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Economics of Fisheries Development

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ECONOMICS OF FISHERIES DEVELOPMENT

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This book provides an introductory text covering first the theoretical principles of fisheries economics and management, and secondly the major issues relating these principles to the fisheries of developing countries.

It is directed to the needs of those developing countries which now, with economic zones extended to 200 miles, find themselves with a large fish resource which, provided it is easily managed and exploited, is capable of generating wealth and income of immense national benefit.

It is also directed towards development economists, who hitherto have not readily had access to text books which recognize the importance of fisheries as an economic resource capable of being exploited to great advantage by developing countries.

It is hoped that this book will be of both academic and instructional value and will stimulate university and college students towards gaining a better understanding of the problems of fisheries growth, particularly in developing countries, whilst providing fisheries personnel in developing countries with a framework within which to determine meaningful options and strategies for development.

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1. Overview of the State of World Fisheries
2. Economic Theory of Fish Resource Exploitation
3. Fisheries Management
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Rowena Lawson became involved in fishery economics in the early 1950s when she prepared a Master's thesis on the Economics of Fisheries of the Gold Coast. At the end of twenty years in West Africa she had established herself as a development economist with special knowledge of fisheries.

Her fisheries work has taken her to all S.E. Asian countries and Hong Kong, India, Sri Lanka, South Korea, Kiribati, Uganda, Bahamas, Senegal, Cape Verde Islands, Gambia, Sierra Leone, Liberia, Ivory Coast, Ghana, Benin, and Nigeria. Her main work has included small-scale fisheries, credit and marketing, fisheries project preparation and evaluation, fisheries aid, management, and migration and resettlement problems in fisheries.

Her consultancy work has been for the World Bank, the Asia Development Bank, Resources for the Future, the EEC, the Inter-American Development Bank, the Food and Agricultural Organization of the UN, and the Overseas Development Administration, UK.

She has worked at the Universities of Ghana, Leeds, Hull, the Australian National University and Stanford University and took early retirement from the University of Hull in 1983 as Emeritus Reader in Development Economics and is currently engaged in consultancy work in fisheries development.

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Preface

The original impetus for this book came when, with the introduction of the 200-mile extended economic zone (EEZ), many developing countries suddenly found they had large fish resources, which—wisely managed and exploited—could generate wealth and income of immense benefit. However, one constraint to this was that many countries, for historic reasons, lacked the expertise to manage fisheries on this scale. Their needs seemed threefold: first, to establish the status of fisheries in both a national and international perspective; second, to provide enough theory of fishery economics to understand the implications of national policies; and third, to present problems and experiences of fisheries development in such a way that the application of theory would yield meaningful options and strategies for development.

A further impetus arose from the realization that few economists and especially development economists teaching in universities and colleges were able to incorporate Fisheries Economics into their courses owing to the lack of readily accessible material. Students were thus failing to recognize the global importance of fisheries as an economic resource capable of generating substantial wealth and income to many countries.

It is hoped that this book will meet some of these needs. It will also help to introduce development economists to some of the problems of developing fisheries in areas of the world where fisheries now present great growth prospects. The case studies used in this book are nearly entirely drawn from developing countries.

There already exists a large and growing literature on fisheries economics. With the exception of a few excellent but rather specialized textbooks, however, much of the literature is highly dispersed—some of it remote, some almost forgotten. I have tried to draw from a wide field and it is likely that some references may be out of print though nevertheless obtainable from libraries, particularly the excellent library of FAO Fisheries Department, or the original source. For the three chapters on theory, I have drawn from the work of Anderson (1977, 1980), Rettig and Ginter (1978) and Gulland (1971, 1974, 1977, 1980, 1983). Anderson's book, *The Economics*

of *Fisheries Management* and Rettig and Ginter's *Limited Entry as a Fishery Management Tool* contain many pages of listed references. Gulland's works to which I have referred appear as publications of the Fisheries Department, FAO, Rome, and open the way to a rich labyrinth of texts on fisheries, available from the FAO fisheries library.

The first chapter is concerned with analysing and interpreting fisheries statistics published annually as the *Yearbook of Fishery Statistics* by FAO. Chapter 8 deals with the methodology of project preparation, appraisal and evaluation and is derived in part from the work of Campleman (1976) and Engström (1974), both of which are FAO publications. The remaining four chapters are partly based on my own writing and experience but also use material drawn from a wide range of sources, in particular from the various regional offices and research and development projects of FAO Fisheries. These are notably publications of the Committee for the East Central Atlantic Fisheries (based in Dakar); the Bay of Bengal Programme (based in Madras); the marketing organization 'Infish' (based in Kuala Lumpur) and its publication; the South China Sea Development and Co-ordinating Programme (based in Manila); the Indo-Pacific Fisheries Council (based in Bangkok). I have also drawn from the excellent publications of the International Center for Living Aquatic Resources Management (ICLARM) based in Manila and the quarterly journal, *Marine Policy*.

It has been no easy task to put together a small book covering such a wide number of sources on fisheries economics. Each of the chapter titles and indeed some of the subtitles presented here could on their own form the title of a book. Much has had to be grossly abbreviated and summarized and some topics only very briefly mentioned and I am very much aware of the shortcomings which arise from this. However, I have tried to give a reasonable balance in covering the major issues which involve fisheries development, in particular as they concern developing countries, and I hope the list of references to other writing will provide a source of supportive material.

Having spent most of my working life living and employed in developing countries, I would like to thank the very many people, in various parts of the world who, over the years, have helped to give me some insight into the problems of fisheries development. In the United Kingdom, Dr Dennis Hall, previously Principal Fisheries Adviser, Overseas Development Administration, has frequently given me supportive criticism for which I am grateful. Some of my colleagues have very kindly given me advice on parts of the text of this

book. In particular I would like to thank Mr M. A. Robinson, Senior Fisheries Economist, FAO, for his careful reading of Chapter 1, Mr C. Newton, also a Senior Fisheries Economist, FAO, for the very helpful suggestions he made for improving Chapters 2 and 3. Mr D. Simon, Department of Accounting, University of Hull, read Chapter 8 and has made some useful comments for which I am grateful. I would like to thank Dr K. Haywood of the Centre of Fisheries Studies, Hull, who kindly read Chapter 7, and in addition Miss Pauline Godkin, also of the Centre, for drawing the diagrams. Many typists patiently battled with my awful handwriting and I would specially like to thank Mrs Jean Willis and Mrs Carole Barrowclough.

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1 Overview of the state of world fisheries

INTRODUCTION

This chapter attempts to put the subject of fisheries in a global context so that its importance in terms of its earnings, the employment and trade it generates, and its contribution to nutrition requirements may be assessed. These data form the basis of discussions in later chapters on fisheries development.

The major source of statistical data on world fisheries are the two volumes of fishery statistics published annually by FAO, covering catches and landings, and fishery commodities. Data on world catches extracted from these publications are given in Table 1.1. The sources of data used in these publications are provided by each of the 218 countries covered by the statistics, and national data cover all nominal catches caught by fishing vessels flying the flag of the country and landed both in domestic ports and foreign ports. Data for each country do not include landings in that country by foreign fishing vessels. One important fishing country omitted from the statistics is Taiwan Province, which has been excluded from data for China. This represents a serious lack because of Taiwan's considerable distant-water fleet and its substantial fish exports.

Table 1 World total catches* (in million tonnes)

	1976	1978	1980	1982
World total†	69.3	70.2	72.3	76.7
Catches in inland waters	6.9	7.0	7.6	8.5
Catches in marine areas	62.4	63.2	64.7	68.2

* Nominal catch = Live weight equivalent of landings (net weight (live) of the quantities as recorded at the time of landings, includes whole or eviscerated fish, fillets, livers, roes, etc.), i.e. fish as it comes out of the sea.

† Total world catch excludes whales, seals, other aquatic mammals and aquatic plants.

Sources: FAO (1982), *Yearbook of Fishery Statistics*, Table A-1 (a). (Note: figures for any given year may vary slightly in different Yearbooks due to updating and revision.) Definitions are taken from the *Yearbook of Fishery Statistics*, 1980, Vol. 50, p. 3.

The term 'nominal catch' refers to the live weight equivalent of landings in tonnes (metric tons) i.e landings which may be variously described as on a round, fresh basis, on a whole basis or on an ex-water basis, with the exception of whales and seals which are given in numbers. Live weight equivalents of fish which are processed at sea, for example by gutting or reduction to fish meal or oil in factory ships, are established by applying conversion factors based on accurate yield rates.

The data cover all species of fish (except the very minor ones) listed in the FAO Yearbooks and include freshwater, brackish water and marine species of fish plus crustaceans, molluscs and other aquatic animals and plants, but exclude fish caught for recreational purposes only. Eight hundred 'species items' of aquatic animals and plants are named and recorded separately. This covers some 88 per cent of the total nominal catch. Catch data refer to calendar years. There are a few minor modifications to national data in some countries and users of the statistics who want highly accurate national data should refer to the notes on individual countries given before Table A in the Yearbook.

REGIONAL DISPERSION OF WORLD FISHERIES

The 218 reporting countries are divided into twenty-seven fishing areas which are shown on the map in Figure 1.1. The largest is the Eastern Central Pacific with 15.9 per cent of total area and the smallest is the Mediterranean and Black Sea with 0.8 per cent of total area. Many of these areas are supported by international bodies dealing variously with management, statistics and other fishery matters.

There are altogether twenty-four major international fishery organizations inside and outside FAO. Nine are regional organizations operating within the framework of FAO, of which three concern inland fisheries, and fifteen were established by international convention. All are listed in Appendix 1 where their membership and functions are described. Of those established by international convention, six are concerned with the management and control of specific stocks, notably tuna, halibut and salmon, and nine are concerned with specific fishing regions.

Of the FAO regional organizations, the ones with the largest membership are CECAF (the Fishery Committee for the Eastern Central Atlantic), and the IOFC (the Indian Ocean Fishery Commission), each with thirty or more member states, including a few non-coastal countries. The functions of the FAO regional organizations are very broadly similar, though some are more active and

effective than others. One of the most successful organizations is CECAF with headquarters in Dakar and whose terms of reference are given in Appendix 2.

The total world catch for 1982 was 76.7 million tonnes compared to 66.06 million tonnes eleven years earlier and 40.2 million tonnes in 1960. From 1971 to 1980 there were some minor fluctuations but the growth over the period is 9.3 per cent, equivalent to just less than an average of 1 per cent per annum. This rate of growth is far lower than the annual rate of population growth, which for example in 1970-7 was 2.3 per cent in low-income countries and 2.6 per cent in middle-income countries. Growth of world fisheries catch was highest in the period 1960-70, growing at an average of 5.8 per cent per annum, some of this emanating from the growth of fisheries in developing countries particularly Peru and South Korea. Growth in catch occurred in the USSR and other centrally planned countries of Eastern Europe and there was considerable growth in the Japanese catch, although most other developed countries showed little change. The overall growth rate of world catch has declined drastically since 1970. The fastest increase has emanated from inland fisheries which increased from 6.38 million tonnes in 1971 to 8.5 million tonnes in 1982, a growth rate over the period of 33 per cent or almost 3 per cent per annum. But this rate increased in 1980 and 1981 to 4.1 per cent and 6.1 per cent. Marine fisheries, however, grew by only 8 per cent over the period, from 59.6 million tonnes in 1971 to 68.2 million tonnes in 1982, or an average of 1.4 per cent per annum. Aquaculture and inland fisheries have grown rapidly since 1971 and it is likely that this rate of increase will continue as aquaculture is expanded, especially in developing countries, and fishing becomes increasingly a farming activity. The main reason for the slowing down of growth in marine fisheries is the limits set by the resource. The state of exploitation of major resources shows quite clearly that many fish stocks are fully exploited. Nominal catches by oceans are given in Table 1.2, which shows that not very much change occurred in the disposition of catches between oceans over the period.

Table 1.2 Nominal catches in marine areas by ocean (in million tonnes)

	1976	1978	1980	1982
Atlantic Ocean	26.6	25.4	25.0	24.7
Indian Ocean	3.1	3.5	3.5	3.6
Pacific Ocean	32.7	34.9	35.6	39.3
Southern Ocean	—	0.4	0.6	0.6

Source: FAO (1982), Yearbook of Fishery Statistics.

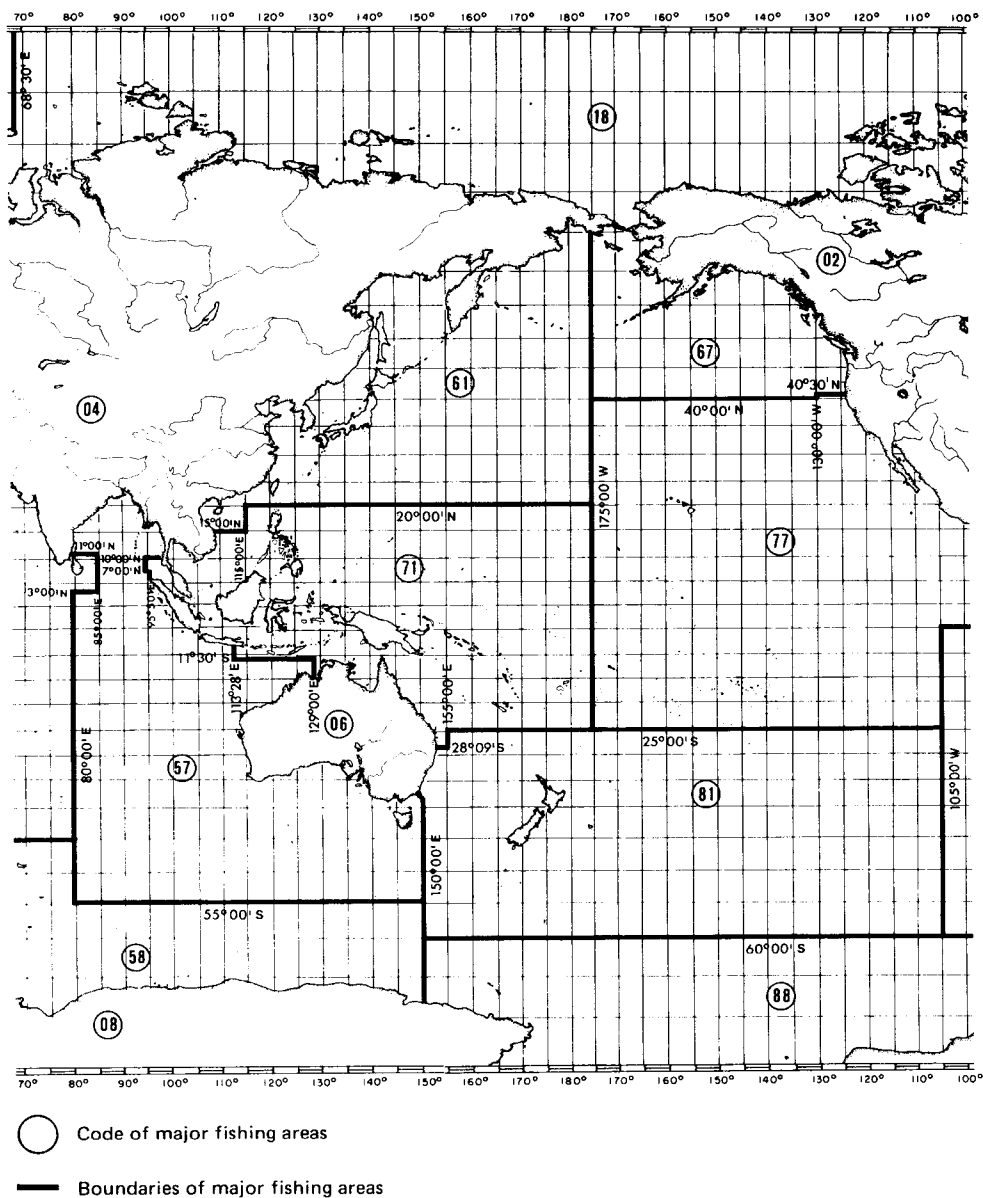
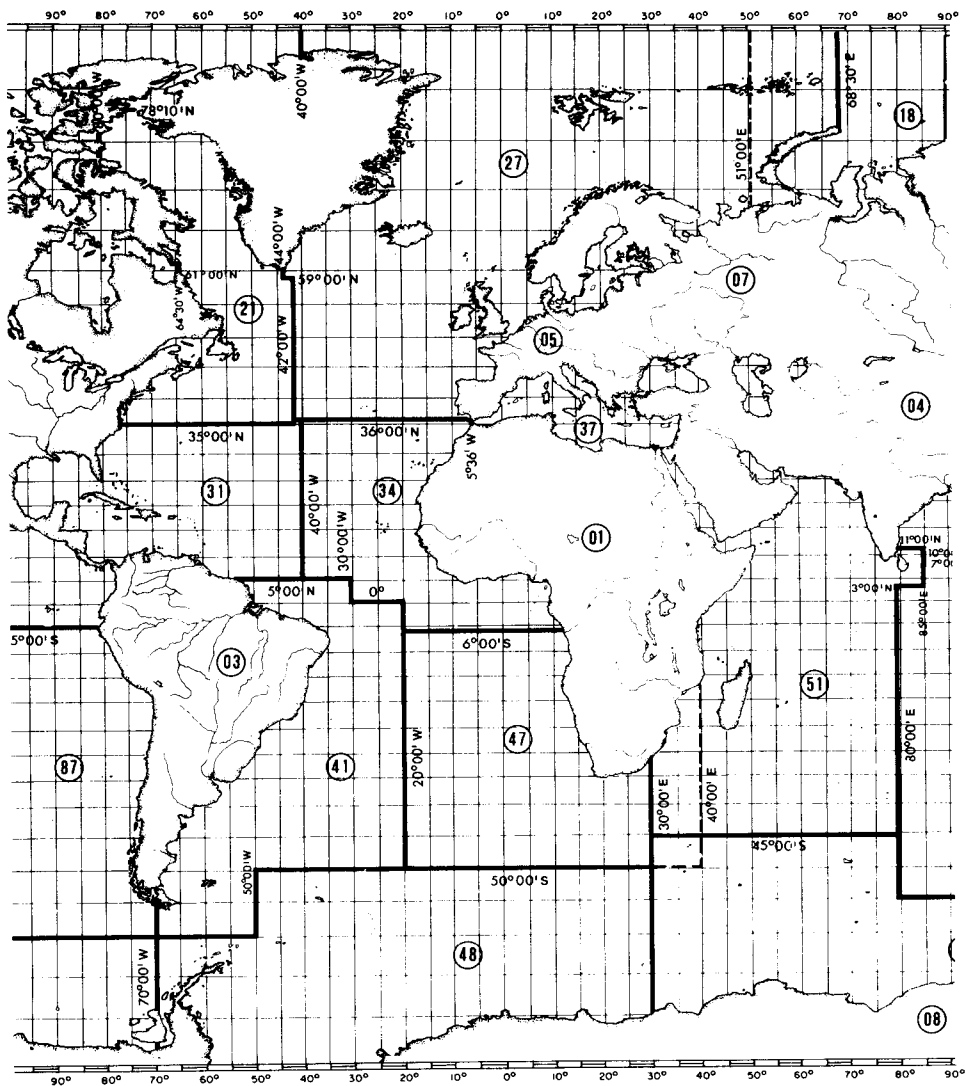


Figure 1.1 World map showing twenty-seven fishing areas.

Source: FAO (1982), Yearbook of Fishery Statistics.



The two major fishing nations are first, Japan and second, USSR, catching between them 27 per cent of total world landings. The ten major producers, which together landed nearly 60 per cent of total catch, given in Table 1.3, are in order of ranking.

The most noteworthy changes in nominal catches over the past ten years are:

- (1) the USSR catch rose by 38 per cent between 1971 and 1976 to 10.13 million tonnes when it was the world's highest;
- (2) both Chinese and United States' landings have steadily increased by 26 per cent over the ten years 1971-80;
- (3) Chilean landings rose rapidly from 1978 and in 1980 were 88 per cent above 1971 levels;
- (4) Peru suffered a drastic fall in landings after 1970-1 following the depletion of stocks of anchoveta. In 1970 Peru was the world's leading fishing nation with landings of 12.5 million tonnes but its 1980 catch fell to 1.5 million tonnes.

Table 1.3 Ten major fish producers, 1982

Rank	Country	Catch (million tonnes)	% of total world catch
1	Japan	10.77	14.0
2	USSR	9.95	12.9
3	China	4.92	6.4
4	USA	3.98	5.2
5	Chile	2.81	4.7
6	Peru	2.73	4.5
7	Norway	2.49	3.2
8	India	2.33	3.0
9	Republic of Korea	2.09	2.9
10	Denmark	2.02	2.6

Other substantial changes between 1970 and 1981 in order of ranking of nominal catches of each country are as follows:

- Norway's landings fell by 20 per cent;
- Indian landings increased by 30 per cent;
- the Republic of Korea's landings showed a spectacular increase of nearly threefold by 1980;
- Denmark's increase was fairly steady at 44 per cent over the whole period;

- other noteworthy changes are those of Mexico—an increase of 212 per cent; Malaysia—100 per cent increase; Senegal—60 per cent increase; Argentina—90 per cent increase; Portugal—a 40 per cent fall.

Increases in nominal catches have originated in both developed and developing countries as shown in Table 1.4. By 1982 developing countries provided 49 per cent of the world catch. Of these the leading countries are China, Chile, Peru, India and the Republic of Korea. The developing countries also lead in nominal catch from inland waters, with China first at 1.24 million tonnes and then, in descending order, India, Indonesia, Philippines and Uganda, followed by the USSR with 0.74 million tonnes.

Table 1.4 Nominal catches by economic classes (in million tonnes)

	1976	1978	1980	1982	Population (1981 millions)
Developed countries	38.4	37.2	38.2	39.1	1178
Developing countries	30.0	32.0	33.0	36.1	3335
Others	0.9	1.0	1.1	1.0	
Total	69.3	70.2	72.3	76.7	4513

Source: FAO (1982), *Yearbook of Fishery Statistics*. Population data from Population Division of the UN.

The particular changes in production by regional and economic groups, differentiating developed from developing countries, are illustrated in Figure 1.2. The most impressive growth in the developing countries has been the steady increase of production in Asian countries. The dramatic fall in Latin America after 1970 is due to the disappearance of anchoveta off Peru. In contrast production in Africa and the Near East has changed little. In the developed countries there have been fluctuations over the period, only North America showing a trend to growth.

The disposition of catch into different methods of preparation and use is given in Tables 1.5 and 1.6. Of the total world catch, about 70 per cent is used for human consumption and the remainder is mostly reduced for fish meal or fertilizers. The majority of fish used for human consumption is frozen first, though almost as much is sold fresh. The proportion cured and canned has remained fairly stable. Curing includes fish dried, salted or in brine, or smoked. In Tables 1.5 and 1.6 the item 'reduction' includes fish used for the extraction of oil and fish meal.

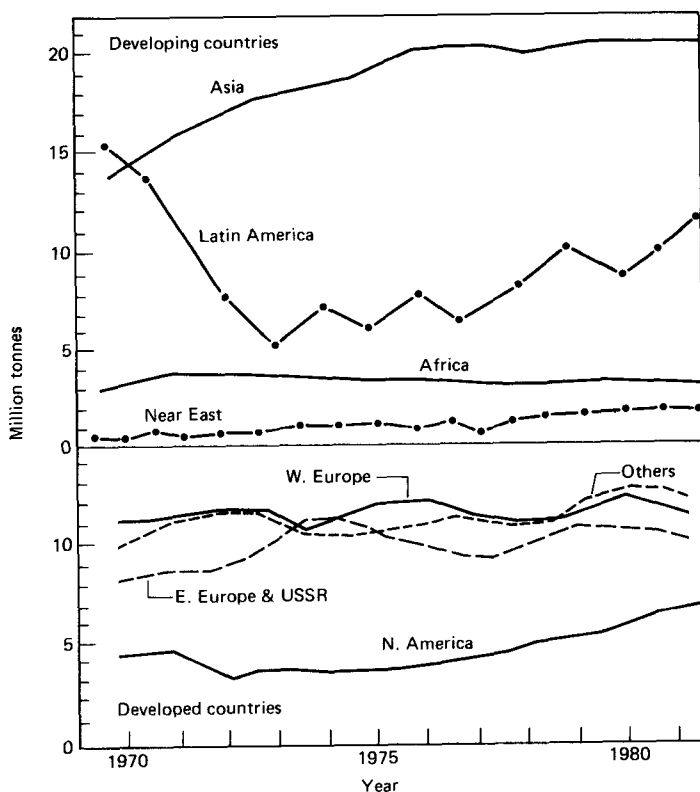


Figure 1.2 World fish production by economic groups of countries. *Source:* FAO (1983), *Fisheries Circular*, 760.

The disposition, by percentage of total, has remained fairly constant over the last seven years. However, over the last thirty years changes have been substantial. The most striking trend has been the change to high fuel-consuming capital-intensive processing, in particular the spectacular growth of freezing for the consumer market. The full effect of this on energy consumption is not, however, shown since the sale and distribution of fish involves further freezing capacity in onshore storage, transport, wholesaling and retailing and in the home. Fishing vessels have had to go further from home port to secure catches and this has necessitated freezing on board. Frozen fish is imported both by developed and developing countries and does not necessarily provide for a high-income demand. The growth of frozen fish is part of the great change in consumer demand in the last thirty years.

Table 1.5 Disposition of world catches (in million tonnes)

	1978	1980	1982
<i>For human consumption</i>	<i>48.9</i>	<i>50.4</i>	<i>53.2</i>
Marketing fresh	14.7	14.3	15.2
Freezing	14.2	15.1	17.0
Curing	10.1	10.8	11.0
Canning	9.9	10.2	10.0
<i>For other purposes</i>	<i>21.3</i>	<i>21.9</i>	<i>23.5</i>
Reduction	20.6	21.2	22.8
Other	0.7	0.7	0.7
<i>Total world catch</i>	<i>70.2</i>	<i>72.3</i>	<i>76.7</i>

Source: FAO (1982), *Yearbook of Fishery Statistics*.

Table 1.6 Disposition of world catches (percentages)

	1978	1980	1982
Total world catch (in million tonnes)	(70.2)	(72.3)	(76.7)
<i>Human consumption</i>	<i>69.6</i>	<i>69.7</i>	<i>69.3</i>
Marketing fresh	20.9	19.7	19.8
Freezing	20.2	20.9	22.2
Curing	14.4	15.0	14.3
Canning	14.1	14.1	13.0
<i>Other purposes</i>	<i>30.4</i>	<i>30.3</i>	<i>30.7</i>
Reduction	29.4	29.3	29.7
Miscellaneous	1.0	1.0	1.0

Source: FAO (1982), *Yearbook of Fishery Statistics*.

FISHERIES GROWTH

There can be dramatic changes from year to year in individual fish stocks and the list of major landings in off-shore waters given in Table 1.7 is for 1980. An example of changes in fish stocks is the sudden collapse of the Peruvian anchoveta fishery in the early 1970s. Many herring stocks in the North Atlantic also collapsed dramatically in the late 1970s. However, certain stocks have undergone rapid