

**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**

**APPARENT HISTORICAL CONSUMPTION AND FUTURE DEMAND  
FOR FISH AND FISHERY PRODUCTS-  
EXPLORATORY CALCULATIONS**

by

Lena Westlund



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## EXECUTIVE SUMMARY

Total world fish production peaked in 1989 at over 100 million tonnes in total reported catches. Although this figure declined between 1990 and 1992, preliminary data for 1993 indicate that total production amounts to over 101 million tonnes. Of this catch about 30% was utilized for non-food purposes, mainly for reduction to meal and oil. Fresh fish is the most important fish product for direct human consumption, its share of total production remaining at around 30% between 1970 and 1990. Frozen products have increased their share, while cured products have lost ground. Canned products have maintained their share of 12% over the period.

Apparent *per caput* consumption of food fish in 1993 is estimated at 13 kgs (defined as *per caput* fish supply for direct human consumption in live weight equivalent). This represents a drop from 1989, when *per caput* consumption peaked at 13.6 kgs. Regionally, *per caput* fish consumption was also higher in 1989 than in 1970. However upon closer examination of consumption trends in major regions, sub-regions, and countries, important differences are revealed. Examples of drops in *per caput* consumption can be found at individual country level; examples include Viet Nam and Bangladesh.

Asia is by far the most important region for direct human consumption of fish owing to the mixture of relatively high *per caput* consumption levels and large populations. For example, Japan had one of the highest *per caput* consumption levels in the world at 71 kgs. China accounted for 27% of the total growth in fish consumption in the period 1970-1990. Europe is the second largest food fish consuming continent. Generally consumption is higher in developed countries than in developing countries. The lowest levels of consumption are to be found in Africa and the Near East. However, there are exceptions: among the small developing island states in the Pacific and in the Indian Ocean as well as in the Caribbean, several countries have a *per caput* fish consumption of over 50 kgs a year.

Species and species group composition of fish consumption also changed in the period 1970-1990. The relative share of finfish declined, and that of crustaceans, molluscs and cephalopods increased. Freshwater finfish increased their share from 16% in 1970 to 22% in 1990. Marine demersal fish declined during the period and *per caput* consumption of pelagic species increased.

Such *per caput* and total supply figures do not necessarily reflect the importance of fish as food and for food security in the various regions. In countries where fish represents a large share of the total protein intake, the relative importance of fish is naturally higher. Apart from the small developing island states already mentioned, countries where this share exceeds 10% include a number of the countries in Southeast Asia and in West Africa. Moreover, the distribution of fish and fishery products may differ significantly among regions and income groups within countries and fish as food may play different roles in these regions and groups. In many countries, especially developing countries, fish consumption depicts a highly skewed distribution with very high consumption in coastal areas where fish is often considered as staple foods. Furthermore, a study in Ghana (Heinbuch, 1994) shows that small smoked pelagic fish is the cheapest source of animal protein and therefore plays a significant role in the diets of lower income groups.

Factors that will help shape future demand for fish and fishery products include population growth, economic growth and the development of disposable income and higher purchasing power, and social factors such as traditional fish consumption patterns. Over time, traditional consumption patterns may change due to changes in social conditions, e.g., lifestyle and family structure. Attitudes towards fish may also change; in developed countries, fish is increasingly considered a healthy food. Other factors that influence food fish demand are the development and degree of sophistication of fish production, processing, distribution and marketing structures.

Exploratory calculations for future fish demand in 2010 give a world total food fish demand within the range of 100-120 million tonnes. Important regions for demand will include China, Japan and the rest of Asia, Europe including the former Soviet Union, and North America. However, as with apparent consumption trends, quite important regional disparities will occur, both among and within regions and sub-regions.

It is difficult to predict demand by product type and species groups. Nonetheless general trends can be identified such as increased demand for fresh and frozen products, and for value-added products. This is mainly due to more disposable income, hence purchasing power. Price will be an important determining factor in the demand for species groups. While consumers in developed countries will continue to demand white fish and an increasing amount of shellfish, low value species will remain important for poorer populations in developing countries. Given the rather pessimistic prospects for economic growth in sub-Saharan African, high value species will probably continue to be exported and small pelagics, etc, consumed in the local market. However, if prices of demersal fish increase significantly due to supply constraints, habitual consumers of white fish may turn to cheaper alternatives - a trend that can be seen already.

Prices of fish compared to possible substitutes will also affect future demand for food fish. It appears clear that supplies of fish will not meet demand, and thus excess demand will increase prices. The way in which these price increases will be reflected in the demand and consumption patterns of the different regions will depend on the consumers' relative purchasing power and the priority fish is given in the menu. Generally, demand will probably be less affected in relatively rich countries where there are strong traditions of eating fish, e.g., in Japan and in the emerging markets in East Asia, than in lower income countries that currently have modest fish consumption, for example in parts of Africa and South Asia. There is a risk that the present gap in average fish consumption between developed and developing countries could grow larger in the future.

## RESUME

La production mondiale de poisson a atteint son niveau maximum en 1989, soit plus de 100 millions de tonnes de captures déclarées. Les captures ont baissé entre 1990 et 1992 mais selon des données préliminaires, la production totale serait remontée à plus de 101 millions de tonnes en 1993. Sur ce total, plus de 30 pour cent a servi à des utilisations non alimentaires, principalement pour la transformation en farine et huile. Le poisson frais est le principal produit halieutique destiné à la consommation humaine directe et sa part dans la production totale s'est maintenue à environ 30 pour cent entre 1970 et 1990. La part des produits congelés a augmenté alors que celle des produits salés a baissé. Quant aux produits en conserve, ils se sont maintenus, sur la période considérée, à 12 pour cent.

La consommation apparente de poisson par habitant était estimée en 1993 à 13 kg (consommation définie comme étant la disponibilité de poisson par habitant pour la consommation humaine directe, en équivalent de poids vif). Cela représente une baisse par rapport à 1989, lorsque la consommation par habitant avait atteint 13,6 kg. Au plan régional, la consommation de poisson par habitant était également supérieure en 1989 qu'en 1970. Un examen plus détaillé des tendances de la consommation dans les principales régions, sous-régions et pays révèle toutefois d'importantes différences. Ainsi, la consommation par habitant a baissé dans des pays tels que le Viet Nam et le Bangladesh.

L'Asie est de loin la principale région pour ce qui concerne la consommation humaine directe de poisson, sous l'effet conjugué d'un niveau assez élevé de la consommation par habitant et de populations très nombreuses. Par exemple, le Japon a l'une des consommations par habitant les plus élevées du monde (71 kg). Au cours de la période 1970-1990, la Chine a assuré 27 pour cent de l'augmentation totale de la consommation de poisson. L'Europe arrive en deuxième place pour ce qui concerne la consommation de poisson. En général, la consommation est plus élevée dans les pays développés que dans les pays en développement. Elle est particulièrement faible en Afrique et au Proche-Orient. Il y a toutefois quelques exceptions comme les petits pays insulaires en développement du Pacifique et de l'Océan Indien ainsi que les Caraïbes, où plusieurs pays ont une consommation de poisson par habitant dépassant 50 kg par an. Il y a également eu, au cours de la période 1970-1990, une évolution de la composition des espèces consommées. On a en effet assisté à une baisse de la part des poissons et à une augmentation de celle des crustacés, mollusques et céphalopodes. La part du poisson d'eau douce est passée de 16 à 22 pour cent entre 1970 et 1990; au cours de la même période, la part des poissons démersaux a baissé et la consommation par habitant de poissons pélagiques a augmenté.

Ces chiffres sur la consommation par habitant et les disponibilités totales ne rendent pas nécessairement compte de l'importance du poisson comme aliment ni de son rôle dans la sécurité alimentaire de diverses régions. Dans les pays où le poisson assure une part importante de l'apport protéique total, l'importance relative du poisson est, de toute évidence, plus élevée. La part du poisson dépasse 10 pour cent dans un certain nombre de pays de l'Asie du Sud-Est et d'Afrique de l'Ouest, sans parler, bien sûr, des petits pays insulaires en développement susmentionnés. En outre, la répartition du poisson et des produits de la pêche peut nettement varier entre les régions et groupes de revenu d'un même pays, tout comme le rôle du poisson en tant qu'aliment.

Dans de nombreux pays, notamment dans les pays en développement, la consommation de poisson est très inégale, avec une très forte consommation dans les zones côtières où le poisson est souvent considéré comme un aliment de base. En outre, une étude réalisée au Ghana (Heinbuch, 1994) indique que les petits poissons pélagiques fumés, qui sont la source la moins chère de protéines animales, jouent un rôle considérable dans le régime alimentaire des groupes à faible revenu.

La croissance démographique, le progrès économique, l'augmentation des revenus et du pouvoir d'achat et des facteurs sociaux tels que le mode de consommation traditionnel de poisson sont autant d'éléments qui façonneront la demande future de poissons et de produits de la pêche. Les modes de consommation traditionnels pourront se modifier à mesure de l'évolution des conditions sociales (style de vie et structure familiale). Les attitudes à l'égard du poisson peuvent également changer; dans les pays développés, la consommation de poisson est de plus en plus considérée comme un facteur de santé. D'autres éléments influencent également la demande de poisson comme aliments tels que le niveau et le développement des structures de production, de transformation, de distribution et de commercialisation de poisson.

Selon des estimations préliminaires, la demande future de poisson pour l'alimentation se situerait, en l'an 2010, entre 100 et 120 millions de tonnes. La demande sera particulièrement forte en Chine, au Japon et dans le reste de l'Asie, en Europe, y compris dans les pays de l'ex-URSS, et en Amérique du Nord. Toutefois, comme pour la consommation apparente, il y aura de très importantes différences régionales, tant entre les régions et sous-régions qu'au sein même de celles-ci.

Il est difficile de prédire la demande par types de produits et par espèces. On peut toutefois dégager des tendances générales telles que: demande accrue de produits frais et congelés et de produits à valeur ajoutée. Cela est principalement dû à l'augmentation des revenus disponibles, et donc du pouvoir d'achat. Le facteur prix jouera un rôle déterminant dans la demande des différentes espèces. Les consommateurs des pays développés continueront à demander du poisson à chair blanche et de plus en plus de coquillages alors que les espèces de valeur inférieure resteront importantes pour les couches les plus pauvres de la population dans les pays en développement.

Etant donné les perspectives assez sombres de la croissance économique en Afrique subsaharienne, il est probable que les espèces de valeur continueront à être exportées alors que les petits poissons pélagiques et autres seront consommés sur place. Toutefois, si les prix des poissons démersaux augmentent sensiblement du fait d'une baisse des disponibilités, le consommateur habituel de poisson à chair blanche pourrait se rabattre sur des espèces moins chères - tendance qui a déjà été observée.

La demande future de poisson pour l'alimentation sera également fonction des prix du poisson comparés à ceux d'éventuels produits de substitution. Il semble évident que la production de poisson ne suffira pas à satisfaire la demande et qu'une demande excédentaire entraînera inévitablement une hausse des prix. L'effet de ces hausses de prix sur la demande et le mode de consommation des différentes régions dépendra du pouvoir d'achat relatif des consommateurs et de la priorité attribuée au poisson dans le régime alimentaire.

Il est probable que la demande sera moins affectée par une hausse des prix dans les pays relativement riches où il existe une forte tradition de consommation du poisson, comme au Japon, ou dans les économies émergentes d'Asie de l'Est que dans les pays à faible revenu où la consommation de poisson est actuellement faible, par exemple dans certaines régions d'Afrique et d'Asie du Sud. Pour ce qui est de la consommation moyenne de poisson, le fossé actuel entre pays développés et pays en développement risque à l'avenir de se creuser davantage.

## RESUMEN OPERATIVO

La producción total mundial declarada de pescado ascendió en 1989 a más de 100 millones de toneladas. Aunque esta cifra bajó entre 1990 y 1992, datos provisionales para 1993 indican que la producción total asciende a más de 101 millones de toneladas. De estas capturas se emplearon un 30 por ciento para fines no alimentarios, principalmente para su reducción a harina y aceite. El pescado fresco es el producto más importante de la pesca para el consumo humano directo, manteniéndose su cuota respecto de la producción total en un 30 por ciento entre 1970 y 1990. Los productos congelados han incrementado su cuota, mientras que han perdido terreno los productos curados. Los productos en conserva han mantenido su proporción del 12 por ciento a lo largo del período.

Se estima que el consumo humano aparente per cápita de pescado en 1993 fue de 13 kg (definido como suministro de pescado per cápita para el consumo humano directo en equivalente de peso en vivo). Esto representa un descenso respecto de 1989, cuando el consumo per cápita alcanzó los 13,6 kg. En el plano regional, el consumo de pescado per cápita fue también mayor en 1989 que en 1970. Sin embargo, tras un análisis más a fondo de las tendencias de consumo en las principales regiones, subregiones y países, se descubren diferencias importantes. Pueden encontrarse ejemplos de caídas en el consumo per cápita a nivel de los distintos países; entre los ejemplos pueden citarse Viet Nam y Bangladesh.

Asia es con mucho la región más importante de consumo humano directo de pescado, debido a la combinación de unos niveles relativamente elevados de consumo per cápita y a sus poblaciones numerosas, por ejemplo, Japón, con sus 71 kg, registró uno de los niveles más altos de consumo per cápita en el mundo. China contribuyó a un 27 por ciento del crecimiento total de consumo de pescado en el período de 1970-1990. Europa es el segundo continente que consume más pescado para alimentación. Por lo general, el consumo es superior en los países desarrollados que en los países en desarrollo. Los niveles más bajos de consumo se encuentran en Africa y el Cercano Oriente. Sin embargo, hay excepciones: entre los pequeños estados insulares en desarrollo del Pacífico y del Indico, así como del Caribe, varios países tienen un consumo de pescado por persona superior a los 50 kg anuales.

La composición por especies y grupos de especies en el consumo de pescado ha cambiado durante el período de 1970-1990. Bajó la cuota respectiva de pescado de escama, y aumentó la de crustáceos, moluscos y cefalópodos. El pescado de agua dulce aumentó su cuota del 16 por ciento en 1970 al 22 por ciento en 1990; el pescado demersal marino bajó durante el mismo período y aumentó el consumo por persona de especies pelágicas.

Estas cifras de suministro per cápita y total no reflejan necesariamente la importancia del pescado como alimento ni la que tiene para la seguridad alimentaria de las distintas regiones. En países donde el pescado representa una gran parte de la ingesta total de proteínas, su importancia relativa es naturalmente mayor. Aparte de los pequeños estados insulares en desarrollo, ya indicados, entre los países donde ese porcentaje supera el 10 por ciento están varios países del sudeste asiático y de Africa occidental.

Por otro lado, la distribución de pescado y productos pesqueros puede variar considerablemente entre regiones, y los grupos de ingresos dentro de los países y el pescado como alimento pueden tener un peso diferente en esas regiones y grupos. En muchos países, sobre todo en los países en desarrollo, el consumo de pescado refleja una red de distribución muy sesgada, con un consumo muy alto en las zonas del litoral, donde el pescado muchas veces se considera un alimento básico. Por otra parte, un estudio hecho en Ghana (Heinbuch, 1994) muestra que el pescado pelágico pequeño ahumado es la fuente más barata de proteína animal y, por consiguiente, es de gran importancia en la alimentación de los grupos de ingresos menores.

Entre los elementos que contribuirán a determinar la demanda futura de pescado y productos pesqueros están el crecimiento demográfico, el crecimiento económico, el desarrollo de los ingresos disponibles y un mayor poder de compra, así como factores sociales como las pautas tradicionales de consumo de pescado. Con el tiempo, esas pautas pueden variar debido a cambios en la situación social, por ejemplo, estilo de vida y estructura familiar. Pueden también cambiar las actitudes frente al pescado: en los países desarrollados, el pescado se considera cada vez más como un alimento beneficioso para la salud. Otros factores que influyen en la demanda de pescado para consumo humano son el desarrollo y grado de complejidad de las estructuras de producción, elaboración, distribución y comercialización del pescado.

Cálculos exploratorios sobre la demanda futura de pescado en el año 2010 arrojan una demanda total mundial de pescado para el consumo humano del orden de 100-120 millones de toneladas. Entre las regiones cuya demanda será importante figurarán China, Japón y el resto de Asia, Europa incluida la antigua Unión Soviética, y América del Norte. Sin embargo, al igual que con las tendencias aparentes de consumo, se producirán disparidades regionales muy importantes, tanto entre las regiones y subregiones como dentro de ellas.

Es difícil predecir la demanda por tipos de productos y grupos de especies. Sin embargo, pueden identificarse tendencias generales como una mayor demanda de productos frescos y congelados y de productos con valor agregado. Esto se debe principalmente a una mayor disponibilidad de ingresos, y por lo tanto a un mayor poder adquisitivo. El precio constituirá un elemento de importancia determinante en la demanda de grupos de especies. Los consumidores de los países desarrollados seguirán pidiendo pescado blanco y una cantidad cada vez mayor de mariscos, pero las especies baratas seguirán siendo importantes para las poblaciones más pobres de los países en desarrollo. Dadas las perspectivas bastante pesimistas del desarrollo económico en el África al sur del Sahara, probablemente seguirán exportándose especies de gran valor y pequeños peces pelágicos, etc., consumidos en el mercado local. Sin embargo, si los precios de los peces demersales aumentan considerablemente debido a limitaciones de la oferta, los consumidores habituales de pescado blanco pueden pasar a alternativas más baratas, tendencia a la que ya estamos asistiendo.

Los precios del pescado en comparación con posibles productos que lo sustituyan también repercutirán en la demanda futura de pescado para consumo humano. Parece claro que los suministros de pescado no cubrirán la demanda; por lo tanto ese exceso de demanda contribuirá a que suban los precios. La forma en que esos aumentos de precios van a reflejarse en las pautas de demanda y consumo de las regiones dependerá del respectivo poder adquisitivo de los consumidores y de la prioridad que en el menú se dé al pescado.

Por lo general, la demanda se verá probablemente menos afectada en países relativamente ricos donde hay una fuerte tradición de comer pescado, por ejemplo, en Japón y en los mercados emergentes del Asia oriental, más que en los países de ingresos inferiores, que corrientemente tienen un consumo modesto de pescado, por ejemplo en parte de África y Asia meridional. Se corre el riesgo de que el actual nivel de consumo medio de pescado entre países desarrollados y en desarrollo pueda aumentar aún más en el futuro.

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## 1. INTRODUCTION

### 1.1 Background and purpose

This thematic study was prepared as part of the documentation for the International Conference on Sustainable Contribution of Fisheries to Food Security being held in Kyoto, Japan, in December 1995. The report provides background information on food fish consumption and presents exploratory calculations of future demand levels which are used as an input to the discussion on fish consumption in 2010 in the Main Technical Conference Document.

### 1.2 Acknowledgements

The author is grateful for the many comments and inputs provided by colleagues at FAO, among others E. Ruckes and K. Leendertse as well as staff in the Fishery Information, Data and Statistics Service (FIDI) and in the Economic and Social Department (ES). The many helpful suggestions and reviews of R.S. Johnston, B. Schrank and J.A. Young are also gratefully appreciated.

### 1.3 Outline of the report

The first part of the report gives an overview of the historical fish consumption. Global trends of production and utilization of catches, and global and regional consumption patterns are presented.

The second part discusses factors influencing the demand for fish and fishery products.

The last section reviews the future demand for seafood at constant real prices. An exploratory assessment by region of demand levels in 2010 is presented. In the concluding remarks, a brief discussion is held on the possible implications of demand according to the projections on future global food fish consumption.

### 1.4 Definitions used and limitations of the report

The report focuses on demand for and consumption of **fish for direct human consumption**; it thus excludes non-food uses of fish.

The data on historical apparent consumption concern mainly the period 1970-1990 for which relatively homogenous information is available. When available, more recent information is referred to.

**Apparent food fish consumption** is assumed to equal **fish supplies for direct human consumption** as defined in food balance sheets, i.e., *production - non-food uses +/- stock changes +/- trade* (in regional/country analysis). Marine mammals and aquatic plants are not included. All figures are given in volume of *live weight equivalent*.

It should be remembered that this measurement does not give the true volume actually consumed, i.e., what is actually eaten; different fish and shellfish yield quite variable amounts of edible flesh.

Also the product form has an important influence on the eventual yield. Consumption of fresh, whole fish would be a more complete use of the flesh than for example fish fillets, as some of the edible flesh is lost in producing fillets. This reality also has implications when comparing fish consumption statistics in live weight between different regions.

It appears that - out of the same amount of live weight - less fish flesh is actually consumed in developed countries where more elaborate fish products are marketed than in developing countries where more often the whole fish is eaten. However, data are scarce on actual consumption in its genuine sense and live weight equivalent is the only unit of measurement available for global comparisons and it has therefore been used, in spite of its shortcomings.

Moreover, considering the level of aggregation, the measurement is appropriate for the purpose of the analysis, i.e., to identify and describe general trends. Therefore, in the report, the *fish supply for direct human consumption* will be referred to as *consumption*.

It should also be remembered that the average apparent consumption statistics for a specific country do not give any information on the relative importance of fish in the diet or on the distribution of fish within the country, i.e., among different regions and - maybe more important - income groups. Although mentioned under section 2.2.3 and in the regional comments when relevant, this issue is not covered in any detail owing to the lack of comprehensive data and the aggregated nature of the present analysis.

While acknowledging the importance of international trade and distribution in consumption patterns, the report does not cover them in its analysis.

It is important to point out that the official statistics of FAO are based on figures reported by countries which may not, for example, take illegal landings or subsistence fisheries into consideration. Especially for inland fisheries, unrecorded subsistence fisheries may constitute important volumes.

Two levels of regional analysis are presented, continental and sub-regional. In the sub-regional analysis, seventeen country-groups have been defined. The details of these groupings are given in Annex I. In Annex II and III, the statistical information used for the analysis of each group is presented.

The forecast of future demand (chapter 4) is based on exploratory estimates and should be considered as an indication of the order of magnitude, and not as a precise projection.

Furthermore, future demand is expressed as the *quantity demanded at constant real prices*; the study does not cover the analysis of future *consumption levels*, although they are briefly discussed in the concluding section.

## 1.5 Sources of information

The historical apparent consumption data are derived from the food balance sheets information as compiled by Mr E. Laureti, FAO Fishery Information, Data and Statistics Service, in Fisheries Circular No. FIDI/C821 (Rev.2) "Fish and fishery products.

Apparent consumption statistics are based on food balance sheets (1961-1990)" and on the associated data base.

Data on meat consumption and urbanization have been obtained from AGROSTAT (FAO) and STARS (World Bank) data bases, respectively. Forecasts of Gross Domestic Product (GDP<sup>1</sup>) have been used as an indicator of future economic growth. Population growth projections are UN estimates (1994 assessment).

In the regional analysis, information from the base studies carried out to prepare the Conference documentation has been used. These studies are listed in the bibliography. The "Regional studies" prepared as part of the Conference documentation have also been consulted for information.

## 2. HISTORICAL GLOBAL AND REGIONAL TRENDS

### 2.1 Production and utilization of catches

Total world fish production<sup>2</sup> increased at an annual rate of 6% from the early 1950s to the beginning of the 1970s. In the 1970s, overall catches grew slower, mainly due to the collapse of the Peruvian anchoveta fishery, which in fact made total fish production decline in 1972 (FAO, 1995).

Other reasons for the stagnation, in particular the decline in food fish production at the end of the 1970s, may be related to the introduction of EEZs<sup>3</sup> and the change in exploitation patterns it entailed, as well as a slack in demand caused by the economic recession in the Western world<sup>4</sup>.

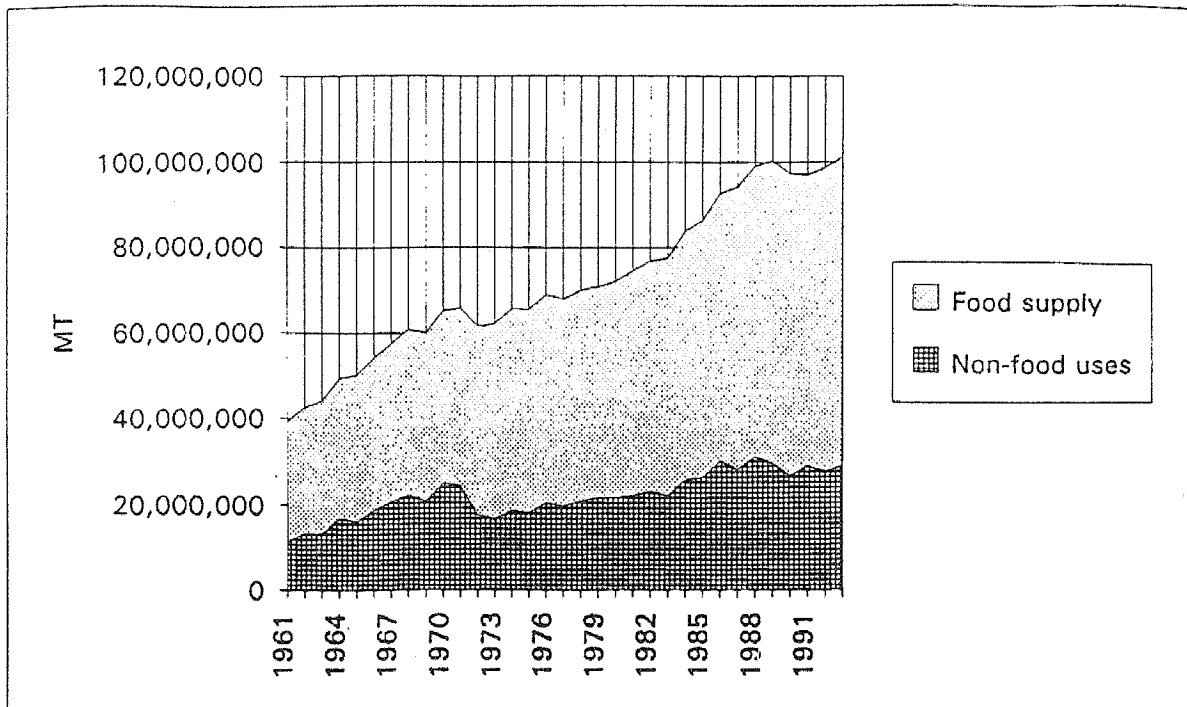
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<sup>1</sup> Forecasts are FAO estimates (May 1994) for GDP in US\$, constant prices (base year 1980), based on World Bank and IMF data.

<sup>2</sup> Includes production of all fish, including crustaceans and molluscs, from both capture and culture fisheries in marine as well as inland waters. Marine mammals and aquatic plants are not included. In accordance with FAO vocabulary, the word "catch" is sometimes used in the report as a synonym to "production".

<sup>3</sup> Exclusive Economic Zones

<sup>4</sup> In Europe, a drop in fish consumption can be seen during the period 1974-79 coinciding with the first oil crisis and the restriction for most EEC nations to access to resources because of the introduction of EEZs (Monfort, 1994).



**Figure 1:** World total fish production: food supply and non-food uses 1961-1993 (MT; live weight equivalent)

(Source: FAO Fishery Information, Data and Statistics Service.)

At the end of the 1970s, fish production - both in total volume and in terms of food fish production - started to increase steadily again. Production peaked in 1989 at over 100 million tonnes in total reported catches.

Thereafter, the production declined to 97 million tonnes annually in 1990 and 1991 and to 98 million tonnes in 1992. Preliminary data for 1993 indicate a new increase in total production amounting to over 101 million tonnes (see Figure 1).

Figure 2 shows the disposition of the total world production by main product types in the period 1961-1990.

During the period, an average of 31% of total catches was used for other purposes than food, mainly for reduction to fish meal and oil.

Up to the end of the early 1970s, production for non-food uses increased whereafter it declined quite drastically when the Peruvian anchoveta fishery collapsed. In 1993, fish production for non-food uses constituted 29% of total catches.

Fresh fish have the highest share of production of food fish, averaging 30% during the period.

Cured products lost importance relatively while frozen products increased its share; from 7% in 1961 to 18% in 1990<sup>5</sup>. Canned products represented approximately 12% of total production during the whole period.

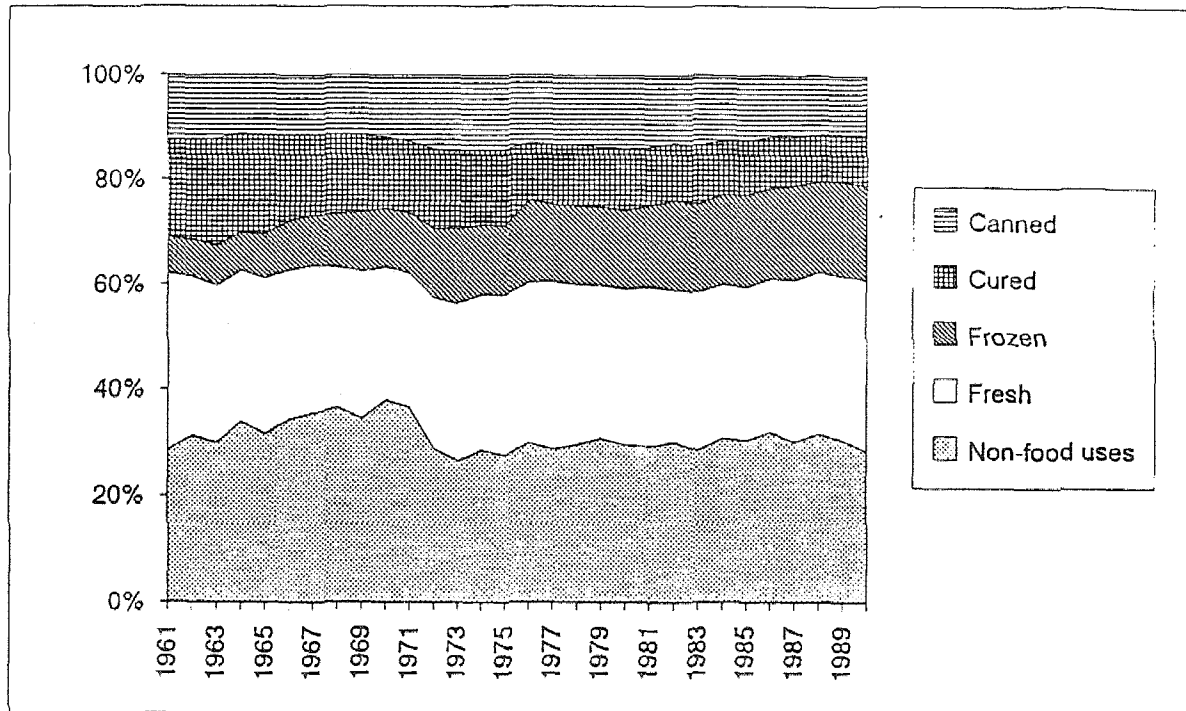


Figure 2: Utilization of world fish production by major product groups 1961-1990 (%; live weight equivalent)

(Source: FAO Fishery Information, Data and Statistics Service.)

## 2.2 Historical consumption patterns<sup>6</sup>

### 2.2.1 *Per caput* consumption and global volumes

In 1993, the apparent world average food fish *per caput* consumption is estimated to have attained 13 kgs (live weight equivalent). This represents a decline since 1989, when *per caput* consumption peaked at 13.6.

<sup>5</sup> The delimitation between fresh and frozen fish in the statistics is not always distinct due to the fact that the two products follow similar distribution and marketing channels. Hence, the data of the two separate groups should be treated with caution.

<sup>6</sup> As mentioned in the Introduction, the following presentation is based on food balance sheets (FIDI/FAO). Historical apparent consumption is assumed to equal past supply calculated as production - non-food uses +/- stock changes (- exports + imports).

Up to then, *per caput* supplies had increased; in 1970 consumption was 10.9 kgs per person. However, the growth during the period 1970-1989 had not been uniform. Food fish supplies decreased during the second half of the 1970s, starting to increase again in the 1980s (see Figure 3).

Also on a regional level<sup>7</sup>, fish consumption was higher in 1989 than it had been twenty years earlier.

Exceptions tend to be at the level of individual countries (e.g., Bangladesh, Vietnam). Figure 4 shows *per caput* consumption by continents for the period 1970-1990.

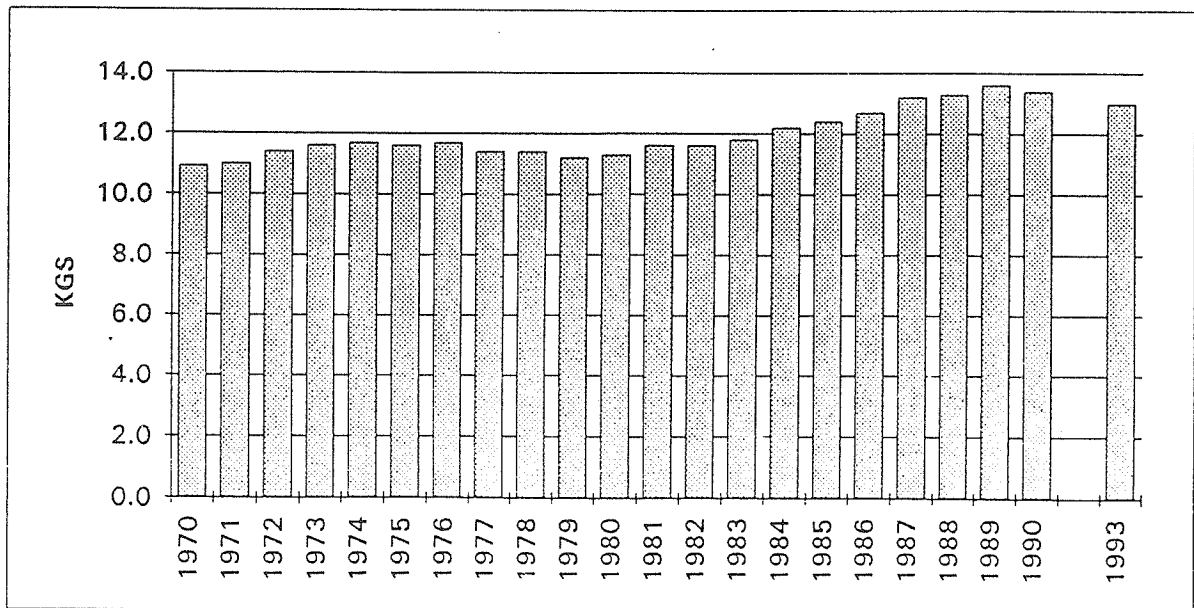


Figure 3: Average *per caput* food fish supply - world total (kgs; live weight equivalent) 1970-1993<sup>8</sup>

(Source: FAO Fishery Information, Data and Statistics Service.)

<sup>7</sup> For the purpose of regional comparisons, the world has been divided into continental areas: Asia, Europe, North America, South America and the Caribbean, Africa and the Near East, and Oceania. For the more detailed analysis, seventeen sub-regions have been identified, see paragraph 2.2.4 and Annex I.

<sup>8</sup> Data for 1991 and 1992 not available.

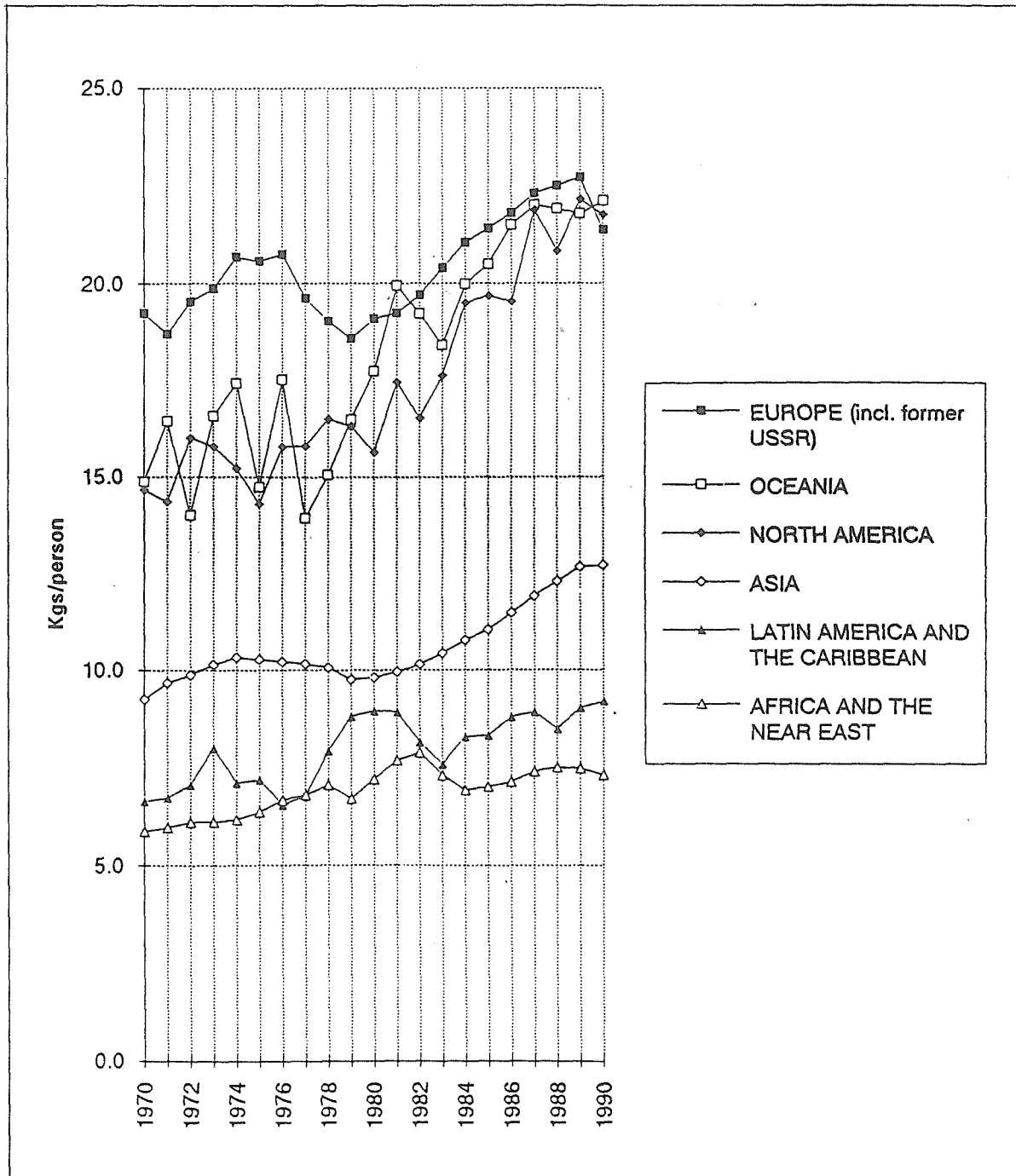


Figure 4: *Per caput* apparent fish consumption - by region (kgs; live weight equivalent) 1970-1990.

(Source: FAO Fishery Information, Data and Statistics Service.)

During the period, Europe had the highest *per caput* consumption among the major regions shown in Figure 4.

The second highest levels are found in North America and Oceania, and in 1990, all three regions reported a *per caput* consumption of approximately 21-22 kgs. Lowest *per caput* fish consumption is found in Africa and the Near East; somewhat above 7 kgs on an average in 1990, whereas in Latin America, *per caput* consumption reached some 9 kgs. In Asia, *per caput* consumption was almost 13 kgs in 1990.

However, important sub-regional differences exist within the continent (see section 2.2.4). *Per caput* consumption is considerably higher in the developed countries than in the developing: in 1990, 26 kgs of food fish were consumed in the developed countries compared to only about 9.5 kgs in developing countries.

In total volume, global fish consumption increased from 40.2 million tonnes in 1970 to 70.8 million tonnes in 1990 and 72.3 in 1993.

Most of the growth took place in Asia, with China alone representing 27% of the total growth for the period 1970-1990. Total consumption of food fish is highest in Asia because of its combination of relatively high *per caput* consumption and large populations. Europe is the second largest food fish consuming continent (see Figure 7).

### 2.2.2 Trends in fish consumption by major species groups

The importance of different species in food consumption shifted over the period 1970-1990 (see Table 1). The relative share of finfishes declined and molluscs, crustaceans and cephalopods became more important. Comparing inland and marine finfish species, it can be noted that the consumption of fresh water species has increased, from a relative share of 16% in 1970 to 22% in 1990.

This increase can largely be attributed to aquaculture production, especially in China. In fact, if China is excluded from the analysis, the relative increase in freshwater fish consumption is more modest; from 14% in 1970 to 17% in 1990. Among marine finfish, consumption of demersal species fluctuated between 2.8 and 3.6 kgs per person a year, with consumption declining in the second half of the 1970s. The average annual *per caput* consumption of pelagic species increased from 2.9 kgs in 1970 to 3.6 kgs in 1990.

More than half of this increase in consumption of pelagic species came from tunas and tuna-like fishes<sup>9</sup>. The consumption of this species group doubled during the period, from 0.4 kgs in 1970 to 0.8 kgs in 1990. Total catches of skipjack and yellowfin tuna rose by 35% in the period 1987-1991.

Annual *per caput* consumption of smaller pelagic species increased by 0.3 kgs during the period 1970-1990. European pilchard and chub mackerel are the most important small pelagic species in volume.

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<sup>9</sup> FAO Statistical group ISSCAAP No 36: "Tunas, bonitos, billfishes, etc".

Table 1

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

Year	Fresh-water/ diadromous species	Demersal	Pelagic	Other marine fishes <sup>10</sup>	Crustaceans	Mollusc	Cepha- lopods	Aquatic animals	Total
1970	1.7	3.4	2.9	1.3	0.5	0.7	0.3	0.1	10.9
1990	2.9	2.8	3.6	1.6	0.9	1.1	0.5	0	13.4

Source: FAO Fishery Information, Data and Statistics Service.

Generally, much of the growth in total fish supplies during the last two decades has been due to an increase in landings of a few species. For white fish species used in food consumption, the largest share of growth has been from Alaska pollock. Production rose from 3 million tonnes in 1970 to 6.7 million tonnes annually in 1986-1988 (Moen Baine, 1994). Even though landings later dropped to 4.8 million tonnes in 1993, the Alaska pollock still accounted for some 10% of total world food fish supplies. Atlantic cod is also among the top food fishes, with landings of over 1.1 million tonnes in 1993. This should, however, be compared to 3.1 million tonnes landed in 1970 (FAO, 1995).

For freshwater species, common and grass carps dominate in volume mainly because of their importance in aquaculture in China. Aquaculture in general has played a significant role in the increase of world food fish production, with an estimated share of total seafood production of 23% in 1993 (Live weight equivalent, i.e., including for example mussel shell.).

The increase in crustacean consumption is largely due to shrimp. As with freshwater fish, aquaculture has made a major contribution to the supply of freshwater crustaceans. Production of shrimps and prawns<sup>11</sup> increased from 1.1 million tonnes in 1970 to 2.6 million tonnes in 1990, aquaculture representing about 25% of this production.

Figure 5 shows an estimate of the evolution of the landed value<sup>12</sup> of major species groups (current prices). Crustaceans are the most valuable type of seafood whereas the pelagic species are relatively inexpensive fish, followed by freshwater species. However, in *real* terms, prices of crustaceans have decreased during the last two decades. Also fresh water and diadromous fish now fetch lower real prices than twenty years ago. This evolution can probably be explained by the influx on the market of aquaculture production. Prices of demersal and pelagic fish have increased (see Table 2).

<sup>10</sup> Non-specified data on marine landings.

<sup>11</sup> FAO Statistical groups ISSCAAP No. 45.

<sup>12</sup> Estimates are based on export prices in US\$.

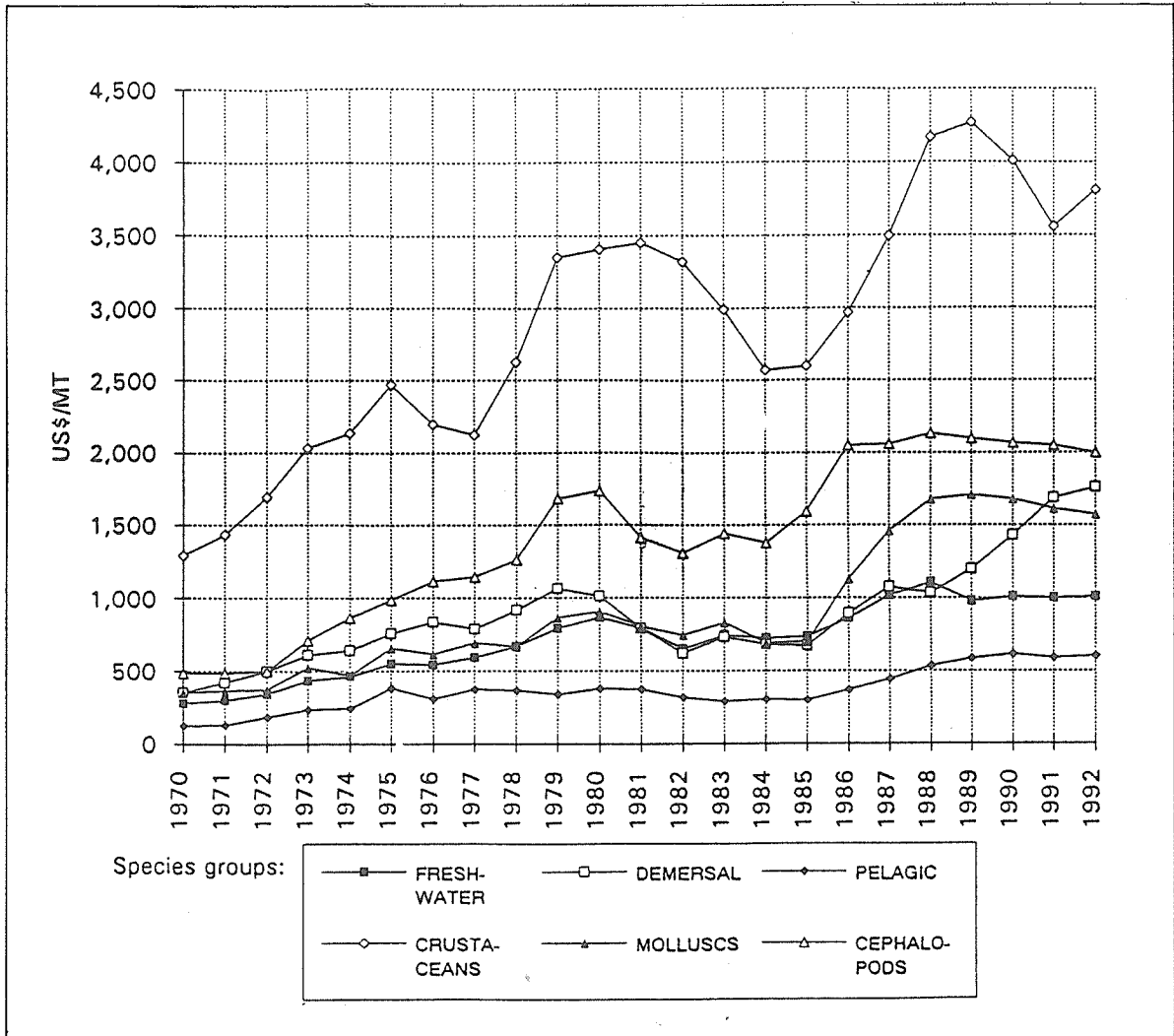


Figure 5: Estimated landed value of fish by major species groups 1970-1992; US\$/MT in current prices.

(Source: Estimate FAO Fishery Information, Data and Statistics Service.)

Table 2

Estimated development of real price (US\$/MT, constant<sup>13</sup>) and change in price of fish by major species groups 1970-1992.

Year/ species group	Fresh- water/ dia- dromous	Demersal	Pelagic	Crusta- ceans	Molluscs	Cepha- lopods
1970	846	1 076	379	3 971	1 083	1 492
1992	746	1 301	446	2 814	1 162	1 478
Change	-12%	+21%	+18%	-29%	+7%	-1%

(Source: Estimate FAO Fishery Information, Data and Statistics Service.)

### 2.2.3 Fish as food

#### (i) The nutritive value of fish<sup>14</sup>

Fish is a good source of high quality animal protein. It is high in lysine and essential amino acids, which make it particularly suitable for complementing diets rich in carbohydrates prevailing in many developing countries and where protein sources are scarce. Fish is also a valuable energy source.

Fish is rich in micro-nutrients that are generally not found in staple foods. It is an important source of preformed vitamin A and D if its oil is consumed, and also of iron, phosphorus and calcium. Marine fish is a good source of iodine. Fish also contributes fatty acids which are necessary for the proper development of the brain and the body. Fatty fish is high in polyunsaturated fatty acids, which are reported to be important in lowering blood cholesterol levels and preventing cardiovascular diseases.

Where staple food is available, a small quantity of fish can contribute significantly to increasing consumption by improving the overall palatability of the food and will therefore add to the nutritive value. For children, whose stomachs cannot digest the bulk of starchy staples, maize and cassava in particular, incorporation of a small quantity of fish can substantially improve the biological value of the diet and contribute to better nutrition.

<sup>13</sup> Deflator: World export unit value index (excluding crude oil), base year: average 1979-1981.

<sup>14</sup> Section based on Kent 1987.

People are more aware of the nutritional qualities of fishery products, particularly in developed countries. In many of these countries, the trend is to consume "lighter" and more natural and nutritious food, favouring the increased use of seafood<sup>15</sup>.

### (ii) Fish and food security

As noted above, the world average *per caput* fish consumption was about 13 kgs in the beginning of the 1990's, with continental averages varying between 7 and 22 kgs. Globally, fish represents 1% of total calory (energy) intake and 5% of world protein supply. The share of fish in animal protein is 19%.

In developing countries as a group, fish is a relatively larger source of protein than in the developed world, representing 6% of the total protein compared to an average of 4% in developed countries (AGROSTAT/FAO).

The *per caput* consumption and total supply figures do not necessarily give the whole picture of the importance of fish as food in the various regions. In countries where fish represents a large share of the total protein or energy intake, the relative importance of fish for food supplies and a sound nutrition is naturally higher.

Hence, the nature of the contribution of fish to protein supplies may appear paradoxical; the lower the share of protein in the diet, and the smaller the relative share of animal protein, the more crucial - for a balanced diet - is fish protein. Therefore, fish may be more important in a country with low *per caput* fish consumption calculated in kilos where it provides a large part of the protein intake, than in a country with high *per caput* consumption. However, in the latter case it is more likely to prevent hunger (FAO, 1995). Countries where the share of fish in total protein supplies exceeds 10% include several small island developing states as well as a number of the countries in Southeast Asia and in West Africa. Only Peru and French Guiana from the Latin American continent show fish as having a share of total protein intake of over 10% (see Table 3).

The distribution of fish and fishery products may differ significantly among regions and income groups within countries and fish as food may play different roles in these regions and groups.

In many countries, especially developing countries, the regional distribution of fish consumption is highly skewed with very high consumption in coastal areas where fish is often considered a staple food. Furthermore, a study in Ghana (Heinbuch, 1994) shows that small smoked pelagic fish is the cheapest source of animal protein and, therefore, plays a significant role in the diets of lower income groups in the country.

This pattern is typical of many developing countries where fish is relatively more important for the poorer part of the population than for middle or high income groups who can afford substitute products.

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<sup>15</sup> See further discussion in chapter 3 "Factors shaping future demand".

Table 3

Protein intake in countries where fish provides at least 10% of total protein

Country/Territory	Total protein intake: gr per caput/day (1992)	Total protein as % of total energy	Fish as % of total protein (1990)
Maldives	113.3	17.6%	49.5%
Solomon Islands	53.1	9.8%	36.4%
Kiribati	66.0	10.0%	34.2%
Seychelles	60.5	10.6%	32.9%
Japan	97.6	13.5%	27.4%
Sao Tome and Principe	40.2	7.6%	23.3%
Philippines	52.4	9.3%	23.2%
Ghana	46.9	8.5%	21.1%
Fiji	74.1	9.6%	19.8%
St. Kitts and Nevis	72.0	11.9%	18.3%
Hong Kong	94.1	12.0%	17.9%
Iceland	123.3	16.1%	17.5%
Korea Republic	86.4	10.5%	16.6%
Angola	39.6	8.6%	15.9%
Korea DPR	82.7	11.7%	15.5%
Portugal	103.2	11.4%	15.5%
Guadelope	81.9	12.4%	15.5%
Grenada	64.8	10.8%	14.5%
Martinique	86.0	12.6%	14.5%
Macau	62.9	11.0%	14.4%
Peru	49.3	10.5%	13.5%
Norway	96.9	11.9%	13.5%
Malaysia	59.9	8.3%	13.4%
Gabon	64.2	10.2%	13.3%
French Polynesia	80.3	11.3%	12.9%
French Guiana	105.9	14.6%	12.7%
Papua New Guinea	48.9	7.5%	12.5%
Senegal	63.9	11.3%	12.2%
Bermuda	90.6	13.5%	12.2%
Thailand	54.4	8.9%	11.9%
Singapore	NA	NA	11.4%
Tonga	68.2	9.3%	11.2%
Denmark	99.1	10.8%	11.1%
Gambia	56.6	9.6%	10.9%
Vanuatu	63.1	9.2%	10.3%
Spain	104.3	11.3%	10.3%
Chad	61.1	12.3%	10.2%
NA = Not Available			

Source: COFI/95/Inf.10, FAO and AGROSTAT/FAO.

## 2.2.4 Trends in major consumer regions and countries

### (i) Sub-regional analysis

A more detailed examination of fish consumption reveals important differences within the major regions discussed above. Table 4 shows the *per caput* food fish supply in seventeen country groupings<sup>16</sup> for the period 1970-1990.

Table 4

*Per caput* food fish supply by sub-region (kgs; live weight equivalent) 1970-1990

SUB-REGION	1970	1975	1980	1985	1990
<b>AFRICA AND THE NEAR EAST</b>	5.9	6.4	7.2	7.0	7.3
Indian Ocean	14.0	18.0	20.1	17.5	21.7
Near East and others	3.2	2.9	5.0	5.4	4.6
North Africa	2.7	4.0	5.1	6.5	7.1
Sub-Saharan Africa	7.7	8.2	8.5	7.7	8.4
<b>ASIA</b>	9.3	10.3	9.8	11.0	12.7
China and Mongolia	3.6	4.5	4.2	6.1	9.8
East Asia - High income countries	16.7	19.5	20.7	22.6	23.0
East Asia - Low income countries	19.6	20.9	19.6	22.0	23.7
Japan	63.5	70.6	65.5	69.5	71.2
South Asia	3.5	3.6	3.6	3.7	4.1
<b>EUROPE (incl. former USSR)</b>	19.2	20.6	19.1	21.4	21.4
Ex-CPEs (Central/Eastern Europe and former USSR)	19.0	22.5	19.9	22.2	19.6
Nordic countries of Europe	31.8	31.5	32.6	32.3	31.4
Western Europe	18.8	18.0	17.6	20.0	22.8
<b>LATIN AMERICA AND THE CARIBBEAN</b>	6.7	6.4	7.2	7.0	7.3
Central America and the Caribbean	5.5	6.3	9.0	9.0	9.3
South America	7.2	7.7	8.9	8.0	9.1
<b>NORTH AMERICA</b>	14.7	14.3	15.6	19.7	21.8
<b>OCEANIA</b>	14.9	14.7	17.7	20.5	22.1
Australia and New Zealand	13.7	13.8	15.2	18.6	20.0
Pacific	19.7	18.4	27.0	27.1	28.9
<b>WORLD AVERAGE</b>	10.9	11.6	11.3	12.4	13.4
<b>DEVELOPED COUNTRIES</b>	22.2	23.8	22.6	25.4	26.0
<b>DEVELOPING COUNTRIES</b>	6.2	7.0	7.3	8.1	9.5

Source: FAO Fishery Information, Data and Statistics Service.

<sup>16</sup> See Annex I for grouping of countries.

Figure 6 shows the total food fish supplies in 1990 for each region and sub-region.

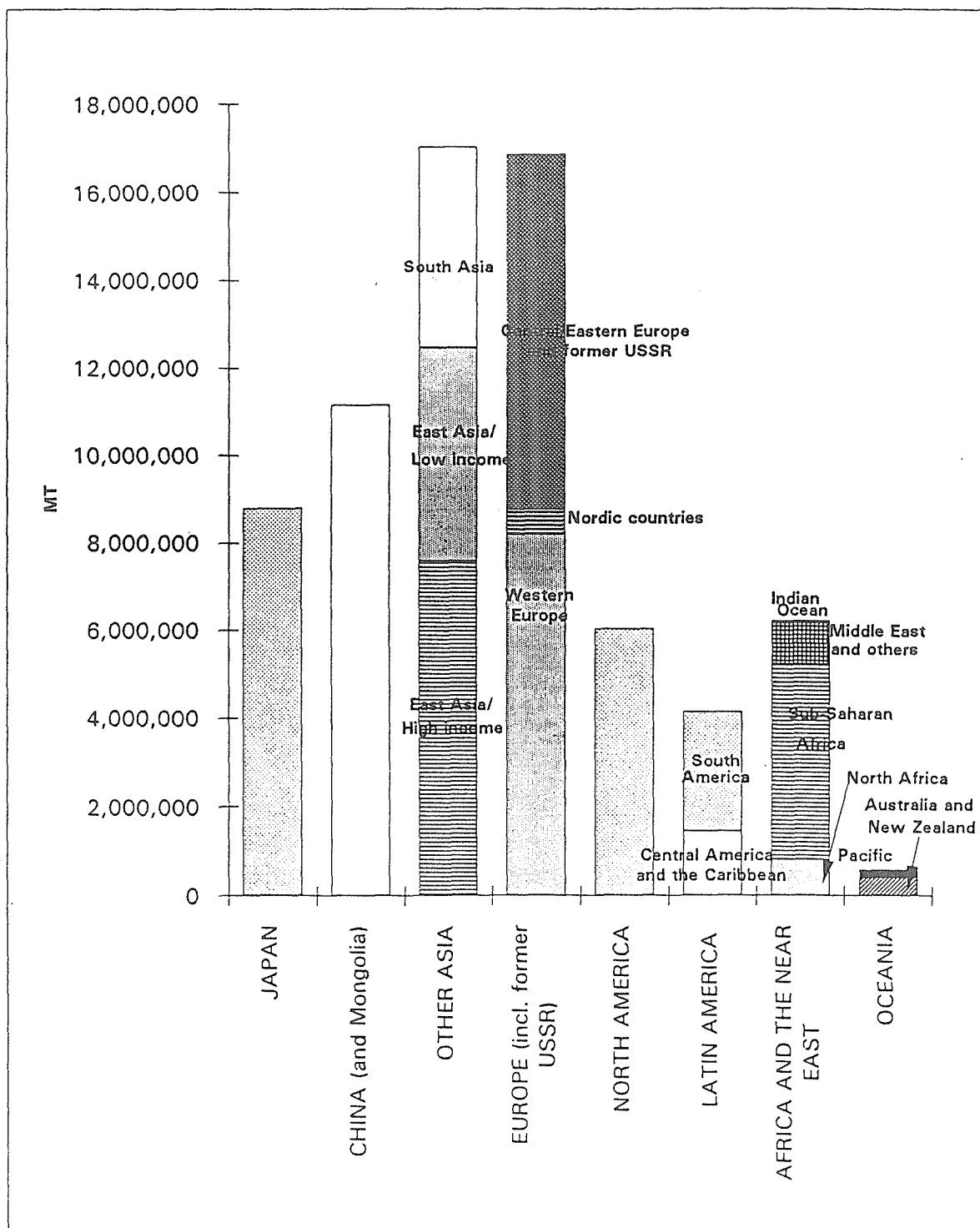


Figure 6: Total apparent fish consumption by sub-region (MT; live weight equivalent) in 1990.

(Source: FAO Fishery Information, Data and Statistics Service.)

## (ii) Africa and the Near East

*Per caput* fish consumption in sub-Saharan Africa has decreased since the early 1980s when the reported average was some 9.5 kgs. In 1990, 8.4 kgs were consumed per person.

This recent trend of decreasing *per caput* consumption is mainly due to two factors: population growth which has outstripped (approximately 3% annually) the growth rate of fish landings for local consumption; and a regional economic situation which cannot afford increased imports.

Comparing total regional fish production with total food fish supply, it can be noted that the region has increased its dependence on imports drastically during the period 1970-1990. In 1990, net imports exceeded 900 000 tonnes compared to some 210 000 tonnes in 1970.

However, there are important sub-regional differences in fish consumption. On an average, *per caput* consumption in Western Africa is three times higher than in Eastern Africa. Consumption is below 2 kgs per person a year in Ethiopia, Eritrea, Burkina Faso, Niger, Lesotho, Rwanda, Sudan and Swaziland, but over 20 kgs in countries like Angola, Congo, Gabon, Gambia, Ghana, San Tome and Principe, Senegal and Sierra Leone. Moreover, *per caput* consumption has steadily increased during the period 1970-1990 in Senegal, Gambia, Ghana, Madagascar, Tanzania and Uganda.

Despite being coastal countries, average fish consumption in the North African countries has been low. In 1990, the *per caput* consumption was 7.1 kgs. This represented nevertheless quite a substantial increase since 1970 when *per caput* consumption was only 2.7 kgs.

In fact, North Africa has had one of the world's highest growth rates in *per caput* fish consumption during the last 20 years, even though the growth has slowed during the second half of the 1980s. It is interesting to note that GDP *per caput* also increased significantly during the period, but slowed during the second half of the 1980s. Gross imports of fish and fishery products also stagnated at the end of the 1980s.

In the Near East, *per caput* consumption of fish has been relatively low; in 1990, the average figure was 4.6 kgs. *Per caput* fish consumption - and meat consumption - has even decreased during the last few years.

Imports became increasingly important during the 1970s, but started to decrease in 1980, shortly after a decline in GDP *per caput*.

In the island states of the Indian Ocean, the aggregate average fish consumption *per caput* of the group was 21.7 kgs in 1990. In 1970, fish consumption was 14 kgs per person. Meat has become significantly more important in the diet during the last 20 years; *per caput* consumption rose from 14.9 kgs in 1970 to 35.3 kgs in 1990.

### (iii) Asia

In many parts of Asia, fish traditionally plays a vital role in nutrition and is culturally an important component of the diet. This importance can also be noted in terms of trade value; in 1992, Asian countries represented 32.7% of world exports and 40.1% of global imports of fish products (Moen Baine, 1994).

Japan has strong traditions of eating seafood and is one of the countries with the highest *per caput* fish consumption in the world - 71.2 kgs in 1990<sup>17</sup>. Since the early 1970s, *per caput* supply has fluctuated between 65 and 72 kgs/year. It is one of the few locations where fish consumption is more important than meat consumption. It is noteworthy, though, that *per caput* meat consumption in Japan has more than doubled during the period 1970-1990; from 17.8 kgs in 1970 to 38.7 kgs in 1990. However, it could be argued that the level of total protein intake, in particular with regard to fish and meat, now has reached its maximum levels and that products rich in protein are competing for a stable *per caput* market in volume terms. The share of protein in total energy intake has increased during the last decades and represented, in 1993, 13.5% of the total. According to the World Health Organization (WHO) the standard level of total protein intake is in the range of 10-15% (WHO, 1990).

Japanese eating habits have changed since the period of rapid economic growth in the 1960's and 1970's in a way that not only has entailed increased meat consumption but also influenced the composition of fish consumption with regard to species and product types. These changes include the westernization of the diet, increased utilization of outside cooking services and simplification of cooking processes.

Especially among young people, there has been a tendency towards eating less traditional food and therefore Western style food - including meat - has become more popular. A liberalisation of beef imports has also taken place which may have had an influence on this trend. However, this trend seems to have slowed somewhat, although older people still tend to consume more fish than younger people. Moreover, fish is increasingly being recognized as healthy food. The increase in incomes and in the number of working women means that demand for outside cooking services and semi-processed products has grown. These changes have influenced the supply and distribution industries in Japan; there is an important on-going expansion of the food industry, encompassing all stages from primary processed food to finished food products (Tasaka, 1994).

Gross imports of fish increased dramatically during the period. In 1970, gross imports were somewhat below 400 000 tonnes representing 3.8 kgs per inhabitant and Japan was a net exporter in volume terms. Twenty years later, gross imports had increased to 3 million tonnes and 24.6 kgs per person. Japan is now the world's largest importing country. In 1993, the value of Japanese fish imports reached US\$ 14 200 million, accounting for 32% of world fish imports in value terms (FAO, 1995)

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<sup>17</sup> Some small island developing states as well as Iceland have similar (and even higher) levels of *per caput* consumption.

More than one quarter (26.9%) of the world's total increase in fish consumption over the period 1970-1990 took place in China/Mongolia<sup>18</sup>. In fact, China accounted for over 15% of world fish consumption in 1990.

However, the *per caput* consumption in China is still relatively low compared to the international average; 9.8 kgs in 1990. China's role as a fish consumer is explained by the fact that the population of the region represents more than one-fifth of the world's population.

Nevertheless, it is worth noting that a significant part of the increase in total consumption volume in China is due to a high growth rate in *per caput* consumption. During the period 1970-1990, China reported an average compounded growth rate in *per caput* consumption of 5% annually. In absolute terms, *per caput* consumption increased by 6.2 kgs from 3.6 kgs in 1970 to 9.8 kgs in 1990.

The increase in *per caput* consumption has been faster during the last ten years of the period and appears to be linked to economic growth. Meat consumption shows a very similar trend; *per caput* consumption grew from 10.3 kgs in 1970 to 27 kgs in 1990.

Important regional differences are concealed behind the impressive figures of growth in consumption for the whole of China. In the southern regions, particularly in the Guangdong province, the *per caput* food fish supply is about 35 kgs whereas the level of fish consumption is negligible in the isolated areas of the north-east (Moen Baine, 1994).

Imports have traditionally been insignificant and the country reports net exports although gross imports have increased recently. Consumption has almost entirely depended on domestic production during the period considered. China has rich fish resources in rivers and along the coast and benefits from a long tradition of aquaculture. It is estimated that, in 1994, 61.5% of the total fish production originated from fish farming (Moen Baine, 1994). Carps represent approximately half of the farmed production.

In South Asia, average *per caput* fish consumption was 4.1 kgs in 1990. This represented a modest increase from 3.5 kgs in 1970. Generally speaking, the region is by tradition not an important consumer area for animal proteins. Meat consumption is also rather modest; some 5 kgs in 1990. With regard to fish consumption, the Maldives is an exception to the low values of the region; *per caput* consumption was 132.6 kgs in 1990.

Looking at the trends for the period 1970-1990, it can be noted that the consumption level has followed the volume of domestic production. Imports are not important in local supply; the area is in fact a net exporter.

Due to their large populations, two countries in the region, India and Bangladesh, are important fish consumers with regard to the total volume of supplies of food fish in spite of a low *per caput* consumption.

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<sup>18</sup> For statistical purposes, China and Mongolia constitute one group. However, in the following the group will be referred to as China.

In India, *per caput* supply has remained around 3-3.5 kgs during the 1980s although showing a slight increase over the past three decades. Total food fish supplies attained some 3.3 million in 1990. Again, important regional differences exist. Close to 98% of the total fish supply is consumed in the coastal states representing about half of the population. The consumption of fish appears to be restricted by distribution constraints and fish consumption also varies significantly between rural and urban areas. In urban areas, a fast growing market for frozen high quality fish products, as well as for canned and dried fish can be noted (Moen Baine, 1994).

In Bangladesh, *per caput* fish supply of fish at 7-7.5 kgs annually is relatively low, but still twice as high as in India. However, the present level is only half of that in the 1960's when consumption was at 14 kgs per person and year. Total fish supply is increasing but not as fast as population growth. In 1990, the country as a whole consumed 820 000 tonnes of fish.

In East Asia, fish provides between 25% and 65% of the animal protein intake depending on the country and is traditionally an important item in the diet. As in Japan, fish is on average more important than meat for the whole sub-region<sup>19</sup>. *Per caput* levels in Hong Kong and the Korea Republic reached 55.8 kgs and 48.4 kgs, respectively. However, meat has increased somewhat its relative importance in the region during the period 1970-1990.

At the same time as being an important consumer area, some of the countries are also large exporters of fishery products. Thailand was in 1993 the world's leading exporter of fish in value terms reporting US\$ 3 404 million worth of exports. Other important fish exporters are Indonesia and the Korea Republic.

Comparing the group of high income countries<sup>20</sup> of the region with the rest of the East Asian countries, it is noteworthy that the *per caput* fish consumption was around 23 kgs in both groups in 1990. However, twenty years ago, fish consumption was 16.7 in the group of higher income and 19.8 kgs *per caput* in the lower income countries. Considering that the cultural context in the groups are similar, it seems that the main factor that has separated the groups has been the economic growth.

#### (iv) Europe

In Western Europe<sup>21</sup>, *per caput* consumption of fish was almost 23 kgs in 1990. This represents an increase from about 20 kgs in 1970. In 1990, the population was approximately 359 million giving a total food fish supply of over 8 million tonnes.

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<sup>19</sup> Except for landlocked Laos; fish represented about 10% of the average animal protein intake in 1990 ("Fish and Fishery Products", FAO Fisheries Circular No 821 (Rev. 2)).

<sup>20</sup> Brunei Darussalam, Hong Kong, Indonesia, Malaysia, Singapore, Korea Republic, Thailand, Taiwan (Province of China). See Annex I.

<sup>21</sup> Here defined as the European Union less Sweden and Finland plus Switzerland.

Major consumer countries are Portugal (58.2 kgs/person in 1990), Spain (38 kgs) and France (31.9 kgs) (Monfort, 1994).

However, the increase in fish consumption has not been constant. *Per caput* consumption decreased slightly during the period 1974-1979. Looking at total food fish supply, this trend is seen quite clearly. The drop coincides with the increasing prices due to the first oil crisis which severely affected the fishing industry. Furthermore, the access to resources for most European Community countries became restricted owing to the enlargement of the EEZs in waters where Europeans used to fish freely. Consequently, the decreased *per caput* consumption in the late 1970s coincides with a decline in total fish production (Monfort, 1994).

It seems that domestic<sup>22</sup> food production has increasingly been replaced by imports from the mid-1980s. The region has always been a net importer but this fact has been reinforced lately. Net imports by the region were 3.4 million tonnes in 1990, representing over 40% of total consumption. The largest importers are France, Spain and Italy with annual imports worth between US\$ 2.6 and US\$ 2.9 billion each in 1991 and 1992. For the same years, Germany and the United Kingdom reported imports worth US\$ 1.9 - 2.1 billion (Moen Baine, 1994). The higher dependence on imports also appears to be reflected in the evolution of types of products consumed; frozen finfish and shellfish have gained dramatically in importance during the 1980s whereas the consumption of fresh finfish, in particular, has declined.

Nowadays, in Western Europe, fish and other seafood are perceived to be healthy food, in particular compared to red meat. The increase in consumption in the 1980s seems to be mainly explained by this positive attitude towards fish and fishery products together with an economic growth accompanying imports, improved distribution networks, and the strong innovation and adaptation done by the processor industry to meet modern customers' requirements (Monfort, 1994).

In the ex-centrally planned economies (ex-CPEs) of Eastern and Central Europe and the former Soviet Union, average fish consumption *per caput* was, in 1990, somewhat less than 20 kgs. However, recent reports indicate that the consumption has fallen drastically, because of decreased catches and a collapse of the distribution system, increased prices, etc, following the politico-economic changes in the region. In Lithuania, for example, the consumption was reported to be only 8.4 kgs/caput in 1993 compared to 18.7 kgs in 1989 (Fisheries Department Lithuania, 1994). For Russia, the corresponding figures are 9 and 20 kgs, respectively (Chuksin, 1994).

Past trends, i.e., 1970-1990, indicate that the *per caput* consumption level was quite stable for a long time. The variation reported coincides with the variation of domestic production. A drop in production can be seen at the end of the 1970s, presumably caused by the extension of coastal jurisdictions (EEZs).

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<sup>22</sup> Domestic production is defined as landings by the national fleet but not necessarily from national waters.

In the early 1980s, gross imports increased drastically but decreased again in 1989. Nevertheless the region was a net exporter during the whole period.

The Nordic countries of Europe<sup>23</sup> have a higher average fish consumption than the rest of the European continent, over 31 kgs per person each year. The *per caput* consumption of fish has remained stable over the last 20 years at around 31-32 kgs yearly, in spite of an increase in GDP *per caput* levels, whereas meat consumption has increased during the period. Consequently, it may be concluded that fish consumption has reached its maximum level.

#### (v) Latin America

In Central America and the Caribbean, *per caput* fish consumption varies within a range of 0.4 kgs yearly in Nicaragua and 86.1 kgs in the British Virgin Islands. Owing to easy access to resources, several of the small island developing states of the Caribbean have strong traditions of eating fish. On the mainland, meat consumption is more important as a source of protein.

On an average, fish and meat consumption in Central America and the Caribbean developed similarly in the period 1970-1990. Food fish *per caput* supply, though, was only 5.8 kgs in 1970 whereas meat was much more important at 22.2 kgs. Consumption of both items increased until the early 1980s; meat consumption peaked in 1983 with 33 kgs and fish in 1981 reaching 11 kgs. During the 1980s, the consumption of both items has been relatively stable but with levels somewhat lower in 1990 than a decade earlier; meat 29.5 kgs *per caput* and fish 9.3 kgs. It can be noted that GDP growth stagnated in the early 1980s and this may be the reason for the fall in both meat and fish consumption.

In South America, in 1990, *per caput* fish consumption was 9.1 kgs. Since 1970, this figure has varied between 7 and 9.5 kgs yearly. Nevertheless, it seems that there is a certain correlation between the GDP *per caput* level and the fish consumption level, especially since the first half of the 1980s. It can be noted that both the much more important meat consumption as well as the fish consumption dropped when economic growth stagnated in the early 1980s.

#### (vi) North America<sup>24</sup>

North American fish consumption increased from 14.7 kgs person in 1970 to almost 22 kgs in 1990. Given a total population of about 277 million, the total food fish supply was 6 million tonnes in 1990. Meat consumption is considerably higher; in 1990, the North Americans consumed 113.5 kgs of meat per person. However, it is noteworthy that *per caput* red meat consumption in the US decreased during the period and that poultry consumption increased drastically; in fact, poultry consumption nearly doubled from 1970 to 1993.

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<sup>23</sup> Faroe Islands, Finland, Iceland, Norway and Sweden.

<sup>24</sup> The section is based on FAO statistical data and on Anderson 1994 (US-specific data).

Real prices for seafood in the US increased by 36% during the same period (relative to all other goods) whereas real prices for red meat and poultry declined by 17% and 32%, respectively.

The increased *per caput* consumption together with the augmented relative prices for fish and fishery products suggest a trend of increasing expenditures for seafood, indicating that demand has shifted in favour of seafood relative to red meat.

The USA is one of the top fish importing as well as fish exporting countries and Canada is among the leading exporters in the world. In volume terms, North America was a net importer 1970-1985, but since 1986 the region is a net exporter. However, the total trade volume has also increased; in 1970, *per caput* gross imports were 6.3 kgs and 9.5 kgs per person in 1990.

In value terms, the USA is the second largest importer after Japan; in 1993, fishery products for a value of US\$ 6 290 million were imported to the country. Exports amounted to 3 179 million in the same year, only exceeded by Thailand. Canada is also a major exporter with a export value of 2 055 million in 1993.

In the 1980s and early 1990s, three main themes influenced consumers' perceptions and demand for fish and fishery products in the US: the first is an increased awareness of the health benefits derived from seafood consumption; secondly, concern over the safety of seafood products; and the consumers' increased awareness of the marine environment and the concern for marine mammals in particular - dolphins and whales - and sea turtles.

In aggregate, it is impossible to quantify the exact impact of the different issues upon consumption patterns but depending on how the issues are dealt with, they will certainly have an influence on future consumption.

#### (vii) Oceania

In the two predominantly meat-eating countries, Australia and New Zealand, fish consumption increased from 13.7 kgs *per caput* in 1970 to 20 kgs in 1990. However, the increase was not steady during the period.

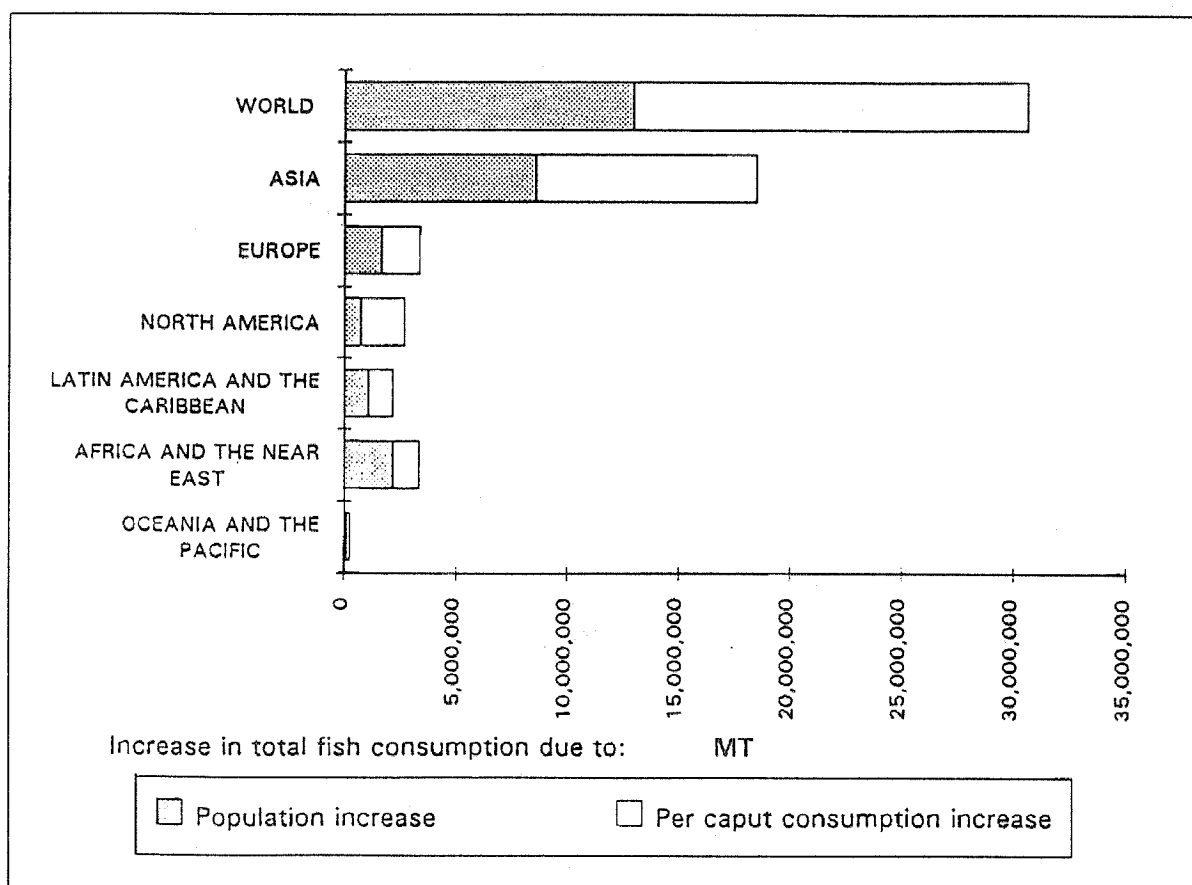
In the 1970s, food fish supply fluctuated between 13 and 15.8 kgs and only since 1984 has the rate of increase been more constant. Gross fish imports account for more than half the volume of food fish consumption but the two countries together are net exporters since 1979.

The Pacific islanders are traditional fish consumers even though meat consumption *per caput* is higher - 32.6 kgs in 1990 on average. *Per caput* fish consumption in 1990 was 28.9 kgs. This represented an increase since 1970 when consumption was slightly below 20 kgs per person. During the 1980s, the *per caput* consumption has been relatively stable.

### 3. FACTORS SHAPING FUTURE DEMAND

#### 3.1 Population growth

It may seem obvious that aggregated demand should be a function of the population growth and that, therefore, a direct correlation between changes in population and in demand may be assumed. However, this relationship may be modified over time by socio-economic and other factors. During the period 1970-1990, population growth appeared to account for less than half of the increase in the volume of global fish consumption, whereas other factors have influenced the *per caput* consumption and thereby contributed to the increased total volume consumed. Figure 7 shows the relative importance of the population growth compared to all other influences on consumption in different regions.



**Figure 7:** Increase in total apparent fish consumption due to population growth and other factors, respectively - by continent 1970-1990 (MT, live weight equivalent)

Source: FAO Fishery Information, Data and Statistics Service.

### 3.2 Economic factors

The economic factors influencing the demand for fish and fishery products are economic growth and the development of disposable income as well as the price of seafood compared to other food stuffs, in particular substitute products such as red meat and poultry. Economic growth and purchasing power as well as prices will also influence the species and product composition of demand.

With an increase in disposable incomes it is reasonable to assume that the demand for fish will rise. However, the analysis of historical data on the correlation between economic growth and fish consumption in volume terms shows that there are important regional differences as to how strong this relation is. In Western Europe (excluding the Nordic countries), fish consumption declined after the recessionary period in the second half of the 1970s and a similar decrease is evident in the recession in the middle of the 1990s. Hence, here the correlation seems clear. Also in Southeast Asia, a difference can be noted in the development of fish consumption between the higher income countries<sup>25</sup> and the rest of the region; in the former *per caput* fish consumption increased by an annual rate of 1.7% and in the lower income countries by only 1%<sup>26</sup>.

In the same period, the high income group countries reported an annual GDP (constant prices) growth of 5.4% and the lower income countries 2.3%. In the Nordic countries of Europe, on the other hand, the volume of fish consumption has remained relatively stable in spite of an important *per caput* increase in GDP during the last two decades. In Africa, there does not seem to be any obvious short-term correlation between economic growth and fish consumption during the last decades; it appears that other factors such as the increase in domestic production and local availability of fish have been more important factors. However, in the longer term, it is certain that economic growth plays a more important role for demand in the region, especially in the future when consumers will depend more on imports. Generally, it could be concluded that economic growth is of great importance to fish consumption in a long-term perspective even though short-term variations may be more influenced by other factors. However, once a saturation level has been reached - like in the case of the Nordic countries of Europe - economic growth may not continue to result in increased fish consumption.

In certain regions, there appears to be negative correlation between fish consumption and economic growth. In a country where fish is readily available, it may be the cheapest food and therefore fish consumption would increase in a period with unfavourable economic conditions. In many areas, it has commonly been believed that fish is low quality food whereas meat is perceived as a higher value food. This perception appears, however, to be changing as health considerations are attaining more attention, especially in the developed world (see below).

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<sup>25</sup> Here including Brunei Darussalam, Hong Kong, Indonesia, Malaysia, Singapore, Korea Rep., Thailand and Taiwan (Province of China). See Annex I.

<sup>26</sup> See also section 2.2.4 "Trends in major consumer regions and countries", (iii) Asia.

With higher income, consumers generally demand higher value products, not only increased volume. In the industrialized world, it is expected that an increased purchasing power will be further oriented towards value-added products (Tasaka, 1994, and Anderson, 1994). Non-fish raw materials used in the products will gain in importance. Moreover, demand for high quality fish meal to be used as feed in fish farming is predicted to increase along with an expanded aquaculture production oriented towards the high value market (Smith, 1995).

Consumers who can afford to choose are becoming more selective. It can be speculated that this partly explains the increased correlation between gross imports and economic growth which has been noted during the last decade for example in Western Europe and in Japan. When the economic situation permits, a shift in demand towards products with a real or perceived higher value may occur and in order to satisfy this changed demand, imports will increase. The development of aquaculture has assisted in this development by making products in demand available to consumers willing and able to pay for them.

Relevant substitute products for fish vary among different cultural and traditional environments. In general, meat, and in particular poultry, can be considered as the main substitutes. The future price relationship between fish and its substitute products will be important in deciding future demand for seafood. In particular in developing countries where purchasing power is limited, the price of fish in comparison with the price of other food products will be a major determining factor for the level of demand. An increase in the price of fish on the international market should provide an incentive for exporting more fishery products. This would decrease the fish available for local consumption<sup>27</sup>. Currently, there is a clear differentiation of the use of different species: higher value species - from either capture fisheries or aquaculture - are exported and lower value species are kept for domestic consumption or even imported. This pattern will develop according to the price evolution of fish in general and of different species on the international market.

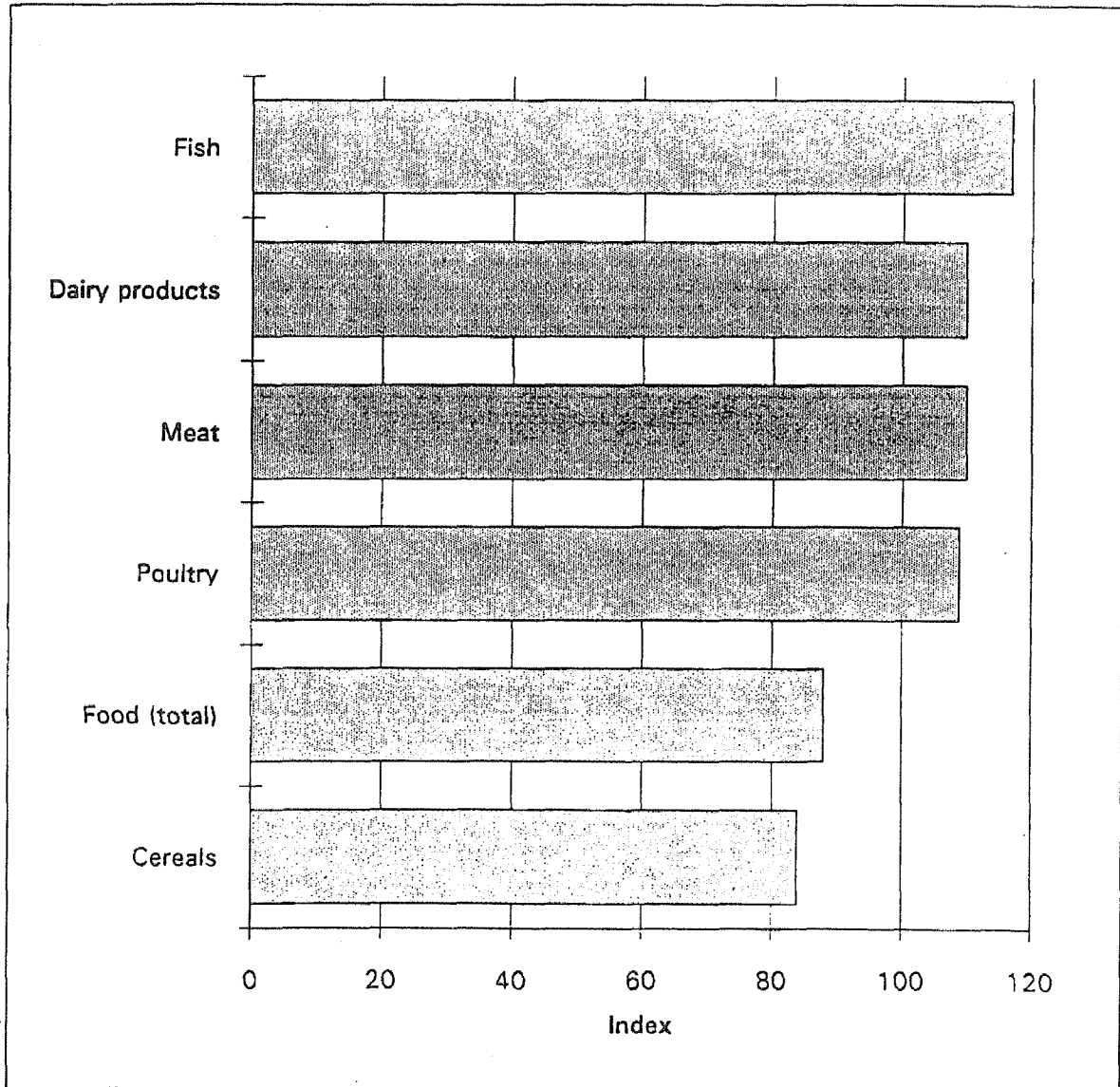
On a global average, apparent total meat and total fish consumption increased at more or less the same pace during the period 1970-1990; an increase in volume of some 22-23%. During the same period, the price of internationally traded fish, on the whole, has increased relatively faster than other foodstuffs, including meat. Figure 8 shows the relative price in food fish prices (internationally traded products) compared to other food items for the period 1980-1990.

This development may be an indication of low price elasticity of demand for fishery products - at least for those products which are traded internationally - since the amount of fish consumed is still increasing at the same rate as substitute products, in spite of the relatively higher prices. However, it should be remembered that a much more detailed analysis would be needed to draw any firm conclusions. There are important differences among species and products as well as between the market for internationally traded goods and local markets.

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<sup>27</sup> However, if the increased export sales mean an improved disposable income which can be used for buying other foodstuffs, fish has still contributed positively to the local food supply.

Information on price trends for locally produced and consumed fish and fishery products is difficult to obtain. In the national statistics of individual countries, price indices for different food products are sometimes available but often only in a format which precludes comparability and time series analysis. Table 5a gives prices (current value) for some selected food items in Bangladesh, and Table 5b shows the development of some current consumer prices for Indonesia.



**Figure 8:** Relative increase in prices of internationally traded foodstuffs in 1990 (index base 1980 = 100).

(Source: United Nations Price Index for External Trade. The fish price index is based on export unit values for: cod fillets (Canada); cod salted (Canada); albacore (Japan); herring (Denmark); the export index of Norway.)

Table 5a

Annual average retail price of selected consumer goods in Bangladesh in 1982/83 and 1991/92 (taka per kg).

Year	Ruhi fish	Rice	Beef	Mutton	Fowl
1982/83	34.81	8.79	24.33	32.32	26.26
1991/92	114.31	14.83	56.73	81.84	71.51
Index (1982/83 = 100)	328	169	233	253	272

Source: Statistical Yearbook of Bangladesh 1993, Bangladesh Bureau of Statistics.

Table 5b

Combined consumer price index of 27 cities 1993 (April 1988 - March 1989 = 100).

Cereals and derived products	Meat and meat products	Fresh fish	Preserved fish	Eggs, milk and dairy products
120.56	161.56	142.35	134.12	148.56

Source: Statistical Yearbook of Indonesia 1993, Biro Pusat Statistik, Jakarta.

In Bangladesh, the price of "ruhi fish" (locally produced carp fish, generally considered as a high value product) increased relatively more than did prices of other food products during the period 1982/1983 to 1991/92. In Indonesia, the urban combined consumer price index gives a different picture: prices of both fresh and preserved fish grew relatively more slowly than did prices of other food rich in protein, for example meat and eggs. In West Africa, a survey of prices for small pelagics shows a trend of slightly stagnating or even decreasing real prices (Westlund, 1994). However, also here the lack of reliable long-term price trends makes the analysis difficult. It may be that prices for low value species which do not enter the international distribution system but are produced and consumed locally have remained relatively low whereas fish as a trade commodity has become more expensive. In many developing countries, cured small pelagic fish have remained one of the cheapest sources of protein for the local population.

### 3.3 Social factors

Examining the different levels of *per caput* fish consumption in various regions, it becomes quite clear that factors other than population and economic growth must also influence the level of fish consumption. These factors include culture and food consumption habits, here referred to as "social" factors.

The nearness and the immediate availability of fishery resources have taught people in coastal areas to consume fish. It seems quite logical that islands would show high levels of *per caput* consumption. In most coastal areas fish consumption is relatively high. There are several examples of countries where these food habits have not spread inland and the average fish consumption level for the country as a whole remains low, e.g., in many North African countries bordering the Mediterranean and in Eritrea.

East Asia appears to be a region with a strong tradition of consuming fish, e.g., in Japan annual *per caput* fish consumption is over 70 kgs. Even though economic growth has played a major role in attaining this high level - fish consumption increased considerably during the 1960s when economic growth was strong - tradition appears to be the determining factor; had there not been a tradition of eating fish, consumers would have chosen to spend their increased incomes on other food products<sup>28</sup>. In many Asian countries, there may be a similar latent demand which will develop when economic conditions permit.

It also seems that tradition sets an upper ceiling for the *per caput* consumption of different foodstuffs. For example, as has been noted above, in the Nordic countries, fish consumption has remained stable at around 30 kgs during the last decades even though economic growth would have allowed for further increases.

Food consumption patterns and tradition may change over time due to other changes in lifestyle and social conditions. Especially in the industrialized world, fish is increasingly being recognized as healthy food. In the United States, for example, a shift from red meat to fish - and poultry - can be noted (Anderson, 1994).

The same evolution is noted in Western Europe and to a certain extent in Japan. In Japan, the increased preference for meat among young people - created by the augmented influence of Western values during the 1980s - may shift back to fish. Also the fact that more women work outside the home is entailing a change in eating habits. Less time is spent on cooking at home and ready-made meals are increasing in popularity. Nowadays, consumers may rather eat fish - especially fresh - in the restaurant than prepare it at home (Tasaka, 1994).

Urbanization and changes in family structure are other social factors having an influence on demand for different food items. In urban centres, the better availability of products may create a demand that does not exist in the rural areas.

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<sup>28</sup> In Japan, other factors have naturally also influenced the present consumption pattern, e.g., restricted beef imports and price relations, but probably to a lesser extent than tradition.

In Africa, in particular in West Africa, this could probably be used for explaining part of the increase in food fish demand and consumption, at least in the short term. The difference in *per caput* fish consumption between rural and urban areas is significant because of the uneven distribution of fish in cities and in the countryside.

In the African coastal states, virtually all capitals and/or major urban population concentrations are situated on the coast, or lakeside, and most of the domestic marine landings as well as a high proportion of imported fish hardly get beyond these coastal cities as urban dwellers generally have more purchasing power. Moreover, markets and communal eating places make fish more easily accessible and the concentration of potential consumers in urban centres allows for economies of scale in the production and distribution systems (Bonzon, 1994).

It should be noted, though, that there are also local examples of the opposite development; when people move from the coastal areas to settle in the inland urban centres, they consume less fish since they do not any longer have direct physical access to the product. Over time, this development will influence the demand for fish.

Looking at fish consumption according to the age structure of consumers in developed countries, reveals that there are differences between generations that probably are - at least partly - related to changes in social conditions. In Japan, it has been noted that older people eat more fish than younger people who tend to prefer meat (Tasaka, 1994).

However, it is an open speculation whether the younger generation will continue to prefer meat as they grow older or increase their fish consumption as is currently the case with older people. In Western Europe too, older people seem to consume more fish. In the United States, seafood consumption seems to be highest among consumers aged 25-55 (Anderson, 1994).

### 3.4 Other factors

Food fish demand levels are influenced by the development of the supply (production) side. In fact, the whole "fisheries system" is intra-linked and, in addition, it is also influenced by factors outside the system. A change in the industry structure may influence the demand and consumption directly through the effects on marketing and distribution channels and indirectly through the impact the change may have on the production.

In the industrialized countries, a development of the industry through various stages can be noted; from traditional small scale operators selling their fish directly when landed to integrated production/processing/marketing enterprises and further to the now prevalent system where production and processing tend to be dissociated and the market powers are concentrated in large-scale distribution businesses dominating the processing sector (Boude, 1994). In developing countries, a similar evolution is seen for the export sector but not for the domestic market where the traditional structure still predominates. The shift of power concentration of the fisheries industry towards the markets of developed countries, enables the suppliers to influence the consumer preferences more than earlier. New products are developed and introduced in the market with the help of promotion and marketing measures. This type of influence on demand could be expected to increase in the future.

#### 4. FUTURE DEMAND FOR FISH AND FISHERY PRODUCTS

##### 4.1 Exploratory calculations of future food fish demand

As mentioned earlier, various factors shape the demand for food fish, the two most important of which seem to be population increase and economic growth.

If it is hypothetically assumed that the *per caput* food fish demand remains stable at the 1990 consumption level, i.e., 13.4 kgs on a *world average*, a simple multiplication of this figure with the predicted population increase gives a total quantity demanded which is some 35% higher in 2010 than the consumption in 1990, i.e., 94.2 million tonnes. However, population seems to grow faster in regions with low fish consumption than in regions with high *per caput* consumption at present. Consequently, a more detailed calculation assuming maintained consumption levels according to the *regional averages* shown in Table 4 gives a requirement of 87 million tonnes in 2010, only taking population growth into account.

However, a realistic projection would need to take the economic, social and other factors influencing demand into consideration as well. The calculation then becomes far more complex, especially given the data constraints and the difficulty of making regional generalisations.

For the purpose of the present study, estimates of demand have been made based on FAO Food Demand Model complemented by trend regression analysis using *per caput* GDP as the only explanatory variable. The analysis indicates that *fish demand for direct human consumption at constant real prices in 2010 will be in the range of 110 - 120 million tonnes*<sup>29</sup>.

The section below discusses the regional exploratory estimates of future demand and some of the assumptions on which these forecasts have been based. Annex IV provides additional details on the analysis.

##### 4.2 Regional trends

###### (i) Africa and the Near East

In sub-Saharan Africa, economic growth prospects are bleak and *per caput* demand for food fish is therefore not expected to reach much beyond the 1990 consumption level; it is expected that the economic constraints will dominate over other factors such as urbanization that could otherwise push demand upwards. Consequently, the present projection calculates an increase in total demand mainly due to anticipated population growth, which is expected to be considerable. Total demand for food fish in the region is expected to increase by over 80%.

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<sup>29</sup> The forecast expresses demand as the quantity of fish (live weight equivalent) demanded at constant real prices (base year 1990). See also Annex IV.

Also in the Near East, *per caput* demand is expected to only be slightly beyond the level of consumption in 1990 whereas in North Africa, demand is expected to increase by 2 kgs per person compared to the consumption level in 1990. In the Near East, population growth is forecasted to be relatively high, but considering the relatively small population of the region, total demand will still only represent a small percentage of the world total.

In the small developing island states of the Indian Ocean, fish consumption habits are assumed to be strong. Given optimistic prospects of economic growth for the forthcoming twenty years, demand for animal protein will increase. Demand for food fish is expected to double from 21-22 kgs in 1990 to 43 kgs in 2010.

## (ii) Asia

The Asian continent - which is expected to represent 60% of total food fish demand in 2010 - shows important sub-regional differences with regard to *per caput* demand.

In South Asia, *per caput* consumption is presently relatively low and it is not expected that future demand will be significantly higher. In large areas of the region, animal protein intake is generally low since consumption is to a large extent based on vegetarian food. The present projection of *per caput* consumption implies a rather important increase in relative terms but in absolute volume, demand for food fish remains low at 6 kgs per person and year. However, the large population of the Indian continent makes the region important in terms of total food fish demand. Population is expected to grow to over 1.6 billion in 2010 and total demand will reach over 9.7 million tonnes.

In China, the population is estimated to attain almost 1.4 billion in 2010 and the country will be in the market for almost 28 million tonnes of food fish. *Per caput* consumption has grown fast during the last decades and in the period 1980 to 1992, fish consumption grew at about the same rate as real GDP, i.e., 10% annually, attaining 9.9 kgs per person in 1992. However, in the present projection, a moderate approach is taken, accounting for the possibility that the values for historical fish consumption may not comprise unrecorded subsistence fishing, which would mean that the official historical consumption data is showing too low levels and that the recent high growth rate in consumption is actually overstated.

In Japan, the high level of *per caput* consumption will be reflected in a demand at the same level during the next decades. However, economic growth and greater openness to foreign influence and habits are likely to encourage diversification of consumption attitudes which could entail higher meat consumption at the expense of fish. It is also probable that there will be a diversion of demand for fish towards more valuable products but without increasing the total quantity demanded. On the other hand, there is still a strong traditional inclination to eating fish as well as emerging health considerations. It also appears that older people eat more fish than younger, and - assuming that also coming generations will follow this trend - an ageing population would mean higher demand for fish. Consequently, it is expected that average quantity of food fish demand will remain at the present level of 71 kgs per person and year.

In the East Asian region, similar traditional ties to fish consumption as in Japan seem to exist and *per caput* food fish demand is envisioned to increase drastically, where economic growth allows this to happen. However, in the future, increased competition from meat products can be expected.

### (iii) Europe

Seafood demand in Western Europe will be mainly determined by economic growth and to a certain extent the evolving perception of fish as healthy food. As in most developed countries, the average total protein intake in Europe is currently high and might have reached or be near saturation.

If so, any future increase in fish consumption would therefore be at the expense of consumption of other protein food. Considering the health aspects, this is a possible scenario and *per caput* demand is likely to increase somewhat. Given a very low projected population increase, the volume of total demand will increase relatively modestly compared to many other regions.

In Nordic countries, *per caput* food fish demand is expected to remain stable at the same level of some 31 kgs annually as over the last twenty years.

In the ex-CPEs of Central and Eastern Europe and the former USSR, where *per caput* consumption has fallen drastically during recent years, it is assumed that, in 2010, demand will attain the level of consumption of 1990, i.e., around 20 kgs. *Per caput* fish consumption remained stable at around 20 kgs during the period 1970-1990. Considering the foreseen 0-growth in *per caput* income, it cannot be expected that demand will reach beyond this level. In Central and Eastern Europe, it is probable that demand patterns will become similar to those in Western Europe and a shift in the species composition of demand away from the pelagic fish - which are predominant in today's consumption - to freshwater and demersal species.

### (iv) Latin America

Latin America on a whole is traditionally not a fish consuming continent. Nevertheless, a raise in *per caput* demand is envisioned thanks to the foreseen increase - although moderate - in GDP *per caput*.

Economic growth and population growth are assumed to be the predominant factors for determining future total food fish demand.

### (v) North America

Seafood demand in North America is expected to follow a similar pattern as in Western Europe. The *per caput* economic growth is expected to be moderate, but factors such as an aging and increasingly urban population will lead to augmented demand. A trend of away-from-home consumption of seafood is also expected to influence the demand level. Also, the perception of fish as healthy food may grow stronger.

#### (vi) Oceania

The future evolution of *per caput* food fish demand in **Australia and New Zealand** is expected to follow the same pattern as in other developed countries.

In the **Pacific**, *per caput* demand is expected to remain in 2010 at the level of consumption in 1990, i.e., at 29 kgs per person. According to historical trends, economic growth does not seem to entail higher demand for fish.

#### 4.3 Demand by product types and species groups

Predicting the product and species composition of future demand is a complex task considering the manifold cross relations between the different product types. However, there are some general trends which can be identified. Commonly, there seems to be a trend towards increasing demand for fresh and frozen products. In China, for example, it is expected that future demand will be oriented towards these product types. In industrialized countries, an increased demand for value-added products can be noted. Frozen fish and value-added convenience products are increasing in popularity. This trend is particularly apparent in Western Europe and North America but can also be seen in Japan, and to a certain extent in Southeast Asia in the higher income strata of the population. On the African market, frozen fish has become more important during the last decades, a trend that is expected to continue even though traditionally processed fish will remain in demand.

With regard to species, the price relation between the different fishes will play an important role. Nevertheless, it could be expected that consumers in developed countries will continue to demand white fish and an increasing amount of shellfish. For poorer populations in the developing countries, the price of the different fish species will be of considerable importance. With the rather pessimistic prospects for economic growth in sub-Saharan African it is expected that high value species will continue to be exported and small pelagics, etc, consumed in the local market. However, if prices of demersal fish increase due to supply constraints, habitual consumers of white fish may turn to cheaper alternatives, causing prices of these to increase as well; this is a trend that already can be seen.

### 5. FUTURE FOOD FISH CONSUMPTION - CONCLUDING REMARKS

Future demand for fish and fishery products will be influenced by a number of different factors. One of these factors is the price of fish in relation to possible substitute food products which was assumed to remain unchanged in the above calculations. Given our knowledge about future supplies of fish - that global fish production will not continue to grow at the same pace in future as it has during the past decades - this assumption is of course not realistic. It appears quite clear that there will be a relative decline in supply of fish compared to demand and that this situation of excess demand will lead to price increases<sup>30</sup>.

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<sup>30</sup> See Annex IV.

The way in which these price increases will be reflected in the demand and consumption patterns of the different regions will depend on the consumers' relative purchasing power and on what priority fish is given in the menu; the same factors as discussed in the demand projections at stable prices will be decisive for the final consumption levels, but their relative importance may change when fish become more expensive. Generally, it can be assumed that among people with a strong preference for fish, price elasticity tends to be lower than for consumers with less tradition of fish consumption.

To apply this reasoning at an aggregated level is difficult since countries and regions, and the different income groups within them, may react very different to price changes. The price and income elasticities vary between coastal and inland areas, between rural and urban populations, as well as between different income or cultural groups.

Furthermore, fish is not a homogenous product. Prices vary according to the type of fishery product and consumers may react differently depending on the type of fish and product. Switching between different species types will take place, i.e. consumers who formerly ate white fish will find it too expensive and may turn to cheaper pelagic fish. Or consumers with increased purchasing power will move from the cheaper fish to more expensive species.

In other cases, consumers may not see the species types as substitutes but rather choose chicken or other meat products instead of a different type of fish. These changes in consumer behaviour will influence the future evolution of the relative prices of different fish species and also be of importance to the development of supply from the different fisheries sub-sectors. The present apparent difference in price evolution between internationally traded high value fishery products and lower value local products will in the future depend on to what extent consumers around the world are prepared to change the species composition of their consumption. If consumers globally start to demand more small pelagic species, these fish will increasingly become part of the internationally traded fish production and price increases will be expected.

At an aggregated analysis level, the above considerations are difficult to quantify. However, generally, it can be expected that demand (as calculated at constant real prices) will be less affected in relatively rich countries where there are strong traditions of eating fish, e.g., in Japan and in the emerging markets in East Asia, than in lower income countries with modest fish consumption at present, for example in parts of Africa and South Asia. There is a risk that the present gap in average *per caput* fish consumption between developed and developing countries will grow larger in the future.

## 6. BIBLIOGRAPHY

Anderson, James, L. 1994. The status of seafood in the US: Hypotheses for fish consumption in 2010 (FAO working paper/project GCP/INT/589/JPN).

Boude, J-P. 1994. Food supply security and the European Fishing industry. (FAO Working Paper/project GCP/INT/589/JPN)

Bonzon, A. Appui au Secrétariat interimaire de la Conférence Ministérielle - Eléments de Programmation: Propositions d'Etudes et de Projets, Documents de travail TCP/RAF/2253, Rome, 1994.

Chuksin, Y. 1994. Demand and prices of fishery products and the major factors determining prices in the Baltic region. Paper presented at the Conference on the Baltic Fisheries, Warnemunde 14-16 November 1994. Atlantic Scientific Research Institute of Marine Fisheries and Oceanography (AtlantNIRO), Kaliningrad, Russia.

Committee on Fisheries (COFI). 1995. The role of fisheries in food security, COFI/95/Inf. 10. FAO, Rome.

FAO. 1993. Fishery Statistics Yearbook, Volumes 76 and 77.

FAO Fisheries Department. 1995. The state of world fisheries and aquaculture. Rome.

Fisheries Department, Ministry of Agriculture, Lithuania. 1994. The demand and prices of fishery products and the major factors determining prices in Lithuania. Paper presented at the Conference on the Baltic Fisheries, Warnemunde 14-16 November 1994. Atlantic Scientific Research Institute of Marine Fisheries and Oceanography (AtlantNIRO), Kaliningrad, Russia.

Heinbuch, U. 1992. Animal protein sources for rural and urban populations in Ghana. IDAF Programme Technical Report No. 58. FAO, Cotonou, 25p.

Laureti, E. 1992. Fish and fishery products: Apparent consumption statistics based on food balance sheets (1961-1990). FAO Fisheries Circular No FIDI/C821 (Rev.2).. FAO, Rome.

Kent, G. 1987. Fish, Food and Hunger. The potential of Fisheries for Alleviating Malnutrition. Westview Special Studies in Ocean Science and Policy (187 pages).

Moen Baine, Eli. 1994. Current global and regional fish consumption patterns (FAO working paper/project GCP/INT/589/JPN).

Monfort, Marie Christine. 1994. The status of fishery products as food: Hypotheses for fish consumption in 2010 and related policy options and development support requirements (Europe) (FAO working paper/project GCP/INT/589/JPN).

Que Wen. 1994. The status of fishery products as food: Hypotheses for fish consumption in 2010 and related policy options and development support requirements (China) (FAO/FIPP working paper/project GCP/INT/589/JPN)

Tasaka, Yukio. 1994. Current trends in fishery product consumption in Japan and the future outlook (FAO working paper/project GCP/INT/589/JPN).

Smith, P. 1995. Aquatic feed industry and its role in sustainable aquaculture, in Proceedings of Feed Ingredients, Asia'95, Singapore 19-21 September 1995.

Statistical Yearbook of Bangladesh 1993. Bangladesh Bureau of Statistics, Bangladesh.

Statistical Yearbook of Indonesia 1993. Biro Pusat Statistik, Jakarta, Indonesia.

United Nations. 1982. Methods used in compiling the United Nations Price Indexes for External Trade. United Nations Statistical Papers, Series M, No. 82. Vol. 1. United Nations, New York.

United Nations Department of Economic and Social Development, Statistical Office. 1993. International Trade Statistics Yearbook 1992. (Annuaire Statistique du Commerce International 1992.) ST/ESA/STAT/SER G./4. Vol. 1.

United Nations. Monthly Statistical Bulletin (various volumes).

Westlund, L. 1994. Report of the Study on Exploitation and Use of Small Pelagics Species in West Africa. FAO Fisheries Circular. No 880. Rome, FAO 1994. 57p.

WHO. 1990. Diet, Nutrition and the Prevention of Chronic Diseases. Report of a WHO Study Group. Technical Report Series, No 797. 203p.

Databases:

AGROSTAT (FAO)

STARS (World Bank)

FISHSTAT (FAO)

## ANNEX I

## Country Groupings

North America

Bermuda  
 Canada  
 Greenland  
 St Pierre and Miquelon  
 USA

Central America and the Caribbean

Antigua and Barbuda  
 Aruba  
 Bahamas  
 Barbados  
 Belize  
 British Virgin Islands  
 Cayman Islands  
 Costa Rica  
 Cuba  
 Dominica  
 Dominican Republic  
 El Salvador  
 Grenada  
 Guadeloupe  
 Guatemala  
 Haiti  
 Honduras  
 Jamaica  
 Martinique  
 Mexico  
 Montserrat  
 Netherlands Antilles  
 Nicaragua  
 Panama  
 Puerto Rico  
 St Kitts and Nevis  
 St Lucia  
 St Vincent  
 Trinidad and Tobago  
 Turks and Caicos Islands  
 US Virgin Islands

South America

Argentina  
 Bolivia  
 Brazil  
 Chile  
 Colombia  
 Ecuador  
 Falkland Islands  
 French Guiana  
 Guyana  
 Paraguay  
 Peru  
 Surinam  
 Uruguay  
 Venezuela

Nordic countries of Europe

Faeroe Islands  
 Finland  
 Iceland  
 Norway  
 Sweden

Western Europe

Austria  
 Belgium-Luxembourg  
 Denmark  
 France  
 Germany  
 Greece  
 Ireland  
 Italy  
 Netherlands  
 Portugal  
 Spain  
 Switzerland  
 United Kingdom

## ANNEX I (cont'd)

EX-CPEs<sup>1</sup>

Albania  
 Armenia  
 Azerbaijan  
 Belarus  
 Bosnia Herzegovina  
 Bulgaria  
 Croatia  
 Czech Republic  
 Estonia  
 Georgia  
 Hungary  
 Kazakhstan  
 Krygyzstan  
 Latvia  
 Lithuania  
 Macedonia  
 Moldova  
 Poland  
 Rumania  
 Russian Federation  
 Slovakia  
 Slovenia  
 Tajikstan  
 Turkemenistan  
 Ukraine

Near East and others

Afghanistan  
 Bahrain  
 Cyprus  
 Gaza Strip  
 Islamic Republic of Iran  
 Iraq  
 Israel  
 Jordan

Kuwait  
 Lebanon  
 Malta  
 Oman  
 Qatar  
 Saudi Arabia  
 Syria  
 Turkey  
 United Arab Emirates  
 Yemen

North Africa

Algeria  
 Egypt  
 Libya  
 Morocco  
 Tunisia

Sub-Saharan Africa

Angola  
 Benin  
 Botswana  
 Burkina Faso  
 Burundi  
 Cameroon  
 Cape verde  
 Central African Republic  
 Chad  
 Congo  
 Cote d'Ivoire  
 Djibouti  
 Equatorial Guinea  
 Ethiopia and Eritrea  
 Gabon  
 Gambia  
 Ghana

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<sup>1</sup> Ex-Centrally Planned Economies in Central and Eastern Europe and former Soviet Union

## ANNEX I (cont'd)

Guinea	<u>China and Mongolia</u>
Guinea Bissau	
Kenya	<u>Japan</u>
Lesotho	
Liberia	<u>Australia and New Zealand</u>
Madagascar	
Malawi	<u>Pacific</u>
Mali	American Samoa
Mauritania	Cook Island
Mozambique	Fiji
Namibia	French Polynesia
Niger	Guam
Nigeria	Kiribati
Rwanda	Marshall Islands
St Helena	Micronesia
Sao Tome and Principe	New Caledonia
Senegal	Niue
Sierra Leone	Northern Mariana Islands
Somalia	Palau
South Africa	Papua New Guinea
Sudan	Samoa
Swaziland	Solomon Islands
Tanzania	Tonga
Togo	Tuvalu
Uganda	Vanuatu
Zaire	Wallis and Futuna Islands
Zambia	
Zimbabwe	<u>East Asia - High income countries<sup>2</sup></u>
<u>South Asia</u>	Brunei Darussalaam
Bangladesh	Hong Kong
Bhutan	Indonesia
India	Korea Rep.
Maldives	Malaysia
Nepal	Singapore
Pakistan	Thailand
Sri Lanka	Taiwan (province of China)

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<sup>2</sup> "High income countries" have been defined as countries with a projected average annual GDP growth rate of more than 5.5% for the period 1990-95, or a GDP *per caput* of more than US\$ 8 000 in 1990.

## ANNEX I (cont'd)

East Asia - Low income countries<sup>3</sup>

Cambodia

Korea DPR

Laos

Macau

Myanmar

Philippines

Viet Nam

Indian Ocean

Comoros

Mauritius

Reunion

Seychelles

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<sup>3</sup> East Asian countries not included in the group of "High income countries".

## ANNEX II

## Selected statistical information by country groups

## AFRICA AND THE NEAR EAST

	1970	1975	1980	1985	1990
Indian Ocean					
Average per caput yearly fish supply (kgs)	14.0	18.0	20.1	17.5	21.7
Average per caput yearly meat supply (kgs)	14.9	17.7	23.5	24.4	35.3
Average GDP per caput and year (USD constant prices; 1980)	571	794	878	1,044	1,404
Average urbanization rate	38.2%	40.8%	42.3%	43.5%	44.6%
Total food fish supply (MT)	22,577	31,569	38,625	36,549	49,715
Total fish production (MT)	12,100	18,122	17,377	23,811	29,980
Gross imports (MT)	10,800	15,747	24,232	19,817	35,679
Net trade (MT)	10,477	13,448	21,273	12,722	19,724
Gross imports/caput (kgs)	6.7	9.0	12.6	9.5	15.6
Total population (thousands)	1,615	1,751	1,918	2,092	2,294
*) Estimate.					
Near East and others					
Average per caput yearly fish supply (kgs)	3.2	2.9	5.0	5.4	4.6
Average per caput yearly meat supply (kgs)	15.4	17.2	21.4	24.1	22.1
Average GDP per caput and year (USD constant prices; 1980)	2,165	2,792	2,905	2,523	2,295
Average urbanization rate	39.0%	43.0%	47.0%	52.0%	57.0%
Total food fish supply (MT)	362,985	383,414	763,012	966,153	940,401
Total fish production (MT)	550,197	602,944	817,215	1,068,095	1,074,353
Gross imports (MT)	54,706	76,226	206,839	194,683	189,348
Net trade (MT)	9,821	23,775	159,033	132,860	98,470
Gross imports/caput (Kgs)	0.5	0.6	1.4	1.1	0.9
Total population (thousands)	115,209	133,466	153,128	177,772	206,335

## AFRICA AND THE NEAR EAST (cont.)

	1970	1975	1980	1985	1990
North Africa					
Average per caput yearly fish supply (kgs)	2.7	4.0	5.1	6.5	7.1
Average per caput yearly meat supply (kgs)	11.5	11.9	14.3	17.3	17.5
Average GDP per caput and year (USD constant prices; 1980)	922	1,101	1,447	1,505	1,484
Average urbanization rate	40.2%	42.4%	44.5%	46.6%	48.6%
Total food fish supply (MT)	186,148	310,459	453,343	659,382	818,740
Total fish production (MT)	383,548	419,028	591,425	853,834	1,070,391
Gross imports (MT)	22,133	62,189	77,126	121,077	148,561
Net trade (MT)	-46,407	-24,125	-15,373	-90,953	-92,401
Gross imports/caput (Kgs)	0.3	0.8	0.9	1.2	1.3
Total population (thousands)	69,222	77,670	88,424	101,371	115,049

	1970	1975	1980	1985	1990
Sub-Saharan Africa					
Average per caput yearly fish supply (kgs)	7.7	8.2	8.5	7.7	8.4
Average per caput yearly meat supply (kgs)	14.0	13.2	14.2	13.8	13.0
Average GDP per caput and year (USD constant prices; 1980)	714	760	734	645	606
Average urbanization rate	18.7%	20.7%	23.0%	25.1%	27.6%
Total food fish supply (MT)	2,238,877	2,766,179	3,312,211	3,479,501	4,397,311
Total fish production (MT)	3,382,370	3,639,602	3,086,699	3,321,858	3,970,693
Net trade (MT)	211,695	324,952	922,419	674,667	904,687
Gross imports (MT)	439,965	649,889	1,226,499	1,098,932	1,383,340
Gross imports/caput (Kgs)	1.5	1.9	3.2	2.4	2.6
Total population (thousands)	292,467	335,519	388,895	450,858	525,005

\*)Equatorial Guinea and Somalia excluded.

## ASIA

	1970	1975	1980	1985	1990
<b>China and Mongolia</b>					
Average per caput yearly fish supply (kgs)	3.6	4.5	4.2	6.1	9.8
Average per caput yearly meat supply (kgs)	10.3	11.9	15.8	20.5	27.0
Average GDP per caput and year (USD constant prices; 1980)	226	264	330	488	669
Average urbanization rate	17.5%	17.3%	19.5%	23.8%	26.5%
Total food fish supply (MT)	2,973,512	4,122,033	4,112,643	6,445,989	11,159,168
Total fish production (MT)	3,096,500	4,247,653	4,235,694	6,779,193	12,095,494
Gross imports (MT)	450	700	1,682	94,458	158,850
Net trade (MT)	-111,988	-122,619	-123,050	-60,699	-386,322
Gross imports/caput (kgs)	0.0	0.0	0.0	0.1	0.1
Total population (thousands)	817,426	912,716	980,155	1,053,348	1,135,443

	1970	1975	1980	1985	1990
<b>East Asia - High income countries</b>					
Average per caput yearly fish supply (kgs)	16.7	19.5	20.7	22.6	23.0
Average per caput yearly meat supply (kgs)	7.9	8.7	10.5	13.4	15.6
Average GDP per caput and year (USD constant prices; 1980)	525	687	920	1,125	1,520
Average urbanization rate	22.9%	25.8%	29.2%	33.3%	37.6%
Total food fish supply (MT)	3,663,636	4,834,280	5,678,969	6,820,002	7,582,501
Total fish production (MT)	4,522,086	6,230,081	7,603,931	9,099,043	10,809,652
Gross imports (MT)	344,724	456,882	625,589	931,655	1,775,842
Net trade (MT)	-172,864	-484,448	-810,273	-1,015,047	-1,422,338
Gross imports/caput (kgs)	1.6	1.8	2.3	3.1	5.4
Total population (thousands)	219,564	247,490	274,876	302,378	329,116

\*) Brunei Darussalaam not included.

## ASIA (cont.)

East Asia - Low income countries	1970	1975	1980	1985	1990
Average per caput yearly fish supply (kgs)	19.6	20.9	19.6	22.0	23.7
Average per caput yearly meat supply (kgs)	10.7	9.9	11.5	12.4	14.4
Average GDP per caput and year (USD constant prices, 1980)	265	301	369	389	428
Average urbanization rate	26.3%	28.0%	29.0%	30.2%	31.3%
Total food fish supply (MT)	2,587,733	3,102,676	3,219,830	4,046,678	4,872,405
Total fish production (MT)	2,629,800	3,638,321	4,144,840	5,127,772	5,798,324
Gross imports (MT)	115,024	123,593	51,072	15,831	168,750
Net trade (MT)	104,185	87,588	-76,764	-146,124	-81,901
Gross imports/caput (kgs)	0.9	0.8	0.3	0.1	0.8
Total population (thousands)	131,886	148,425	164,502	184,037	205,721

\*) Macau not included.

Japan	1970	1975	1980	1985	1990
Average per caput yearly fish supply (kgs)	63.5	70.6	65.5	69.5	71.2
Average per caput yearly meat supply (kgs)	17.8	23.6	30.5	34.1	38.7
Average GDP per caput and year (USD constant prices, 1980)	6,448	7,456	9,070	10,628	13,028
Average urbanization rate	71.0%	76.0%	76.0%	77.0%	77.0%
Total food fish supply (MT)	6,624,202	7,878,354	7,649,452	8,392,916	8,794,117
Total fish production (MT)	8,824,800	9,896,170	10,433,997	11,408,883	10,353,555
Gross imports (MT)	394,942	906,253	1,172,645	1,857,390	3,041,331
Net trade (MT)	-325,013	148,855	352,506	1,253,867	2,600,778
Gross imports/caput (Kgs)	3.8	8.1	10.0	15.4	24.6
Total population (thousands)	104,345	111,524	116,782	120,754	123,537

## ASIA (cont.)

	1970	1975	1980	1985	1990
<b>South Asia</b>					
Average per caput yearly fish supply (kgs)	3.5	3.6	3.6	3.7	4.1
Average per caput yearly meat supply (kgs)	4.0	4.0	4.1	4.4	5.1
Average GDP per caput and year (USD constant prices; 1980)	226	234	250	289	330
Average urbanization rate	18.1%	19.4%	21.0%	22.1%	23.3%
Total food fish supply (MT)	2,516,027	2,897,531	3,173,374	3,710,988	4,578,793
Total fish production (MT)	2,758,800	3,256,986	3,596,378	4,261,256	5,380,295
Gross imports (MT)	85,593	30,514	42,453	64,000	82,220
Net trade (MT)	-59,070	-105,715	-115,792	-182,435	-243,044
Gross imports/caput (kgs)	0.1	0.0	0.0	0.1	0.1
Total population (thousands)	712,431	799,880	893,452	1,002,997	1,116,538
*) Bhutan excluded.					

## EUROPE (incl. former USSR)

	1970	1975	1980	1985	1990
<b>Ex-CPEs</b>					
Average per caput yearly fish supply (kgs)	19.0	22.5	19.9	22.2	19.6
Average per caput yearly meat supply (kgs)	50.7	63.7	65.5	67.8	75.0
Average GDP per caput and year (USD constant prices; 1980)	1,942	2,479	2,960	3,266	3,328
Average urbanization rate	48.2%	52.0%	57.7%	60.9%	65.3%
Total food fish supply (MT)	6,687,142	8,264,424	7,609,909	8,837,046	8,092,866
Total fish production (MT)	7,955,258	11,233,297	10,573,216	11,687,474	11,179,723
Gross imports (MT)	277,851	309,327	411,802	761,520	973,341
Net trade (MT)	-172,979	-458,458	-334,674	-93,808	-454,263
Gross imports/caput (kgs)	0.8	0.8	1.1	1.9	2.4
Total population (thousands)	351,253	367,579	383,177	398,590	411,990
*) Average of countries for which data is available.					

## EUROPE (incl. former USSR) (cont.)

	1970	1975	1980	1985	1990
<b>Nordic countries of Europe</b>					
Average per caput yearly fish supply (kgs)	31.8	31.5	32.6	32.3	31.4
Average per caput yearly meat supply (kgs)	47.8	55.6	59.5	57.2	58.2
Average GDP per caput and year (USD constant prices; 1980)	10,628	12,240	13,637	15,186	16,924
Average urbanization rate	69.0%	72.6%	73.8%	74.4%	75.3%
Total food fish supply (MT)	532,524	541,262	569,480	571,329	568,045
Total fish production (MT)	4,223,574	4,089,788	4,557,149	4,548,147	3,897,646
Gross imports (MT)	228,548	238,130	288,242	301,929	394,101
Net trade (MT)	-1,362,360	-1,191,359	-1,339,749	-1,669,681	-1,764,761
Gross imports/caput (Kgs)	13.6	13.9	16.5	17.1	21.8
Total population (thousands)	16,769	17,171	17,447	17,692	18,092
*) Faeroe Islands excluded.					
**) Faeroe Islands and Iceland excluded.					

	1970	1975	1980	1985	1990
<b>Western Europe</b>					
Average per caput yearly fish supply (kgs)	18.8	18.0	17.6	20.0	22.8
Average per caput yearly meat supply (kgs)	68.1	73.7	82.5	84.3	88.0
Average GDP per caput and year (USD constant prices; 1980)	7,648	8,585	9,821	10,499	12,084
Average urbanization rate	73.0%	75.0%	76.0%	77.0%	78.0%
Total food fish supply (MT)	6,296,111	6,158,078	6,137,202	7,051,585	8,197,877
Total fish production (MT)	6,941,842	7,265,015	6,947,515	7,213,379	6,802,971
Gross imports (MT)	2,390,364	2,590,713	3,628,721	4,636,760	7,141,194
Net trade (MT)	808,110	914,014	1,470,628	1,730,021	3,401,911
Gross imports/caput (Kgs)	7.2	7.6	10.4	13.2	19.9
Total population (thousands)	334,278	342,954	348,822	352,446	358,806

LATIN AMERICA AND THE CARIBBEAN		1970	1975	1980	1985	1990
Central America and the Caribbean						
Average per caput yearly fish supply (kgs)		5.5	6.3	9.0	9.0	9.3
Average per caput yearly meat supply (kgs)	*)	22.2	25.2	30.3	31.5	29.5
Average GDP per caput and year (USD constant prices; 1980)	*)	1,615	1,890	2,241	2,229	2,115
Average urbanization rate	*)	51.9%	55.4%	58.5%	61.4%	64.1%
Total fish supply (MT)		529,585	693,271	1,116,727	1,251,306	1,445,753
Total fish production (MT)		595,221	824,643	1,744,845	1,867,325	1,899,480
Gross imports (MT)		198,837	236,106	232,879	226,882	247,969
Net trade (MT)		89,265	111,528	70,180	67,908	56,997
Gross imports/caput (Kgs)		2.1	2.1	1.9	1.6	1.6
Total population (thousands)		96,167	110,266	124,053	138,875	154,873
*) Average of countries for which data is available.						
South America						
Average per caput yearly fish supply (kgs)		7.2	7.7	8.9	8.0	9.1
Average per caput yearly meat supply (kgs)		40.3	41.6	43.9	39.4	44.5
Average GDP per caput and year (USD constant prices; 1980)		1,754	2,060	2,332	2,110	2,093
Average urbanization rate		60.0%	64.0%	68.0%	72.0%	75.0%
Total food fish supply (MT)		1,383,262	1,648,035	2,149,249	2,133,043	2,686,554
Total fish production (MT)		14,761,780	5,771,974	7,783,347	11,933,316	14,417,634
Gross imports (MT)		185,292	190,416	259,181	134,489	325,827
Net trade (MT)		26,368	-87,329	-936,605	-837,837	-907,321
Gross imports/caput (Kgs)		1.0	0.9	1.1	0.5	1.1
Total population (thousands)		191,138	214,634	240,460	267,689	294,115

NORTH AMERICA		1970	1975	1980	1985	1990
North America						
Average per caput yearly fish supply (kgs)		14.7	14.3	15.6	19.7	21.8
Average per caput yearly meat supply (kgs)	*)	107.2	124.1	109.2	111.2	113.5
Average GDP per caput and year (USD constant prices; 1980)	**)	9,808	10,511	11,722	12,853	14,263
Average urbanization rate	*)	73.8%	73.9%	73.9%	74.7%	75.4%
Total food fish supply (MT)		3,321,451	3,413,405	3,940,611	5,194,279	6,022,688
Total fish production (MT)		4,195,598	3,898,517	5,115,868	6,509,259	7,626,445
Gross imports (MT)		1,421,658	1,587,099	1,722,785	2,572,807	2,619,205
Net trade (MT)		477,241	771,390	228,445	182,681	-354,856
Gross imports/caput (Kgs)		6.3	6.6	6.8	9.8	9.5
Total population (thousands)		226,480	238,809	251,900	263,763	276,745
*) Greenland excluded.						
**) USA and Canada only.						
OCEANIA						
Australia and New Zealand						
Average per caput yearly fish supply (kgs)		13.7	13.8	15.2	18.6	20.0
Average per caput yearly meat supply (kgs)		110.8	126.4	115.7	113.9	116.8
Average GDP per caput and year (USD constant prices; 1980)		8,892	9,712	10,200	11,082	11,816
Average urbanization rate		84.4%	85.3%	85.4%	85.2%	85.3%
Total food fish supply (MT)		212,779	233,871	270,126	353,659	408,576
Total fish production (MT)		162,100	173,169	347,414	466,497	780,396
Gross imports (MT)		108,677	132,103	152,368	210,342	234,581
Net trade (MT)		55,179	64,784	-76,706	-83,215	-157,889
Gross imports/caput (Kgs)		7.0	7.8	8.6	11.1	11.5
Total population (thousands)		15,576	16,976	17,808	19,035	20,391

OCEANIA (cont.)		1970	1975	1980	1985	1990
Pacific						
Average per caput yearly fish supply (kgs)		19.7	18.4	27.0	27.1	28.9
Average per caput yearly meat supply (kgs)	*)	23.6	26.5	28.3	29.4	32.6
Average GDP per caput and year (USD constant prices; 1980)	**)	1,000	1,066	997	948	934
Average urbanization rate		17.0%	20.0%	21.0%	23.0%	24.0%
Total food fish supply (MT)		77,463	81,610	134,180	150,647	179,391
Total fish production (MT)		45,950	77,249	129,762	140,533	167,887
Gross imports (MT)		57,693	43,117	100,440	93,745	99,378
Net trade (MT)		37,373	11,797	18,649	40,301	56,438
Gross imports/caput (kgs)		14.6	9.7	20.2	16.8	16.0
Total population (thousands)		3,941	4,436	4,976	5,566	6,201
*) Average of countries for which data is available.						
**) Based only on Fiji, Samoa and Papua New Guinea.						

**ANNEX III**  
**Population and economic growth by country groups**

POPULATION 1970-1990 AND PROJECTION 2010							Annual growth rate	
	1970	1980	1990	2000	2010	1970-1990	1990-2010	
<b>AFRICA AND THE NEAR EAST</b>								
INDIAN OCEAN	1,615	1,918	2,274	2,731	3,253	1.7%	1.8%	
NEAR EAST AND OTHERS	116,096	154,222	207,569	274,032	345,092	2.9%	2.6%	
NORTH AFRICA	71,454	91,298	118,206	146,022	173,108	2.5%	1.9%	
SUBSAHARAN AFRICA	291,134	382,449	512,190	682,842	893,016	2.9%	2.8%	
<b>ASIA</b>								
CHINA AND MONGOLIA	831,931	1,000,540	1,157,482	1,287,258	1,391,657	1.7%	0.9%	
EAST ASIA - HIGH INCOME COUNTRIES	205,553	257,791	308,562	354,219	394,294	2.1%	1.2%	
EAST ASIA - LOW INCOME COUNTRIES	131,867	164,054	204,440	252,439	299,599	2.2%	1.9%	
JAPAN	104,331	116,807	123,537	126,472	127,152	0.8%	0.1%	
SOUTH ASIA	712,444	893,464	1,118,927	1,364,750	1,617,426	2.3%	1.9%	
<b>EUROPE (incl. former USSR)</b>								
EX-CPÉs	350,548	381,798	410,842	418,814	429,290	0.8%	0.2%	
NORDIC COUNTRIES OF EUROPE	16,769	17,447	18,088	18,930	19,492	0.4%	0.4%	
WESTERN EUROPE	334,400	348,980	358,734	368,735	368,686	0.4%	0.1%	
<b>LATINA AMERICA AND THE CARIBBEAN</b>								
CENTRAL AMERICA AND CARIBBEAN	92,157	118,402	146,580	177,635	206,886	2.3%	1.7%	
SOUTH AMERICA	191,050	240,030	293,131	346,231	396,946	2.2%	1.5%	
NORTH AMERICA	226,479	252,461	277,838	306,280	331,571	1.0%	0.9%	
<b>OCEANIA</b>								
AUSTRALIA AND NEW ZEALAND	15,355	17,682	20,248	22,981	25,401	1.4%	1.1%	
PACIFIC	3,962	5,012	6,184	7,676	9,425	2.3%	2.1%	
<b>WORLD</b>	3,697,145	4,444,355	5,284,832	6,158,047	7,032,294	1.8%	1.4%	

	PER CAPUT GDP AT 1980 PRICES 1970-1990 AND PROJECTION 2010					Annual growth rate 1970-1990	Annual growth rate 1990-2010
	1970	1980	1990	2010			
WORLD	2,154	2,599	2,912	4,475	1.5%	2.2%	
DEVELOPING	553	752	865	1,934	2.3%	4.1%	
DEVELOPED (incl. ex-CPEs)	6,065	7,783	9,544	14,217	2.3%	2.0%	
AFRICA AND THE NEAR EAST							
INDIAN OCEAN	571	878	1,404	3,751	4.6%	5.0%	
NEAR EAST AND OTHERS	2,165	2,905	2,295	4,090	0.3%	2.9%	
NORTH AFRICA	922	1,447	1,484	2,014	2.4%	1.5%	
SUBSAHARAN AFRICA	714	734	606	709	-0.8%	0.8%	
ASIA							
CHINA AND MONGOLIA	226	330	669	2,849	5.6%	7.5%	
EAST ASIA - HIGH INCOME COUNTRIES	525	920	1,520	4,468	5.5%	5.5%	
EAST ASIA - LOW INCOME COUNTRY	265	369	428	745	2.4%	2.8%	
JAPAN	6,448	9,070	13,028	26,694	3.6%	3.7%	
SOUTH ASIA	226	250	330	694	1.9%	3.8%	
EUROPE (incl. former USSR)							
EX-CPEs	1,942	2,960	3,328	3,327	2.7%	0.0%	
NORDIC COUNTRIES OF EUROPE	10,628	13,637	16,924	22,501	2.4%	1.4%	
WESTERN EUROPE	7,648	9,821	12,084	19,408	2.3%	2.4%	
LATINA AMERICA AND THE CARIBBEAN							
CENTRAL AMERICA AND THE CARIBBEAN	1,615	2,241	2,115	2,981	1.4%	1.7%	
SOUTH AMERICA	1,754	2,332	2,093	3,282	0.9%	2.3%	
NORTH AMERICA	9,808	11,722	14,263	19,126	1.9%	1.5%	
OCEANIA							
AUSTRALIA AND NEW ZEALAND	8,892	10,200	11,816	17,235	1.4%	1.9%	
PACIFIC	1,000	997	934	1,318	-0.3%	1.7%	

## ANNEX IV

## Demand projections

1. Supply, demand and consumption

The demand projection presented in Chapter 4 expresses future demand as the quantity of food fish demanded at constant real prices (base year 1990). Using this definition, demand in 2010 is expected to be in the range of 110 - 120 million tonnes.

The concept of *constant real prices* has been introduced in order to identify the role of changes in non-price factors in demand. In a further analysis of demand and of consumption, the demand projection should be combined with a forecast of future supply levels and the price factor be included.

Figure 1A shows a simplified diagram over total global fish supply and demand. It has been assumed that the supply curve is vertical, i.e. supply is perfectly price-inelastic and the quantity of fish supplied is determined primarily by non-economic factors<sup>1</sup>. The point  $P_e, Q_e$ , i.e. the intersection of the demand and supply curves, represents the equilibrium quantity and price in 1990. The quantity  $Q_e$  is equal to consumption.

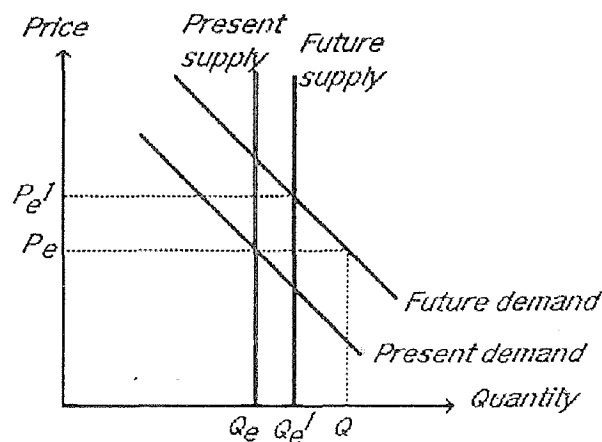


Figure 1A:

Schematic diagram over supply and demand in the fisheries sector

<sup>1</sup> A perfectly price-inelastic supply is naturally an over-simplification of the real situation; even though supply from the marine and inland capture fisheries could be assumed to be relatively price-inelastic, the production from the aquaculture sector is probably much more sensitive to market prices. However, for the purpose of this diagram, a vertical supply curve is appropriate.

When there is a change in any of the non-price factors influencing demand, the demand curve will move. For example, when consumers' disposable income increases, the demand curve will shift upwards to the right<sup>2</sup>. If the price level is kept constant at  $P_e$ , the quantity now demanded will be  $Q_e^1$ . This is the quantity that the present study attempts to predict, and which has been estimated to 110-120 million tonnes in 2010.

However, the point  $Q P_e$  is not a market equilibrium. Assuming that also the supply curve has shifted to the right - due to an increase in the supply of fish - the equilibrium point is instead  $Q_e^1 P_e^1$ . As it can be seen, the price level has increased, i.e. from  $P_e$  to  $P_e^1$ . The quantity  $Q_e^1$  represents future consumption.

## 2. Demand projections

The global demand forecast of 110-120 million tonnes is based on the aggregation of seventeen regional demand projections (see Annex I). Future *per caput* demand has been estimated by region. These regional projections have thereafter been multiplied by the expected population<sup>3</sup> of each region and regional totals of food fish demand have been arrived at. The regional totals have then been added together to form the world total food fish demand. Table 1A shows the regional projections.

The *per caput* demand projections for each region are estimates based on the FAO Food Demand Model, complemented by a trend regression analysis using *per caput* GDP as the only explanatory variable. The food demand model is an agricultural commodity projection model developed by the Commodity and Trade Division of FAO<sup>4</sup>. The model uses GDP and a trend factor incorporating all other influences on demand, e.g., tradition, attitudes, etc, as the explanatory variables. The modelling work used as a basis for the present projection was carried out in the beginning of 1992. It included 125 countries and covered all major commodities in the diet of each country. However, especially with regard to demand income elasticities, the data used in the model have not been up-dated recently. Furthermore, since 1992, projections for economic growth have been revised. Therefore, a trend regression analysis was also carried out, using GDP projections made in 1994 as the variable parameter.

The food demand model gave a world total of quantity demanded at constant prices of 122 million tonnes in 2010. The trend regression analysis indicated a total demand of 125 million tonnes<sup>5</sup>.

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<sup>2</sup> Assuming a positive income elasticity.

<sup>3</sup> UN assessment 1994.

<sup>4</sup> See Agricultural Commodity Projections, 1970-1980, Part I: General Methodology, FAO, 1971.

<sup>5</sup> In the trend regression analysis, it has been assumed that the reported historical figures of Chinese *per caput* consumption for China are too low; a correction for this has been made in the calculation.

However, in spite of the apparent coherence between the results of the two methodologies, quite some significant differences were found in the forecasts for individual regions.

Therefore, the figures presented in Table 1A are the results of a compromise of the two analyses. When available, the results of other studies have also been taken into account. Some of the more important considerations are explained below.

For the Nordic countries of Europe and the ex-CPEs, the food demand model showed increases in demand whereas the regression analysis resulted in a *per caput* demand at the level of apparent consumption in 1990.

In the final estimate, the latter projection was considered the most realistic. For Japan, a non-growth in *per caput* quantity demanded compared to consumption in 1990 has also been applied (Tasaka, 1994).

The North American demand estimate is based on Anderson's (1994) forecast for future US *per caput* fish consumption which is expected to rise by an annual rate of 1% up to the year 2010.

This figure corresponds to the average of the results of the FAO food demand model and the trend regression analysis and has therefore been used as a basis for the demand forecast.

For China, the FAO food demand modelling resulted in a *per caput* demand in 2010 of 26 kgs. The regression analysis gave 22 kgs<sup>6</sup>. Among the regions of the analysis, China is the most critical country due to the uncertainty of available data and to the large population making China have a tremendous impact on the world total demand forecast.

In the final projection, the figure 20 kgs has been used as an estimate of *per caput* demand in 2010. Even though this is lower than the result of the two models, it still represents a doubling of the average *per caput* demand in 2010 compared to consumption in 1990.

The presented forecasts should be considered only as a first attempt to quantify future demand in order to ameliorate the projection methodology, the data used needs to be improved. This is a long term task which includes the collection of price information, market analysis, etc., on a continuous basis.

It should also be remembered that this kind of exploratory estimates aim at illustrating the possible magnitude of future global demand and the relative difference among various regions, not at providing precise values. For total global demand, it is therefore preferred to refer to the range 110-120 million tonnes rather than to the total figure in table 1A.

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<sup>6</sup> See previous footnote.

Table 1A:  
Exploratory estimates of *per caput* and total food fish demand at constant real prices in 2010 - by sub-region (live weight equivalent)

	2010 projected demand		2010 projected demand
	Kgs/ caput	Total (Thousand MT)	Share of total world demand
AFRICA AND THE NEAR EAST	8	11,460	10%
Indian Ocean	43	140	0%
Near East and others	5	1,725	1%
North Africa	9	1,558	1%
Sub-Saharan Africa	9	8,037	7%
ASIA	18	69,244	60%
China and Mongolia	20	27,833	24%
East Asia/High income countries	37	14,589	13%
East Asia/Low income countries	27	8,089	7%
Japan	71	9,028	8%
South Asia	6	9,705	8%
EUROPE	23	18,407	16%
EX-CPEs	20	8,586	7%
Nordic countries of Europe	31	604	1%
Western Europe	25	9,217	8%
LATIN AMERICA AND THE CARIBBEAN	10	6,245	5%
Central America and the Caribbean	11	2,276	2%
South America	10	3,969	3%
NORTH AMERICA	27	8,952	8%
OCEANIA	25	858	1%
Australia and New Zealand	23	584	1%
Pacific	29	273	0%
Total world	16	115,167	100%
Developed countries	27.4	37,372	32%
Developing countries	13.7	77,795	68%





