna, frozen shrimp, and frozen cephalopods.

4. FISH CONSUMPTION, 2010

4.1 Additional supply requirements at constant prices

Projected demand at constant prices is estimated to increase about 17 per cent to an average annual *per caput* consumption of about 26 kg., equivalent to a range of 10.0-11.0 million t. (2.3). Supply in 1990 is estimated to have been about 8.8 million t., indicating a supply-demand gap at constant prices 1.2-2.2 million t.

4.2 A reconciliation of supply and demand

Effective management may enable an increase in landings of marine fish of 0.7-1.0 million t. ^No additional significant costs would be incurred in achieveing this increase. Depending on the respective prices in Europe and the U.S.A., some part of it - say a half - may go into the U.S. market, suggesting some 0.3-0.5 million t. going into the European market. In addition, depending on prices, production from European aquaculture could increase by a further 1.0 million t. Again, however, a proportion of this increase - say 20 per cent - may be exported, leaving up to 0.8 million t. available for the European market. These very broad speculative assumptions indicate there would be available an obtainable increase in European supplies of 1.1-1.6 million t., albeit at an increase in real prices.

In practice, the increase in demand at the increase in real prices which emerge, is likely to be met by increases in European supplies, as indicated above, together with an increase in imports of, particularly, those fish at present imported in significant quantity from outside Europe, i.e., tuna, shrimp and cephalopods. The increase, however, in net imports may be relatively small.

5. POSSIBLE POLICY INTERVENTIONS

5.1 Fisheries Management

If the projected increase in production from marine capture fisheries is to be realized, or a larger increase than indicated above, effective management measures will be required to be continued, where they currently exist and strengthened where appropriate.

5.2 Environmental management

In order to protect coastal stocks, effective environmental management measures will be necessary, including the appropriate regulation of coastal aquaculture.

5.3 Aquaculture

The aquaculture sector has performed well with minimal governmental intervention, other than financial start-up support in some areas. Consideration may have to be given, however, to ways in which the marketing of seabass and seabream can be made more effective to enable these products to reach a wider market.

USA

Demand and Supply of Fish and Fish Products in USA
Perspectives and Implications for Food Security

by

J. Anderson and Joan Anderson
FAO Consultants

CONTENTS

I. THE STATUS OF SEAFOOD IN THE US

1.1 Consumption Trends: Seafood vs. Other Protein Sources - 1970-1993

Seafood consumption has increased since 1970, when it was 5.3 kg of edible weight per capita (11.7 lbs. per capita). As seen in Figure 1, seafood consumption rose through the 1970s and 1980s until it reached its highest level, 7.4 kg per capita (16.2 lbs. per capita), in 1987. Since that time, it has fluctuated around the 1993 average of approximately 6.8 kg per capita (15 lbs. per capita). This reflects an increase between 1970 and 1993 of about 28 percent. See Appendix Table 1a for details.

Over the same period, 1970-1993, red meat consumption declined from 59.7 to 50.7 kg per capita (131.7 to 111.9 lbs. per capita), a decrease of approximately 15 percent. Poultry consumption nearly doubled during that time period, increasing from 15.3 kg per capita (33.8

lbs. per capita) in 1970 to 27.7 kg per capita (61.1 lbs. per capita) in 1993. This represents an increase of almost 81 percent. These trends can also be seen in Figure 1 and Appendix Tables 1b and 1c.

1.2 Price and Expenditure Trends: Seafood vs. Other Protein Sources - 1970-1993

While the quantity of food consumed is an important measure, the expenditure on a given food group is perhaps a more useful market indicator. As seen in Figures 2a, 2b, and Appendix Table 1a, while the per capita quantity of seafood consumed increased by 28.2 percent between 1970 and 1993, the nominal price of seafood (Appendix Table 1a) increased by approximately 400 percent. Over the same time period, nominal food prices, in general, increased 259 percent, red meat prices increased 207 percent, and poultry prices increased 157 percent. From 1970-1993, real seafood prices increased 36 percent (relative to all other goods), while real prices of food in general, red meat, and poultry declined 1, 17, and 31 percent, respectively.

Since both the quantity consumed and the price of seafood increased between 1970 and 1993, it follows that consumer expenditures on seafood increased as well during that time. In fact, estimated nominal per capita seafood expenditures increased by 537 percent over this period (see Figures 3a and 3b). Over the same period, estimated nominal red meat expenditures increased 160 percent. Nominal poultry expenditures increased 366 percent. Between 1970-1993, estimated real per capita expenditures increased 71 percent for seafood, real red meat expenditures decreased 30 percent, and real poultry expenditures increased 25 percent. However, real expenditures for seafood have declined somewhat since 1987.

Over the past two decades, per capita consumption has generally remained relatively stable, or only increased modestly, despite the decline in the consumption of red meat. This can be partially explained by the rise in seafood prices relative to competing proteins (red meat or poultry) and consumer prices for all goods. However, increasing expenditures for seafood indicate that demand has shifted in favor of seafood relative to red meat.

1.3 Seafood Consumption by Type: 1970-1993

As seen in Figure 4, a major change occurred in US per capita seafood consumption over the period 1970 to 1993 in the relative shares of fresh/frozen fish and shellfish. During this time period, per capita fresh/frozen finfish consumption increased from 2 to 2.9 kg per capita (4.5 to 6.3 lbs. per capita), an increase of about 40 percent. Per capita consumption of fresh/frozen shellfish increased 62 percent over this period. On average, consumption in the fresh/frozen category increased 46 percent over this 23-year period.

In contrast, per capita consumption remained stable or fell in most categories of canned and cured fishery products. Overall, per capita consumption of canned products increased slightly (2 percent) from 1970 to 1983. However, within the canned category, salmon and shellfish per capita consumption declined 43 percent and 40 percent, respectively. This may be due to the greater availability of fresh product in these categories. Over the same period, per capita consumption of canned tuna increased from 1.1 to 1.6 kg per capita (2.5 to 3.5 lbs. per capita), a 40 percent increase. This movement to fresh/frozen from canned/cured indicates a shift on the part of the US consumer to higher-value seafood.

A list of the top ten most commonly consumed seafood species (based on per capita consumption, edible weight) is compiled annually by the National Fisheries Institute (NFI). Results for 1987 and 1993, plus the percent change over this period, can be seen in Table 1. The top ten species eaten account for approximately 80 percent of total US seafood consumption. Tuna consumption, primarily canned, remains at the top.

Table 1. Top Ten Seafoods
(Based on per capita consumption, edible weight)

Rank	1987		1993		% Change
	Item	KG (Pounds)	Item	KG (Pounds)	(1987-1993)
1	Tuna	1.59 (3.50)	Tuna	1.59 (3.50)	0
2	Shrimp	1.04 (2.30)	Shrimp	1.13 (2.50)	+9%
3	Cod	0.76 (1.68)	Pollock	0.54 (1.20)	+35%
4	Pollock	0.40 (0.89)	Cod	0.47 (1.03)	-39%
5	Flatfish	0.33 (0.73)	Salmon	0.45 (0.99)	+130%
6	Clams	0.30 (0.66)	Catfish	0.44 (0.98)	+63%
7	Catfish	0.27 (0.60)	Flatfish	0.28 (0.62)	-15%
8	Salmon	0.20 (0.43)	Clams	0.26 (0.58)	-12%
9	Crab	0.15 (0.32)	Crab	0.17 (0.37)	+16%
10	Scallops	0.15 (0.32)	Scallops	0.11 (0.25)	-22%

Source: Talley, K., 1994; NFI, 1994

The trend toward greater fresh/frozen consumption of species which have been enhanced by aquaculture is confirmed by the data for per capita consumption of other species. For example, per capita shrimp consumption increased 9 percent between 1987 and 1993; however, over the past 20 years, consumption increased from 0.63 kg per capita (1.4 lbs. per capita) in 1973, to a record 1.13 kg per capita (2.5 lbs. per capita) in 1993, an increase of 78.6 percent. The importance of shrimp is further indicated by the restaurant and retail market surveys conducted by *Seafood Business* (Table 2). In 1994, shrimp is the number one best seller in both the restaurants and retail outlets surveyed and the second fastest growing sales item for retail outlets. Increases in shrimp consumption can be partially attributed to greater availability, particularly of imports, due to aquaculture production.

Table 2. *Seafood Business* Survey: 1994 Best Selling Fresh/Frozen Seafood		
US Restaurant Best Sellers	US Retail Sales	
	Best Sellers	Fastest Growing Items
Shrimp	Shrimp	Salmon
Pollock, Cod, Haddock	Salmon	Shrimp
Salmon	Pollock, Cod, Haddock	Tilapia
Swordfish	Catfish	Catfish
Scallops/Flounder	Flounder	Orange Roughly
Lobster	Orange Roughly	
Tuna	Swordfish	
Clams	Halibut	
Catfish	Scallops	
Halibut/Mahi Mahi	Surimi	
Source: Perkins, C., 1994 a and b.		

Another predominantly fresh/frozen and increasingly aquacultured species which has increased in popularity in the US is salmon. Consumption of fresh/frozen salmon has increased from 0.2 kg per capita (0.43 lbs. per capita) in 1987 to 0.45 kg per capita (0.99 lbs. per capita) in 1993, representing an increase of 130 percent (see Table 1). Salmon rose from the eighth to the fifth most popular seafood between 1989 and 1993. Fresh/frozen salmon was the second and third best selling seafood in retail outlets and restaurants, respectively, according to the *Seafood Business* survey for 1994 (Perkins, 1994 a and b). Furthermore, it was the fastest growing sales item in the 1994 retail survey (Perkins, 1994 b). The growth of salmon consumption has mirrored the increased availability of high quality product resulting from the entrance of aquaculture into the industry.

Another species increasing in popularity is catfish. Once considered a low-value, undesirable species, catfish has gained widespread acceptance since aquacultured product became dominant.

Four of the five fastest growing seafood items are species for which the increases in US supply are heavily dependent upon aquaculture (shrimp, salmon, catfish, and tilapia). The fifth, orange roughy (Perkins, 1994b), is an imported product closely controlled by an individual transferable quota (ITQ) program in New Zealand. In contrast, many of the important, traditional wild fisheries have shown declines. As shown in Table 1, cod, flatfish, clams, and scallops have all experienced declines in per capita consumption. In each of these fisheries, wild stocks have been subject to full or overexploitation, and only limited aquaculture has moved in to replace US supply. This is changing rapidly for scallops and clams, as both US and foreign producers increase aquaculture efforts.

Of all of the species in the top ten, the only strictly wild-caught finfish in which consumption increased is pollock (up 35 percent from 1987 to 1993). The pollock case illustrates another trend, the use of "technology assisted" processing, turning a once underutilized fish into surimi, a process which allows it to be extended with binders or fillers of other species to simulate a more desirable species, such as crab. In addition, pollock has been used as a substitute for frozen cod and other whitefish blocks in the production of processed, breaded products, such as those sold at fast-food operations.

2. TRENDS SHAPING THE SEAFOOD MARKET

2.1 Demographics of Seafood Consumption

Several surveys and demand analyses have been conducted to provide insight into the nature of the seafood consumer in today's market. In general, it has been found that seafood consumption and expenditures tend to increase with income (Keithly, *et al.*, 1993; Cheng and Capps, 1988; Wessells *et al.*, 1994; Israel *et al.*, 1991) and to be greatest among consumers aged 25-55 (ASMI, 1991; Egan, 1993). Seafood consumption and expenditures tend to be higher in coastal (Wessells *et al.*, 1994) and urban (Haidacher, 1982; Israel *et al.*, 1991) areas.

There should be a modest increase in real income over the next decade which will stimulate seafood consumption. An aging and increasingly urbanized US population will also cause seafood consumption and expenditures to increase, as should the continuing trend of increasing coastal population[1].

2.2 Restaurant vs. At-Home Seafood Consumption

Current estimates indicate that approximately 50 (at the primary US supply level) to 70 (at the consumer level) percent of US seafood expenditures are associated with food service purchases (USDC, 1994). Higher-valued seafoods appear to be more frequently consumed in restaurants. For example, it is estimated that 68 percent of salmon is consumed in the food service sector (ASMI, 1991). The trend of away-from-home consumption of seafood is expected to continue. Despite considerable efforts by retail outlets to expand their seafood displays, it is expected that restaurants and other away-from-home institutions will retain their status as the major outlets for seafood. This is a particularly important trend to consider as new seafood products are introduced, since most consumers first gain exposure to seafood through their restaurant experiences. After becoming familiar with a product, they may eventually attempt

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[1]It is interesting to note that poultry is also consumed in greater quantities by the urban consumer. This is in contrast to red meat, for which consumption is equally distributed between rural and urban areas, although in some regions, per capita red meat consumption is greater in rural areas (Haidacher *et al.*, 1982).

to prepare it at home. However, there are still several seafoods that many consumers generally do not prepare at home. This category includes many molluscan shellfish, sushi and related products, unfamiliar species, such as bluefish, squid, tilapia, hybrid striped bass, preparations which involve the cleaning or cutting of fish, and live seafood, such as lobster. Restaurants provide a ready alternative for much of the consumers' reluctance.

One aspect of the eating out trend is the continuing success of chain restaurants and family-style restaurants. These restaurants are oriented towards convenience for working people, both singles and families, and are expected to receive a greater share of the consumer food dollar over the next decade. Furthermore, US consumers aged 29-47 ("baby boomers") spend 23 percent more than the average individual on restaurant dining (*Advertising Age*, 1994). This group also has a higher level of per capita seafood consumption than those in other age groups. Chain restaurants, in particular, prefer portion-controlled products which are easy to prepare. This creates opportunity for aquaculture products which are easily standardized, such as shrimp, salmon, and catfish. Aquacultured product can be harvested in a more controlled and uniform manner than wild product. This provides a more consistent supply. It is expected that aquacultured products, and other seafood products which can be presented in an easy-to-prepare and highly uniform way, will gain increased share within these chain systems.

As the restaurant segment of seafood consumption grew in the 1980s, retail stores made considerable efforts to increase sales as well. Several supermarket chains installed full-service seafood counters, incorporating upgraded displays with whole fish, freshly cut fish, ice, and other characteristics associated with a premium fish market. Many of these full-service supermarket seafood counters have been highly successful, especially in "super stores." However, in other instances, the extra maintenance and labor costs for a full-service seafood counter have not led to increased profits. Recently, the trend toward full-service counters has slowed.

Growth in retail sales may be achieved through improved self-service displays, better packaging, improving the knowledge of seafood counter personnel, and consumer education. Many personnel at supermarket seafood counters are still uninformed about the origin of, quality of, and required preparation for the seafood they sell. This undermines consumer confidence in their seafood purchase decisions and contributes to lost sales. This is particularly true for high-priced seafoods, where consumers may be reluctant to pay a high price for a product if they are unsure of its quality or how it should be prepared, especially when chicken may be selling for less than $2.20/kg ($1.00/pound).

2.3 Consumer Perceptions of Seafood

In the 1980s and early 1990s, three important themes influenced the consumers' perception of and demand for seafood. The first is an increased awareness of the health benefits derived from seafood consumption. Many seafoods are low in cholesterol, generally low in fat, and are a good source of high-quality protein. These benefits could contribute to increased consumer demand. However, due to supply constraints and industry fragmentation, the seafood industry has demonstrated a limited ability to take advantage of these positive characteristics.

The second issue influencing seafood consumption is the concern for its safety. These concerns were heightened by media attention regarding poor sanitation practices, ocean pollution, and naturally occurring algal toxins such as domoic acid and organisms such as *Vibrio vulnificus* and *Gymnodinium breve*, the latter is responsible for red tide (Institute of Medicine, 1991). These factors may have a negative impact on the demand for seafood.

The third major concern is the consumers' increased awareness of the marine environment, in particular, marine mammals, such as dolphins and whales, and sea turtles. Recently, concerns have arisen involving potentially or currently endangered salmon stocks. Environmental concerns about these marine mammals, turtles, and other endangered species have led to increased restrictions on the supply of fish. They have also influenced some consumers to avoid seafood consumption because of concerns of potentially environmentally damaging fishing practices.

In aggregate, it is difficult to gauge the influence of these consumer perceptions. On one hand, consumers are clearly becoming more aware that quality seafood is nutritious. On the other hand, there is concern regarding the safety of seafood consumption and the seafood industry's fishing and handling practices. These concerns should continue to exert influence throughout the coming decade.

Some concerns associated with seafood consumption could be mitigated by the implementation of a mandatory seafood inspection program. Final regulations for the Food and Drug Administration's Hazard Analysis and Critical Control Point (HACCP) program are scheduled to be completed by early- to mid-1995. Complete implementation of this mandatory seafood HACCP program will probably not occur until 1-2 years thereafter.

Both domestic and foreign firms which export to the US will be required to develop HACCP plans and keep rigorous records to indicate that the HACCP plan and the quality of the seafood produced has been maintained. Importers of seafood will be required to document that their suppliers have HACCP plans in place and have complied with the same standards as US producers. This should contribute to increased consumer confidence and possibly increase seafood demand. It may also result in increased concentration in the seafood industry.

Certain types of seafood producers will be able to adopt HACCP practices more easily than others. For example, surimi processing plants and plants which process frozen fish block should find compliance with HACCP quite simple. Plants which process high quality, consistent product, such as farmed salmon, will probably also be able to meet these goals easily. Plants that are small, produce for niche markets, and process underutilized species, may encounter more difficulty with compliance.

2.4 Domestic Landings

Another major trend influencing US demand for seafood is the level of US domestic landings. Although total domestic landings increased substantially in the early 1980s, most of this increase was the result of exploitation of the pollock resource in the Pacific Northwest (Figures 5 and 6). Most pollock is used for fish block or for surimi production, which eventually becomes simulated crab legs, shrimp, scallops, or similar products.

Although Alaska's salmon fisheries appear to be doing well, in Washington, California, and Oregon, there is considerable concern surrounding endangered salmon stocks. Other fisheries, such as the lobster and surf clam, appear to be reasonably managed. However, data on US fish stocks indicate that 28 percent of stocks are considered overexploited, and another 25 percent are considered to be fully exploited. Only a few stocks, 13 percent, are considered underexploited (USDC, 1991, p. 16). In the US, cod, haddock, and flatfish stocks are under stress. Supply of fish from domestic harvest, especially high-valued species, is not expected to increase substantially in the near future. Fisheries managers and environmentalists are being particularly aggressive in protecting certain stocks. In 1992, in Newfoundland, a moratorium on cod fishing was imposed and remains in force, and it is highly probable that major sectors of the Northeast US groundfishery will be virtually shut down in the near term. The Pacific Northwest salmon fishery has recently experienced many closures because of endangered species concerns. In addition, there is increasing pressure on the fishing industry to ban certain types of fisheries, such as gillnet. All of these factors will tend to reduce the supply from the US domestic, traditional fishery.

To further protect the supply, several fisheries are moving toward rights-based fisheries, using policies such as various individual transferable quota (ITQ) systems. This type of fisheries management gives greater control to the fishermen for decisions regarding intensity and time of harvest. Limited access oriented policies should result in the harvest of higher quality fish which would be taken in accordance with market demand. It is expected that as these fisheries become more market driven, as has occurred in the Canadian halibut fishery after the introduction of ITQs, more high quality fish should enter the market.

2.5 Changing Sources of Supply

In aggregate, it is not expected that domestic supplies from the traditional fisheries will increase significantly over the next decade. Therefore, if seafood supply is inadequate to meet future demand, three other sources must be used. These are: 1) exploitation of underutilized species; 2) domestic development of aquaculture, and 3) increased imports from both aquaculture and ocean fisheries abroad.

1. Underutilized Species

Despite considerable effort to entice fishermen to develop underutilized species over the past two decades, there has been limited success. Frequently, when efforts to exploit underutilized species have been successful, fisheries management regimes have been ineffective at managing stocks, which, in turn, have become overexploited or fully exploited very rapidly. An example of this is the urchin fishery in California. However, there are still several apparently underexploited fisheries in the US, such as the red hake, skate, mackerel and spiny dogfish fisheries (USDC, 1991). Given the fragmented nature of the seafood industry and the supply inconsistencies of underutilized species, it is difficult to expect new markets to develop to any significant degree. Without a consistent supply and commitment to market development, it is unlikely to occur. One exception is the development of markets that are derived from taking an underutilized or low-valued species, and reconstructing it into a product which already has an established market. This is the case with the Alaskan pollock fishery. This industry takes low-valued pollock and reconstitutes it into a competitor for the crab/shrimp markets or produces frozen blocks to substitute for the declining cod supply. In this case, they are not selling underutilized species, but rather crab analogs and cod substitutes. If processes are developed which transform underutilized species into value-added products which meet consumer needs and tastes, then new markets will develop. However, significant markets for products such as fresh or canned mackerel are probably a long way off.

2. Aquaculture

Aquaculture is growing on both a global and domestic scale (Figures 7 and 8). Aquaculture production in the US increased over 120 percent between 1983 and 1992. The dominant aquacultured species in the US is catfish. Catfish was once assumed to be a product which would not find demand in the US outside of the South. It did, however, and has been very successful. Farmed catfish production increased dramatically, from 21,072 MT (46.46 million lbs. processed weight) in 1980, to 208,189 MT (459.01 million lbs.) in 1993, an increase of nearly ten fold (USDA, 1994). Like shrimp and salmon, in 1994 catfish is also one of the fastest growing (fourth fastest) sales items in retail outlets. Catfish was the fourth best selling retail item and the ninth best selling restaurant item in the 1994 *Seafood Business* survey (Perkins, 1994 a and b). By increasing the quality and minimizing an unappealing, muddy off-flavor, farmers have been able to increase consumption while maintaining relatively stable prices. Wholesale catfish in the early 1990s frequently sold for a price higher than that of wholesale salmon. This is a result of the catfish producers': 1) desire to produce a quality product; 2) ability to produce a consistent product; and 3) considerable marketing efforts. However, in many ways, catfish is not really sold as catfish. It is marketed as a convenient, value-added product. It tends to be sold breaded or with a variety of available sauces. It is easy for the restaurant sector to prepare and is relatively convenient for the at-home consumer.

In addition to catfish aquaculture, the US has well established trout, salmon, and oyster aquaculture industries; growing clam, mussel, hybrid striped bass, and tilapia industries; and experimental operations utilizing such species as flatfish, mahi mahi, and others. However, aquaculture in the US is severely constrained by the lack of support it receives from government agencies and the many regulations which act as barriers to entry. These include issues related to use of the coastal zone, transport of live fish, constraints on the use of antibiotics and other types of drugs for disease control, conflicts with traditional users, such as fishermen and recreational sailors, and conflicts with coastal land owners. These constraints will tend to continue to curtail the coastal development of aquaculture in the US. For example, in 1988, Alaska placed a permanent moratorium on private, for-profit finfish aquaculture. Although aquaculture has developed very slowly in the coastal zone of most of the US, freshwater aquaculture development is somewhat less constrained. An important reason for the success of catfish aquaculture is that it is raised in freshwater farms, and, therefore, not subject to the same degree of conflicts, barriers, and regulations that apply to marine aquaculture.

It is expected that freshwater aquaculture will continue to grow, contribute significantly to US supplies, and take a greater share of the consumer's dollar. Growth of coastal aquaculture in the US, on the other hand, is expected to remain constrained. However, there are considerable efforts currently underway to create offshore systems for aquaculture as well as on-shore, intensive systems, which may or may not prove successful in the coming years.

3. Imports

Imports accounted for about 64 percent of the value and nearly 41 percent of the quantity of edible US fishery supply in 1993. The largest supplier, by value, to the US was Canada, followed by developing nations such as Thailand, Ecuador, China, Mexico, and Chile (USDA, 1994).

Aquaculture is growing more rapidly in areas outside the US, and much of that aquacultured production is coming into the US through imports. One of the most successful ventures, and one of great significance to the US, is shrimp aquaculture in Latin America and southeast Asia. Worldwide, 30 percent of the shrimp supply is derived from aquaculture (Csavas, 1994). In the US, more than 50 percent of the shrimp consumed is imported aquaculture product from countries such as Thailand, Ecuador, and China. This is a major shift since aquacultured shrimp accounted for less than 10 percent of world supply in 1985 (Csavas, 1994). Imported shrimp accounts for nearly 37 percent of the value of US imports (see Figures 9 and 10 for details).

In addition to the rapid growth of shrimp aquaculture, salmon farming is increasing in countries such as Norway, Chile, Scotland, Canada, Australia, and Japan. In 1980, salmon raised in ocean pens accounted for less than one percent of world salmon harvest. By 1991, farmed, net-pen production exceeded the production of all salmon catch in the US ocean fisheries, including Alaska. Currently, more than half of the fresh and frozen salmon consumed in the US comes from farmed salmon production, primarily Canadian and Chilean (Anderson, 1994).

As commercial fisheries in the US are increasingly restricted, and since US aquaculture will unlikely be able to fill the gap, increased pressure will be placed on imports to meet US consumer demand. The US can be expected to increase its demand for imported shrimp, groundfish from traditional fisheries, flatfish, and many other products. However, there are limitations to the United States' ability to demand products from abroad. In particular, within the next several years, countries which export to the US will have to have some type of HACCP plan in place. This may limit some developing countries, which are unable to comply with HACCP regulations, from being able to sell to the US. Furthermore, the US has become increasingly concerned about the harvesting practices of other nations in an effort to protect the worldwide environment. An example is the dolphin taken in conjunction with the tuna harvests. The US recently invoked embargoes of tuna products from Columbia, Mexico, Panama, and Venezuela. In addition, the US has pressured other countries, such as Mexico and some Caribbean nations, through the threat of embargo, to employ turtle excluder devices (TEDs) if they intend to sell trawl-caught shrimp to the US. It is conceivable that the US will continue to use its leverage to influence the environmental practices of nations throughout the world from which we import significant quantities of seafood.

In addition to practices associated with wild harvests, those associated with aquaculture production, such as wetlands or mangrove destruction, may eventually precipitate trade barriers to countries which the US believes are excessively exploiting their resources.

United States per capita income is not expected to grow rapidly relative to some other nations such as Malaysia, Thailand, China, and others, which have experienced rapid increases in real income. Increasing income will cause these countries, many of which are largely seafood consuming, to be competitors in the global market for seafood products. This may tend to bid up seafood prices in the international arena, especially for products for which the US is already a significant consumer, such as shrimp and salmon.

2.6 Processed and Value-Added Seafood

There is expected to be a continuing trend towards fresh and frozen seafood consumption, both in shellfish and finfish. Although developments in convenience and packaging have been slow for many species, there have been some tremendous changes in the US seafood market as a result of the introduction of value-added products throughout the 1980s and early 1990s. More changes are expected. The most notable is the growth of the surimi market. In the US, surimi (crab analogs) was essentially an unknown product in the late 1970s. By the early 1990s, it had become a significant factor in at-home consumption, and even more so within the restaurant sector. Surimi is used in all types of pasta dishes, soups, seafood salads, and sushi. In addition to surimi products, portion control of fresh and frozen products is becoming more prevalent. The aquaculture sector, especially salmon and catfish, is leading the way in the development of these products, many of which are targeted at the food service sector. It is expected that this trend will continue.

3. HYPOTHESES FOR US SEAFOOD MARKETS IN 2010

3.1 US Fisheries

As US stocks decline or stabilize, the expected price for products solely dependent upon the wild fisheries will tend to increase at a rate greater than inflation. These include products such as cod, flounder, other flatfish, tuna, and swordfish.

3.2 Aquaculture and Imports

Increases in US consumption will require greater supplies from aquaculture and imports. Canada will probably continue as the largest single source of imports, but it is possible that developing countries, such as Thailand or China, with rapidly growing aquaculture industries, may surpass Canada. Furthermore, in aggregate, traditional fisheries and aquaculture in developing countries will be the most significant source of additional supply to the US.

Aquaculture production destined for the US market will be oriented towards the higher-valued seafood products. However, for the fisheries where aquacultured products are dominant, it is expected that the prices will either keep pace with inflation or lose ground. Real prices for catfish, salmon, and shrimp have all experienced a downward trend as production has increased through the past decade.

As aquaculture becomes an increasingly significant factor, prices will tend to approach the marginal cost of aquaculture production. Although costs will likely decrease with improved technology, nutrition, and breeding, cost of inspection and quality control, as well as increased regulation, may offset much of the cost reduction. Environmental regulation should have a significant influence in raising cost.

3.3 Value Added

It is expected that analog and portion-control products will continue to represent an increasing share of the seafood market. Underutilized species will probably not be very successful in the US market, despite current attempts to market them in an unprocessed form. Even if they are successful, the availability of consistent stocks is uncertain.

3.4 Demographics

With the "baby boom" generation moving into its late thirties and forties, the continued popularity of eating out, coupled with moderately increasing incomes, should increase the demand for seafood throughout the next decade. Away-from-home consumption should continue to take an increasing share of the consumer's food dollar.

3.5 Aggregate Seafood Prices

As increasing population and increasing demand put pressure on price from the consumer side, stable or declining wild stocks and increased costs of doing business will decrease supply and push price up from the producers' side. In addition, since the aquacultured products being sold in the US are primarily high-valued species, it is expected that aggregate prices for seafood will increase faster than the inflation rate. Seafood prices should also increase faster than the prices of competing products, such as red meat and poultry.

3.6 Aggregate Per Capita Consumption

Based on preliminary trend analysis[2], indications are that per capita consumption should increase at a rate of about 1 percent per year, to the range of about 7.7 to 9.1 kg per capita (17-20 lbs. per capita) by the year 2010 (Figure 11). In the 1980s, many in the industry forecasted per capita consumption to reach 9.1 kg per capita (20 lbs. per capita) by the year 2000. The expression, "20 by 2000" was common. This was unrealistic then, and it seems unlikely that consumption will exceed 9.1 kg per capita (20 lbs. per capita) by the year 2010. These forecasts are also seen in Figure 11.

Based on analysis of trends in the poultry, fish, and red meat markets, it is expected that the seafood share of per capita consumption of animal proteins should increase from about 8 percent to about 9.5 to 10 percent. In contrast, poultry share will likely increase from 32.5 percent to approximately 40 percent in 2010. Red meat consumption should continue to decline, from a share of about 59.5 percent to about 50 percent of per capita consumption by the year 2010. These forecasts can be found in Figure 11.

3.7 Fresh and Frozen Per Capita Consumption

It is expected that fresh and frozen seafood consumption will continue to comprise an increasing share of per capita consumption. Fresh and frozen fish consumption is likely to exceed 5.5 kg per capita (12 lbs. per capita edible weight) by the year 2010. Consumption of canned fish, such as tuna, is expected to remain stable or increase slightly, and consumption of canned shellfish and cured fish is expected to decline.

3.8 Additional Supply Requirements

As noted earlier, per capita consumption of seafood is expected to increase about 20 percent by 2010, to about 8.4 kg per capita (18.6 lbs. per capita). Population projections indicate that by 2010, the US will have approximately 298 million people, an increase of about 16 percent (USDC, 1993, Table No. 17). Based on seafood consumption of 8.4 kg per capita (18.6 lbs. per capita), an additional 1.7 billion pounds (more than three times that amount on a round-weight basis) of edible seafood will be required to meet quantity demanded. This represents an increase of approximately 44 percent over current aggregate consumption of edible seafood.

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[2]The trend analysis employs a basic state-space, time-series model similar to those used in Vukina and Anderson (1994) and Gu and Anderson (1994).

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