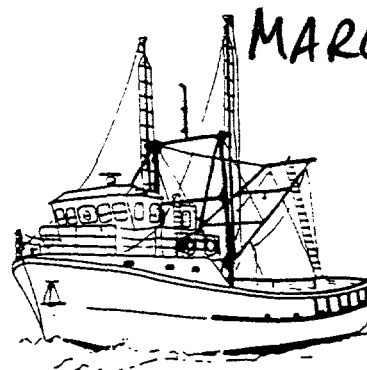


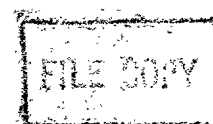
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# A Strategy for Fisheries Development



Eduardo A. Loayza  
in collaboration with  
Lucian M. Sprague

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# A Strategy for Fisheries Development

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Eduardo A. Loayza  
in collaboration with  
Lucian M. Sprague

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Washington, D.C.

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## Abstract

This paper proposes a strategy for fisheries development, aimed primarily at the World Bank Group but it is also believed to have relevance to all development institutions concerned with fisheries development. The paper was developed from an extensive review and analysis of the current trends and worldwide status of the fishery sector and its relationship with other economic and social sectors, giving ample consideration to the lessons learned from past experience.

The authors propose a development strategy built on four institutional elements and a number of avenues in which sectoral prospects may be influenced in positive directions to further development. The institutional elements are: interagency coordination, sector studies, fisheries research, and private sector development. The sectoral aspects are: improving resource management, managing the environment, developing human resources, particularly recognizing the role of women in development, developing aquaculture, developing artisanal and inland water fisheries, and developing and restructuring semi-industrial and industrial fisheries primarily through the private sector.

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## Foreword

A marked change in the worldwide prospects for fisheries development has occurred in the last two decades. Among the reasons for this were the increases in global oil prices, growing constraints on fisheries resources, a great increase in the number of international joint ventures for harvesting and marketing, the development of commercial aquaculture for high value species and the deleterious impact a shortage of foreign currencies had on the fishing industry in many developing countries.

The fisheries sector is unique and important in the role it could play in the economic and social development of many developing countries, but the experience with development in the sector has been disappointing. There are many economic, social and environmental benefits to be reaped from improvements in the way in which fisheries development is carried out.

Proposals for a change in the strategy employed for fisheries development are timely since even if change were not sought, it would soon be forced upon us.

The main proposals made in this paper are greater cooperation among donor agencies and between development agencies, the implementation of aid coordinating mechanisms in the fisheries sector, a greater use of sector studies to develop blueprints for effective country actions for fisheries development, increased attention to fisheries research, and a greater involvement of the private sector in fisheries development. They certainly seem to be essential for the sector to significantly contribute to overall economic and social development.

Because of its diversified lending operations, geographic coverage, interdisciplinary approach, contribution to development policy, role in aid coordination, commitment to private sector development, through its various arms (IBRD, IDA, IFC, MIGA), the Bank Group is ideally suited to play a strategic global role in the sector.



Michel Petit

Director

Agriculture and Rural Development Department



## Acronyms

AfDB	African Development Bank
AMRO	Amsterdam Rotterdam Bank
CEC	Commission of the European Communities
COFI	Committee on Fisheries, of the FAO
CGIAR	Consultative Group for International Agricultural Research
DANIDA	Danish International Development Agency
EEZ	Exclusive Economic Zone
MN	Middle East and North Africa Region of the World Bank
FAD	Fish Aggregating Device
FAO	Food and Agriculture Organization of the United Nations
FFDDC	First Fisheries Development Donors Consultation
FDDC	Fisheries Development Donors Consultation
FJS	Fisheries Judicial System of a Fisheries Management Regime
FMR	Fisheries Management Regime
FMS	Fisheries Management System of a Fisheries Management Regime
FPC	Fish Protein Concentrate
GIS	Geographic Information System
IBRD	International Bank for Reconstruction and Development, of the World Bank Group
ICLARM	International Center for Living Aquatic Resources Management
ICMRD	International Center for Marine Resource Development of the University of <del>the</del>
Island	
IDA	International Development Agency of the World Bank Group
IDF	Industrial Development and Finance, Development Lending Sector of the World Bank Group
IFC	International Finance Corporation of the World Bank Group
IUCN	International Union for the Conservation of Nature and Natural Resources
MCS	Monitoring Control and Surveillance of a Fisheries Management Regime
MIGA	Multilateral Investment Guarantee Agency of the World Bank Group
MSY	Maximum Sustainable Yield
NGO	Non Governmental Organization
ODA	Overseas Development Agency of the United Kingdom
OECS	Organization of Eastern Caribbean States
OED	Operations Evaluation Department of the IBRD/IDA
SIDA	Swedish International Development Authority
SIFR	Study of International Fisheries Research
TOGA	Tropical Ocean and Global Atmospheric Programme
UNDP	United Nations Development Programme
WBG	World Bank Group, IBRD, IDA, IFC, MIGA
WB	World Bank (IBRD, IDA) of the World Bank Group
WCRP	World Climate Research Programme
WFP	World Food Programme

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# EXECUTIVE SUMMARY

## Background

Fish is the largest single source of animal protein and the fastest growing food commodity entering international trade. Fisheries provide employment to over a 100 million people, most of whom are poor. Fish, and shellfish are the main source of animal protein for more than a billion people. Dietary patterns involving fish and fish products are the least influenced by religious principles, and recent research shows that beneficial reduction of cardiovascular and other diseases can be achieved by the regular inclusion of fish in the diet.

During the last two decades, a number of events have influenced the fisheries sector; many of them are sufficiently important, to warrant substantial changes in the way development in the sector should be approached. Notable among these events were:

- the oil crisis of the seventies with its crippling effect on global fishing fleets, which had the effect of bringing about both many bankruptcies and attempts to improve fuel efficiency;
- a virtual halt in both the large and small scale fisheries in many developing countries, due to mounting external debt and chronic shortages of hard currency, resulting in shortages of spare parts and other essential imports which became either unavailable or prohibitively expensive;
- a new accountability for resources management to coastal states as the Law

of the Sea mandated a 200 mile extended jurisdiction;

- the doubling of both marine catches (40 to 84 million tons/yr, 1988) and the gross registered tonnage of the world's fishing fleet (5 to 10 million gross ton., 1988)
- a proliferation of licensing agreements and joint ventures between foreign fleets and developing coastal states;
- serious overfishing of many commercial species as a result of free and open access, unsatisfactory property rights, and poor resources management;
- the devastating effect of the 1982/83 El Niño phenomenon, which increased the awareness of the role of the oceans on global climate variability and the environment; and
- major growth in aquaculture led by the private sector in response to a gap in fish supplies, particularly of high value species.

## Main Issues

The most important characteristic of fisheries is the common property problem embodying open and free access to the resources and the almost universal absence of defined property rights. Therefore, a large number of traditional fishing grounds, particularly in coastal waters, are being over-exploited as a result of open access, technological developments in harvesting, and increasing demand and prices of fisheries products.

Most of the world's highest-value fisheries are located in coastal waters, leading in many instances to conflicts, sometimes violent, between artisanal and semi-industrial fishermen. Delimiting fishing grounds and enforcing regulations is difficult and costly; new approaches and strategies are badly needed.

Since fish have no political boundaries, effective fisheries management must address local, national, international, technical, economic and political complexities. Regional cooperation is a necessary challenge for some coastal states and development programs.

Large foreign fleets operate off the coast of developing nations under licensing and other agreements. Most less developed countries lack the means to manage these fleets and many are not receiving an equitable share of the catch value.

Population growth, socio-economic development and pollution place a heavy burden on coastal areas, often resulting in depletion of natural resources and environmental degradation. The implementation of planning and integrated management of resource use and allocation programs should be accelerated.

Some 30,000 to 40,000 miles of drift nets pose a major threat to living resources in the oceans. Many of these nets are lost or abandoned. As they subsequently trap and kill almost anything that swims into them, be it fish or mammal, they constitute a unique and deadly form of pollution. There is an urgent need to accelerate international action started at the level of the United Nations and strongly recommended at the 1991 FAO/COFI meetings.

Post harvest losses from artisanal fisheries and discards of incidental catches from industrial single-species fisheries amount to tens of millions of tons per year. Additionally, lack of market and technological research is hampering the development of food-fish products from species used for fish meal which represent about one third of total world catches. A mix of market research, improved technology, and informed policies could lead to increased supplies at a much faster pace than that for any other food commodity.

Culture fisheries are part of the long term alternative to the limited supplies from **wild-stocks**. However, substantial differences in the level of aquaculture development exist among continents, regions and even countries. Globally there is an urgent need for research, training and extension if aquaculture is to make its expected contribution to the gap in food-fish supplies.

### **Bank Experience With Fishery Lending**

The Bank has been financing fisheries projects for the last three decades; lending has amounted to US\$0.6 billion for total projects costs of US\$1.6 billion. With some exceptions, however, the results have not been satisfactory.

Lack of knowledge of the fisheries sector induced financial institutions to transplant principles from agriculture and rural development to fisheries. Lack of (a) sector studies, (b) well designed strategies and (c) action plans led to ad-hoc financing of fishery projects. The institutional weaknesses of executing agencies in beneficiary countries contributed to delayed implementation and poor overall performance of many ill-conceived projects.

Fisheries development experienced a slow learning curve in its approach to development as there was no historical basis for it. This led to many project failures, contributing to a poor but believed to be wrong image of the sector.

In 1982 the Bank published a Fishery Sector Policy Paper in an effort to halt the *ad-hoc* approach to the sector's development and to establish a course of action. The paper strongly supported small-scale fisheries and downplayed the role of industrial and semi-industrial activities. The Policy adopted a neutral stance by stating that "...the Bank stood ready to provide assistance when interest in such development existed."

World fisheries are changing at a faster pace than the Policy, drawn up in 1982, could envision, and a number of operational questions do not find appropriate answers in the current sector policies.

### **Key Elements of the Strategy for Development**

An analysis of the present state of world fisheries and lessons learned by the Bank and donor community have led to a reassessment of current policies and strategies. A revised strategy is needed and proposed, taking into account the need for social progress in the sector, environmental enhancement, food production and economic development.

The proposed strategy rests upon the following four elements:

- Interagency cooperation -- an essential element for further progress;
- Sector studies -- needed to reach an understanding of the problems and for

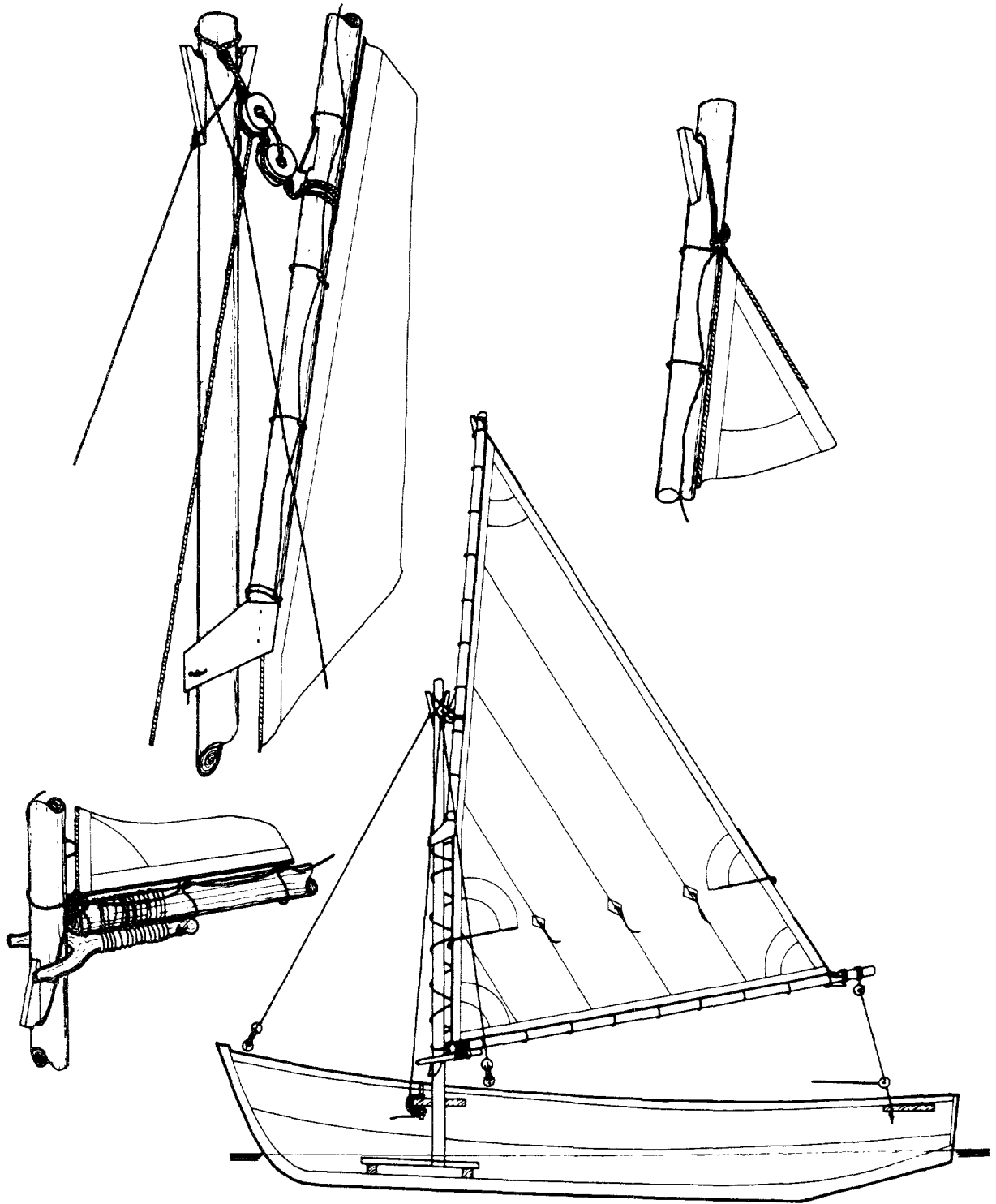
designing rational strategies and action plans;

- Fisheries research -- required to fill the gaps in the knowledge base needed to achieve development; and
- Private sector development -- crucial to mobilize individual initiative and creativity.

Within this framework, discussion sections of sector specific strategies are proposed, encompassing:

- Improving Resources Management;
- Managing the Environment;
- Developing Human Resources, with particular emphasis on the role of women;
- Developing Aquaculture;
- Developing Artisanal and Inland Water Fisheries; and
- Developing and Restructuring Industrial Fisheries, primarily through the private sector.

The implications for Bank Group operations in the sector are also discussed, including: an indicative outline of regional and project operational potentials in the sector, other opportunities for specific Bank Group involvement, and an outline of how a sustained effort of the Bank in concert with the donor community can help developing nations benefit from fisheries development.



*Fishing boat with sail*

# INTRODUCTION

Bound for the moon,  
the earth resembles  
"A BIG BLUE MARBLE"

WDCA TV

## Purpose

The purpose of this paper is to propose a strategy for the improvement of fisheries in the developing countries as an instrument of overall economic development. The World Bank (WB)<sup>1</sup> and the donor community have been involved in fisheries development projects for many years, and both have had a range of successes and failures. It is because of the rapidly changing circumstances in the fisheries sector and these lessons of experience that a new strategy is proposed.

The proposed strategy was developed primarily from an extensive analysis and review of the current trends and worldwide status of the fishery sector and its relationship with other economic and social sectors, giving due consideration to the lessons learned from past experience.

The paper has been written for fisheries and non-fisheries professionals alike to help them better understand the opportunities and constraints of fisheries development and to evaluate the sector's potential relevance to their particular area of concern.

The paper also seeks to highlight the opportunities for further Bank Group involvement in the sector and to show how a coordinated effort with the donor community can help developing nations benefit from

harvesting the aquatic environment. Such an approach is timely because the sector is at a seminal and critical moment.

## The Oceans

As seen from outer space, the blue and white earth reminds us that seven tenths of our planet is water and, in the words of astronaut William A. Anders, of its resemblance to a "Christmas tree ornament, how fragile it is."

Three billion years ago, the earth's atmosphere had no oxygen and although the sun was 25% dimmer than it is today, a blanket of carbon dioxide, 200 times denser than modern levels, kept the surface of our planet at tropical temperatures. Single-cell organisms thrived in the primordial oceans, living from the energy obtained from sulfur given off by volcanic action. This early "greenhouse" was brought to a halt by organisms which began to utilize carbon dioxide and produce oxygen as a by-product.

Presently, through phytoplankton photosynthesis, the oceans contribute about 50% of the earth's oxygen and the oceans absorb nearly half the carbon dioxide released by human activity. We do not know what future role the oceans may play in absorbing increases in atmospheric carbon dioxide.



## World Fisheries Harvests and the Oceans

Today the role of the world oceans in providing fishery products for food and other purposes is an important one. The harvesting, processing and marketing of these resources is a source of income for over 100 million people, about 80% of whom are in the low income or poverty group. Fish represent the primary source of animal protein for over 1 billion people. And of the animal protein foods, it is the least influenced by religious principles. Recent medical research shows that its regular inclusion in the diet may help prevent cardiovascular diseases and other health disorders.<sup>2</sup>

In 1950 total world fish production was about 20 million tons, In 1990 the world harvest of fish and aquatic products from marine and inland waters, including aquaculture, is estimated to be about 100 million tons.<sup>3</sup> About 50% of production came from developing countries, a figure which has remained more or less constant for over 20 years.

Fish (for direct human consumption) are the world's largest single source of animal protein. In 1988 fish for consumption (69.6 million tons) exceeded that of beef (47.7 million tons), pork (59.0 million tons), sheep (8.0 million tons), poultry (31.4 million tons), milk (15 million tons, [protein equivalent]) and eggs (30.5 million tons).<sup>4</sup> These data are illustrated in Figure 1.

Six countries, three developed and three developing, predominate in the catch statistics of world fisheries as shown in Figure 2.

The importance of fishery commodities traded in international markets is increasing. More than one third of the world's fish

production enters international trade, the highest proportion of any basic food commodity. In 1989, total world fish exports amounted to about US\$32 billion, of which an estimated US\$10.5 billion in net foreign exchange earnings went to developing countries.<sup>5</sup>

In many developing countries, fisheries are the primary source of foreign exchange. For example, in the Asian-Pacific region, shrimp exports generate more foreign currency (US\$2.7 billion) than the exports of cocoa or rubber. Table 1 shows data on the increase in indicative production from 1975 to 1988 of cultured shrimp.<sup>6</sup>

The exports of shrimp from shrimp farming operations are particularly important but, export data does not distinguish between ocean caught and farmed shrimp.

Despite the importance of fisheries in world markets and to the economies of industrial and developing countries, fish production is still basically a hunting and gathering activity. Only recently has aquaculture (fish farming) become a small but significant factor in fish production.

## Historical Rates of Growth in Fisheries Harvest

The ability to increase fish harvests is limited by the natural productivity of the environment and the fish stock, and not just the level of effort applied to it. As a result, although world fish harvests have steadily increased, as shown in Figure 3, the rate of increase has fluctuated from about 6.5% per year in the period 1950 - 1970 to less than

Table 1

Indicative Estimates of Shrimp Farming Production and Projections, from Asia and Latin America between about 1980 and 1988, Estimates in Whole Shrimp

	1980	1988
Country	Metric Tons	Metric Tons
China	14,000	180,000
Indonesia	9,000	70,000
Ecuador	25,000	70,000
Thailand	11,000	45,000
Philippines	5,000	45,000
Taiwan (Province)	15,000	45,000
Vietnam	5,000	25,000
India	14,000	24,000
Bangladesh	7,000	18,000
Central America (Region)	2,000	13,000
Malacia	- -	3,000
Other	5,000	22,000
TOTAL	112,000	560,000

Source: 1980 estimates: U.S. National Marine Fisheries Service, World Bank Staff;  
1988 estimates: World Bank.<sup>6</sup>

1% per year in the period 1970 - 1980. Global percentages, however, mask substantial yearly variations in a number of species as shown in Figure 4.<sup>7</sup>

According to the Food and Agriculture Organization (FAO), aquaculture production of all types (**marine, and inland including fish, shellfish, and plants**) grew 46.39% in the period 1984 - 1988, with much of the increase in the form of high-value species for export.<sup>7, 8</sup> About 80% of the total is used for direct human consumption. At current levels, total value is estimated by FAO to be about US\$22.5 billion.<sup>8</sup> (See also Section Developing Aquaculture.)

Production of fish, crustaceans, and mollusks from inland waters **including wild stocks and aquaculture production** for 1988 was 13.4 million tons; production from Asia is almost 70% of the total, as shown in Figure 5.<sup>9</sup>

### **Open Access, Common Property, Fisheries Management and Fish Stocks**

World fisheries are at a crucial and historic turning point as catches approach what are believed to be the upper limits of sustainable harvests for the majority of commercial food fish species.

The sustained increase in the worldwide demand for fish as food and for industrial purposes and the commensurate rise in prices have increasingly encouraged the entry of more fishing vessels with more sophisticated catching technology into traditional, as well as new, fishing grounds. The result has been that the current harvesting capacity of the

world's fleet far exceeds the estimated biological sustainability of most commercial fish species.

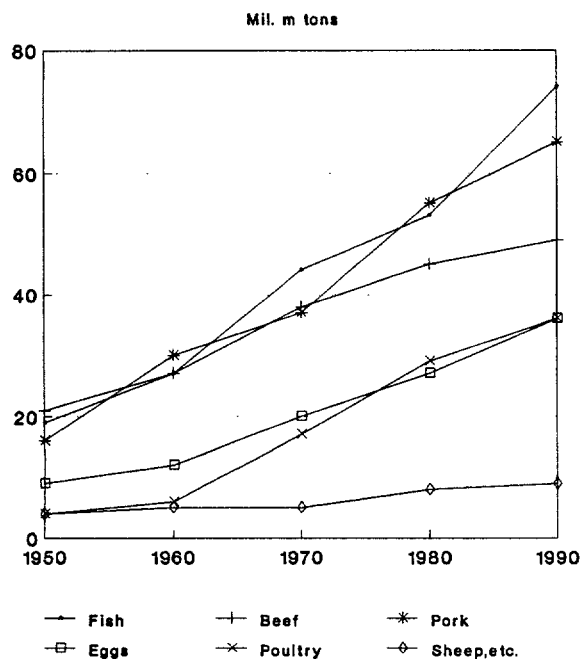
According to FAO, "Fishery resources around the world are closer now to their maximum catch limits and many show signs of biological degradation and economic waste."<sup>10</sup>

Such a situation has resulted from "the tragedy of the commons" with free and open access to fishing grounds -- the general rule -- and a lack of solutions to problems of allocation.<sup>11</sup> A fishery-by-fishery, species-by-species review of the major stocks of world fisheries is not appropriate here, but Table 2 presents some selected rough data to provide a flavor of the nature of estimates of the present degree to which fisheries resources are harvested or over-harvested.

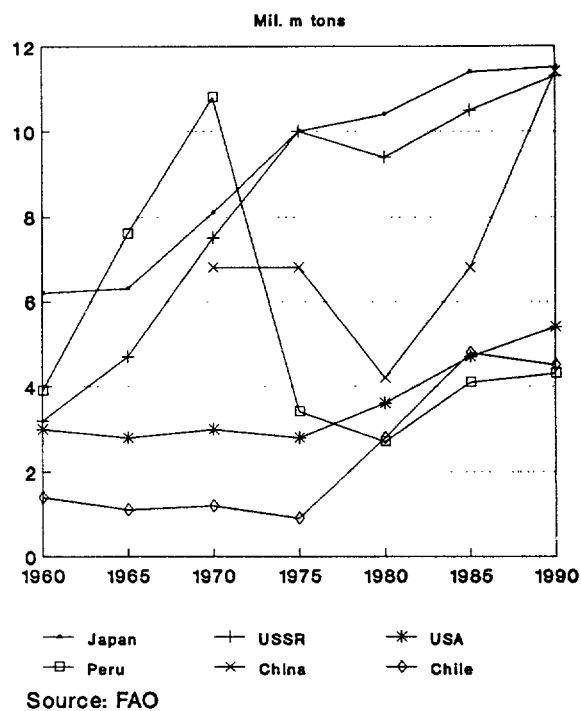
Understanding the nature of fisheries stocks, particularly those in the tropical oceans, and forecasting and managing them awaits a far keener understanding of the dynamic process involved than is now available. A dilemma arises when it is clear that measures to ameliorate some of the most severe problems cannot wait until this data and understanding is available.

Most fisheries management concepts rest on the ability to reasonably forecast the stock size of, and recruitment to, any given fishery. Most stock and recruitment models have been developed for temperate water species (cod, herring, etc.) where the major characteristic is that the fishery is overwhelmingly for a single species. The situation in tropical fisheries is diametrically different (some exceptions occur because of

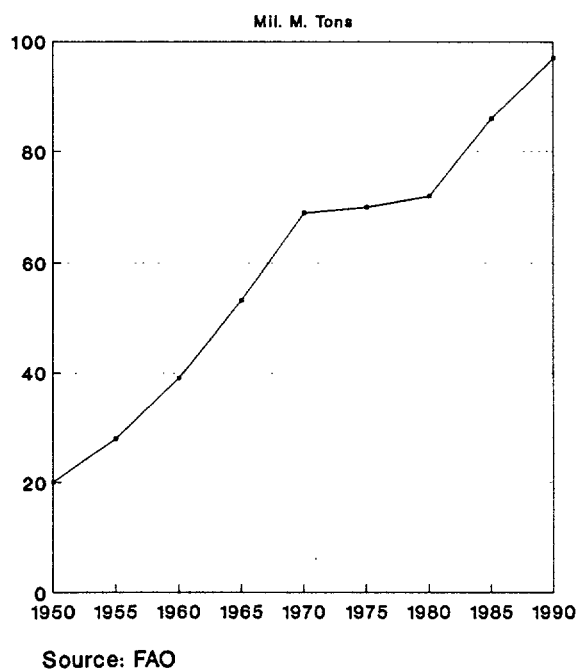
**Figure 1**  
**Production Protein Foods**  
(direct human consumption)



**Figure 2**  
**Selected Catch Data**



**Figure 3**  
**World Catch**  
Fish, Crustaceans, Molluscs



**Figure 4**  
**World Catch of Selected Pelagics**

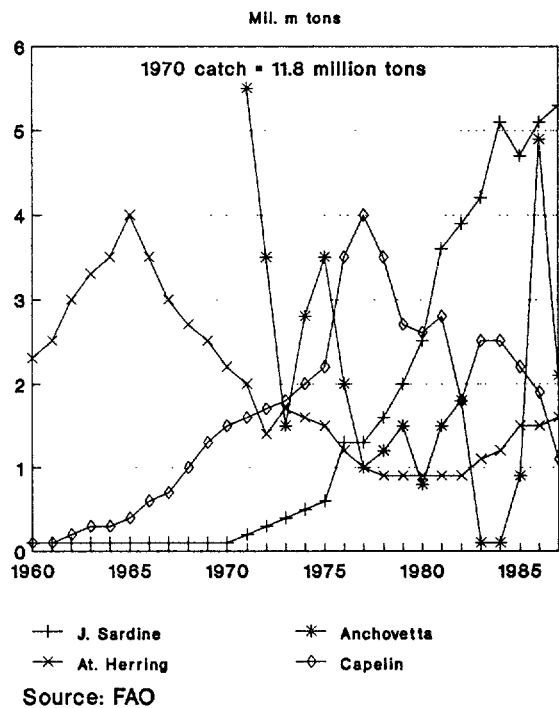


Table 2

Indicative Estimates of the State of Exploitation  
of Fish Stocks in Major Fishing Areas

Fishing Area	% Fully - heavily - over Exploited or Depleted
North Western Atlantic	94
North Eastern Atlantic	99
Western Central Atlantic	66
Eastern Central Atlantic	97
South Western Atlantic	89
South Eastern Atlantic	93
North Western Pacific	67
North Eastern Pacific	74
Western Central Pacific	35
Eastern Central Pacific	60
South Western Pacific	54
South Eastern Pacific	72

Source: World Bank Staff and FAO

selective gear, tuna for example). The predominant mode in the tropics is a multi-species fishery, sometimes containing hundreds of species. The commercial "target" species may be neither (a) the largest species, nor (b) the most numerous species in the catch, nor (c) a single species but a mix of species. Therefore the usual models are often inappropriate, for an understanding of such fisheries.

Considerable progress has been made in estimating the biological parameters, of one or another of the predominant species, in tropical fisheries. But much remains to be accomplished before models which accurately forecast stock and recruitment for multiple species in these fisheries can routinely be used for management purposes.

The degree to which a fish species is regarded as over-fished or depleted often depends upon judgements and who is making the judgement. Nevertheless, many species clearly are subject to excessive fishing effort.

The value and accessibility of the species is often the key to whether or not it is over-fished. The more valuable it is and/or the more accessible, the more effort will be used to harvest it. Gear type and fish behavior also play a major role in the equation.

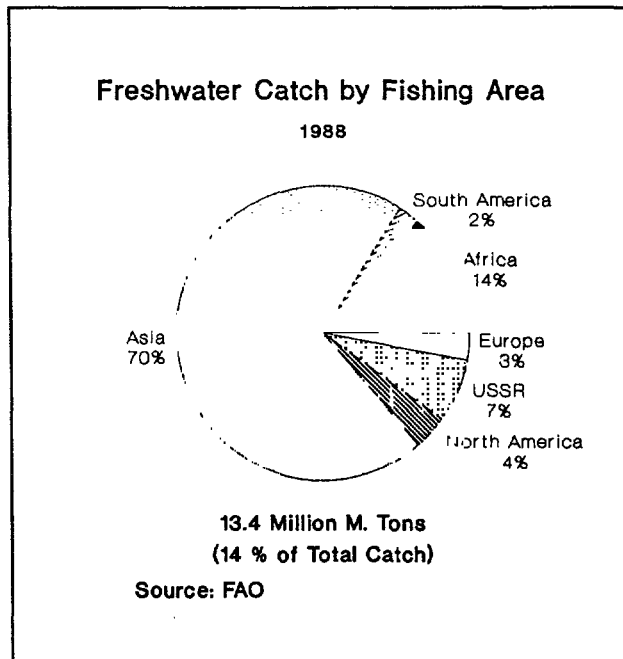
Gear may be selective: hook and line is a good example since by and large single species or groups may be targeted. Gear may also be unselective: trawls are a good example because by and large trawls catch most fish that they encounter.

Since the types of gear are many and fish behavior is complicated, the management equation may be highly complex. Generally, bottom-associated species (demersals) caught by trawls are more likely to be over-fished than are surface-associated species (pelagics). But, pelagics are more subject to population collapse apparently due to a combination of environmental fluctuations and fishing activities. However, there are many exceptions and qualifications which blur this tidy distinction.

There are four major means of controlling access to fisheries resources: a license, a quota, a tax, and territorial use right in the fishery. All have advantages and disadvantages; all require elements which pose practical difficulties in execution. More will be said about these subjects in Section III dealing with Fisheries Management Regimes.

All the unique problems of fisheries investment, development and management appear to derive from the extraordinary and almost universally difficult problem of finding

Figure 5



acceptable solutions to the socio-economic and political issues raised by open access fisheries.

But, despite theoretical concerns about open access, for the most part the fishing industry has thrived where a combination of wise policies, adequate resources, good markets, and an accommodation between various levels of producers' interests have taken place. However, in a number of cases lack of appropriate resources management policies, absence of leadership, greed, and destructive fishing practices etc. have led to resources depletion and financial collapse of the industry, both in developing and developed nations.

Under the present scenario that has resulted from open access policies, a major issue that emerges is that of "exit." Most of the regulatory and economic problems associated with over-fishing result from over-investment and over-capitalization in the absence of appropriate legislation which could establish some form of satisfactory property rights.

Resistance from interested parties to limitations of fishing effort by means of one or more of the policy options mentioned above may be due to the fact that there is not enough knowledge or experience available to devise a fair transition from the existing situation to an "exit" from the fishery.

While it is clear that actions in the future should be directed toward establishing some form of property rights, it is still highly unclear how the problem of the existing effort and investment should be reduced in order to provide an orderly and fair "exit" from the fishery.

The Bank has taken up this issue which affects developed as well as developing nations alike and is conducting a thorough assessment to devise appropriate mechanisms to deal with the "exit" issue. Please see Appendix 1 for a useful overview and discussion of the fisheries economics of some of these issues and a conceptual model.

### **Law of the Sea**

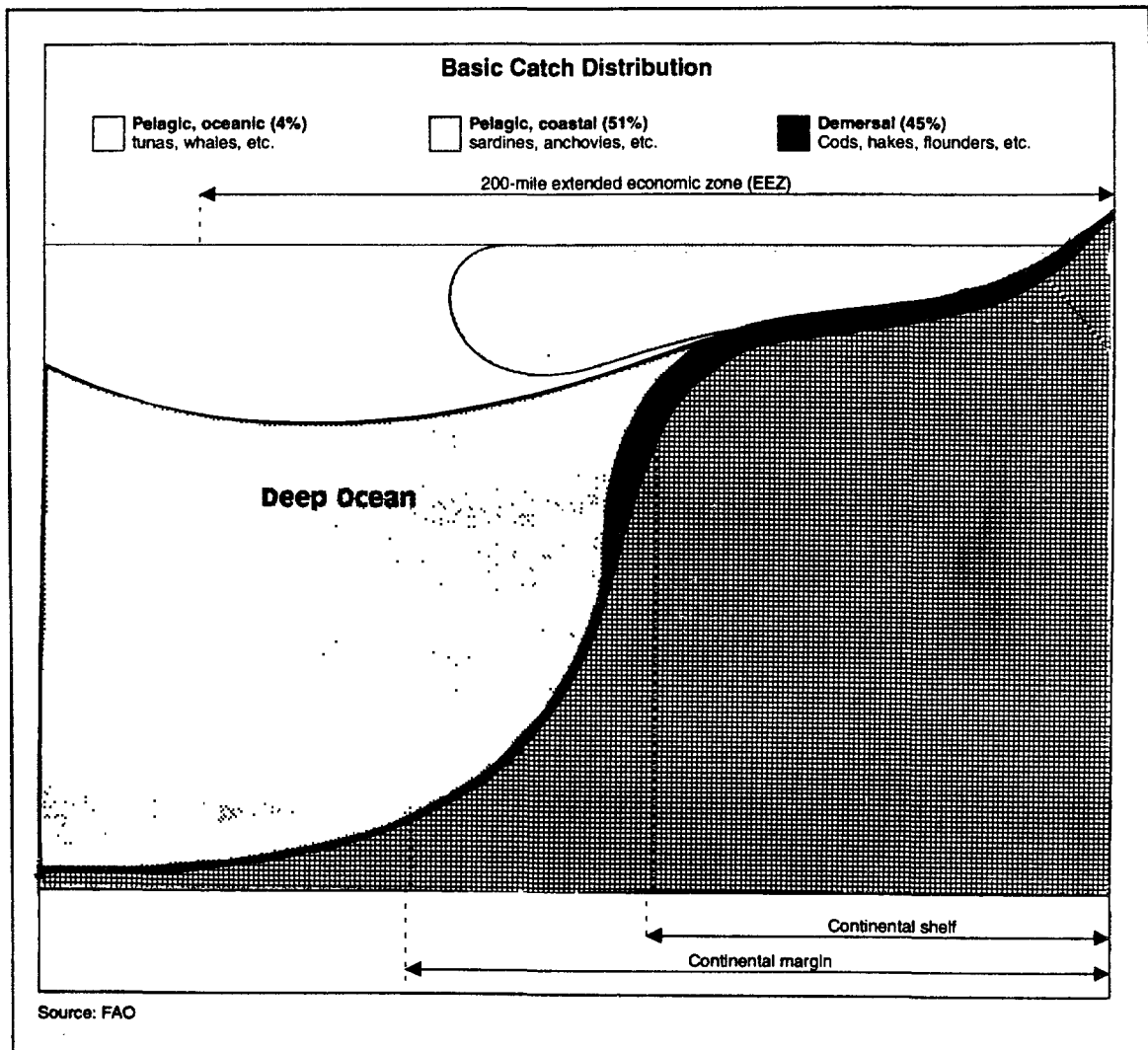
The 1982 Convention of the Law of the Sea, which validated the much earlier decisions of some coastal states to extend jurisdiction up to 200 nautical miles off their coasts (Exclusive Economic Zone--EEZ), also assigned coastal states the responsibility for the management of all living resources within that zone. About 96% of the commercial resources currently under exploitation and a relatively few significant untapped ones fall within the coastal zones of both developed and developing nations, as shown in Figure 6.

### **Fisheries Development**

The need for careful planning and for commitment by participating agencies is not unique to fisheries development programs, but the nature of the resources and activities in the fisheries sector do create unique constraints.

Taking into account the constraints, fisheries development also represents a rare opportunity to foster development in segments of many rural populations not readily accessible to other means of assistance, and on a case-by-case basis other economic segments as well. And certainly the sector often represents an opportunity to capture the benefits of indigenous national resources for the national well-being of many developing countries.

Figure 6





## II. AN OVERVIEW OF THE STRUCTURE OF THE FISHERIES INDUSTRY

No other food production activity requires more public-private interaction than fisheries.

Anonymous

### Background

As an aid to understanding the proposed strategy, some background information on the economic, technological and institutional framework of the fisheries sector is presented.

### Typical Production Modes

There are several distinct levels of fish production in developing countries. The most important can be summarized as follows:

- artisanal fisheries;
- semi-industrial fisheries;
- shore-based industrial fisheries;
- ocean-going industrial fisheries;
- foreign fishing under license, charter, joint ventures, etc.; and
- aquaculture (fish farming).

### Artisanal Fisheries

Artisanal fisheries are characterized by the predominance of labor over capital. They utilize: small craft, beach seine nets, hook and line, traps, etc. There is little technology involved in this fishery, but a great deal of skill is required to make a living from it.

### Operations

Artisanal fishing operations are limited to near-shore waters, and boats are generally propelled by paddle, sail, outboard engines or a combination of these. Fish are either used for subsistence, sold locally to a wholesaler/transporter, or processed at a low level of technology (e.g., smoking) to extend its shelf life.

### Processing and Marketing

Processing (salting, home canning, smoking, and drying) may be an important activity in certain fisheries. In many countries women play a key role in processing and marketing and in some, particularly in West Africa, in financial operations.

### Constraints

Development of this sector is often constrained *inter-alia* by the remoteness of the villages and lack of:

- access roads;
- preservation and processing capabilities;

- appropriate extension services at the village level;
- well-established marketing systems and the corresponding infrastructure;
- access to formal credit markets, coupled with poor or inappropriate institutional credit mechanisms and inadequate knowledge of the lending channels (credit is most often channeled through informal sources, which, despite high interest rates, mostly operate effectively); and
- understanding by governmental and international development agencies of the sociological implications of artisanal fisheries development.

Often as a result of the above constraints, the financial and technical assistance provided by governments and external aid donors falls considerably short of the objective of improving the living standard of fishermen and their families.

### **Semi-Industrial and Industrial Fisheries**

The semi-industrial and industrial fisheries are characterized by higher capital to labor ratios. They are exemplified by larger vessels usually powered by in-board diesel engines. Boats are generally owned by entrepreneurs and manned by salaried crews.

#### ***Operations***

The scale of industrial fisheries ranges from fairly small operations up to large-scale ocean-going self-sufficient vessels. Typically vessels larger than about 10 meters in length are equipped with electronic aids to navigation, depth and fish finding devices. Vessels of this

type may venture offshore or may compete directly with artisanal fishermen in inshore waters particularly when management measures are non-existent and/or not enforced. The fishing gear used varies with the species pursued, but is often technologically sophisticated.

#### ***Processing and Marketing***

The harvest from a semi-industrial fisheries is typically sold to urban fish wholesalers, processors or packers. Large corporations may be involved in vessel ownership and/or processing of the product, such as canning, freezing and reduction (fish meal) as exemplified by the shore-based industrial fisheries for tuna, hake, or anchovies. The technology used in the industry will often include the most technically advanced equipment, such as that used for mechanical filleting, plate freezing, etc. Markets for the products of industrial fisheries are usually well developed and often international in scope.

#### ***Credit***

Entrepreneurs must be willing to invest relatively heavily in fisheries of this scale. And development of these fisheries depends on access to credit. But, even when formal lending institutions are available, they may be reluctant to lend to fishing activities due to their lack of experience, skilled personnel, and flexible lending procedures appropriate to the sector.

#### ***Constraints***

Even in a highly successful industrial fishery operation in a developing country, many of the production inputs have to be imported. And a number of developing coastal states must still rely heavily on foreign

fleet activity. In those cases, the benefit of the 200-mile EEZ does not rest on the value-added contribution to the sector, but on the direct revenues Governments receive in cash and/or in kind from the fishing licenses granted to foreign fleets.

## **Foreign Fishing under License and Related Modes of Operation**

### ***Licensing and Constraints***

The 1982 Convention of the Law of the Sea provided coastal states, *inter-alia*, with legal rights to manage and regulate the exploitation of living resources up to 200 nautical miles off their coasts. Important among several considerations of the Law is that most of the commercial fish resources, currently under exploitation or with potential for expansion, lie within the 200-mile EEZ of coastal states.

The transfer of management responsibility for fish harvested in the EEZ to the coastal state allows for potential economic gains to the state. If the coastal state cannot directly harvest the resources, it can license, or counter-trade with, other countries in return for fishing rights.

If the coastal state wishes to directly harvest the resources, its ability to maximize its economic gains will depend on its existing fishing industry and the competence of that industry and related infrastructure to take advantage of the potential. The economic gains will also depend on that state's deftness and willingness to successfully allocate the fishery among its own fishermen. The economic gains will also depend upon the ability to organize, if necessary, satisfactory allocation arrangements with other coastal states which may share the resources.

Only a few of the developing countries have the technology and infrastructure to translate the transfer of harvest rights into economic benefits. And most do not possess the biological and economic information or political mechanisms to optimally manage the resources.

In addition to the above problems common to all capture fisheries, each developing nation may have its own unique set of problems which are in turn translated into problems for individuals and firms attempting to thrive in the fishing industry.

While processing and marketing of fishery products do not have the problems associated with harvesting common property resources, sustained development of these activities is often hindered by many constraints. Examples of such constraints are: unfair competition of parastatals, restrictive credit, poor technology transfer, absence of domestic marketing systems, lack of knowledge about export markets and excessive government control of the industry.

Overcoming these constraints in most cases requires a basket of appropriate actions, including various policy reforms and government and private sector research. For example, many of the constraints involve actions that are too expensive for a single individual or firm to handle. A small processing firm could not bear the expense of providing sites and services in the harbor area or of researching markets for its products in industrialized nations. However, the benefits from sites and services and market studies, if shared among other industry members, may far outweigh the costs of obtaining them. There may then be clear incentives for collaborative action and for using policies and

actions on the part of government to promote balanced industrial development.

### **The Role of Government and the Private Sector**

Experience in the successful advancement of fisheries development shows that if a delicate balance between government intervention and private sector initiative is reached, the industry and the nation will greatly benefit.

The private sector often requires the informed, case-by-case intervention of the government in areas such as resources management, research, technology transfer, sites and services infrastructure, marketing research and aquaculture planning, water use, and research for hatchery development. The government, in turn, requires the initiative, flexibility and risk taking of the private sector to obtain the benefits from a healthy economy.

### **Aquaculture and Fish Farming**

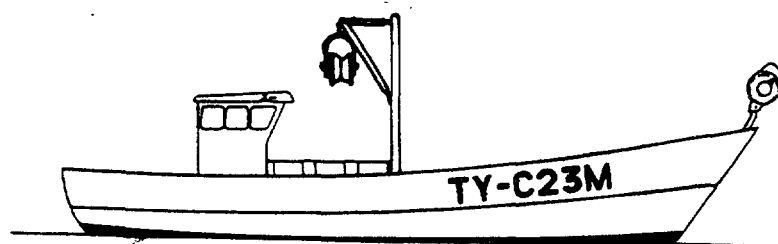
In aquaculture, producers often have clearly defined property rights to their lands, and thus, do not suffer from the inefficiencies related to common property resources.

However, there are other constraints which clearly hinder the development of aquaculture. Among these constraints are archaic leasing practices for public land and/or bodies of water, and a variety of other legal and administrative barriers.

Aquaculture may also suffer from lack of appropriate skills, inability to transfer technology, poor or no access to formal credit, and the general inadequacy of infrastructure (technical, managerial and institutional) to support expansion of fish culture activities.

There is potential for aquaculture to interact with capture fisheries and agriculture, e.g., competition with wild fisheries for brood or seed stock and with other established socio-economic, agricultural and institutional arrangements. Therefore, aquaculture development requires careful planning and a view toward integrating the specific activity into the larger economy.

An appropriate interaction between government and the different elements of the private sector (small farmers and medium and large scale entrepreneurs) is indispensable if aquaculture development is expected to fill the growing gap between supply and demand.



*Purse Seine - Set Net Boat  
Length 12m*

### III. IMPORTANT ISSUES IN THE FISHERIES SECTOR

"The Tragedy of the Commons"

G. Hardin, 1968

#### Common Property and Open Access

One of the most important characteristics of capture fisheries is the common property of the resources, generally free and open access, and lack of satisfactory property rights to the resources.

Technological improvements have led to a worldwide overcapacity in fishing vessel tonnage, particularly in the industrialized nations' fleets, which, despite extended jurisdiction, continue to operate under licensing and other agreements off the coasts of many developing nations.

But, as a result of the adoption of the EEZ, the problems created by open access are progressively improving, at least, in relation to the activities of foreign fleets off coastal states. Harvesting of most commercially valuable stocks is thought to have reached or will soon reach or exceed levels of sustainable exploitation. This situation occurs at a time when developing coastal states are increasing their efforts to maximize domestic fish supplies, generate foreign exchange, improve the fishery sector's value-added potential, and diversify their economies. Such a scenario is sending a clear signal to governments, development agencies and the international community in general that constructive actions leading to more rational exploitation of the natural resources should be taken.

While the situation with regard to foreign distant water fishing fleets may be improving, catches exceed sustainable yields on a large number of traditional fishing grounds, particularly in the highly important coastal areas. (See table 2.) Such over-exploitation is being fueled by a sustained increase in world demand and prices.

#### Intra-Sectoral Conflict for Fishing Rights

Because most of the world's high-valued fisheries resources are in coastal waters, potentials commonly exist for conflict among artisanal, semi-industrial, and industrial fishing interests both local and foreign. The question of how to resolve conflicts within an open access fishery--which requires good will (often not present) between the interested parties--is a challenging task.

Several options which may lead, in the medium and long term, to solutions to these problems are suggested in Section V-B.

Particular note should be made of the increasing use of artificial habitat structures (artificial reefs) to: (i) define the extent of community-based fishing areas, (ii) exert management control over geographic areas of *de facto* tenure, and (iii) control the activities of near shore semi-industrial trawlers by introducing gear damaging structures on the trawling grounds.<sup>12</sup>

## Fisheries Management Regimes

Almost universally fisheries management regulations generate controversy, discord and disagreement. However, recently many fisheries participants are faced with the alternative of reaching agreement on some management structure or going out of business.

The following example of one tested management structure may be a window to the future. Experience gained over the past twenty years, notably in Iceland, has led to the concept of the Fisheries Management Regime (FMR). The regime consists of three elements:

- A Fisheries Management System (FMS), that sets out rules for conducting fishing;
- A Monitoring, Control and Surveillance (MCS) System, to monitor fishing activities and enforce fishing rules; and
- A Fisheries Judicial System (FJS), that complements the MCS and ensures adherence to the overall management system.

Of the three topics above, a discussion about the FJS is beyond the scope of this paper, but the FMS and MCS will be briefly discussed below because they have specific relevance to some Bank operations.

However, in the following discussion please understand that the ideal situation is to employ the full panoply of measures which could be made available under an FMR. Particular note should be taken of the benefit brought to fisheries management by a special judicial system for fisheries.

## *Monitoring, Control and Surveillance (MCS)*

Many of the less developed coastal states lack the financial, technical and institutional, means to properly manage the resources within their EEZ and to develop their own shore-based fishery capabilities. Weak or non-existent FMR and monitoring, control and surveillance capabilities put many developing countries in a poor position to manage operations of the foreign fleets in accordance with established agreements. Coastal nations often rely on the good faith of the foreign entities, which more often than not act in their own best interests.

Political considerations outside the fisheries sector often hamper the establishment of appropriate management programs and constrain the design or the effective implementation of MCS strategies, much less the more complicated FMRs.

Although the world's capture fisheries for many commercial species are at risk in terms of levels of sustainability, and theoretical solutions are frequently discussed, little is being done on the practical side to halt the trend. This is due to the many political forces involved, often more or less equally balanced in opposition, as well as forces favoring the status quo and *inter alia* to the lack of persuasive political reasons for governments to implement resources management programs and to enforce established regulations. The Bank could, in certain selected cases, play an important persuasive role in this complex issue, if suitable conditionalities for resources management and programs for MCS were included, whenever possible, in Structural/Sectoral Adjustment Loans/Credits or similar Bank operations.

### ***Policy Options for Management***

As noted earlier, there are four means of controlling access to fisheries resources. They are:

- *A license.* This method attempts control effort and is easy to administer and understand. It does not always control the catch because it may not specify all the technological options open to the license holder.
- *A quota.* This method attempts to control the catch and is difficult to administer and enforce since there are usually many places where catch may be landed and many ways to subvert the quota limit.
- *A tax.* This method attempts to achieve an economically efficient system by transferring economic rents from the fishery to the government (see Appendix 1). In practice, determining the level of tax is difficult, and insuring accurate reporting is seldom feasible.
- *A territorial use right.* This system grants a type of *de facto* tenure to a specific area. The grantee has the responsibility to maximize the net revenues obtained from the area and would reasonably be expected to manage the area for the long-term benefits to be derived. Such a method, however, is confined to easily delimited areas such as areas of artificial habitat deployment--unfortunately a relatively tiny percentage of the marine aquatic environment.

Some combination of the above options and the institution of an effective FMR can, with the use of observers, log books, spot checks, and user participation, act to regulate effort and catch. Ideally such a regime could function to make the overall fishery more profitable for the participants and ensure the return to government of a fair share of the revenue generated by the resources. But it is not easy.

### **Ecosystems and Political Boundaries**

Fish do not respect national boundaries; therefore, resources management programs must address the complexities of the geo-political arena. Because fish are a renewable common-property resource, influenced by natural and man-made factors, they frequently overlap and often cross political boundaries. Any strategy to manage such stocks often must do so in a multi-country or regional context. Devising regional strategies which will accommodate existing bilateral arrangements or previous understandings among neighboring countries is a highly difficult task. Developing mechanisms at the Bank to deal with regional organizations, set up to manage shared resource concerns, also becomes a real challenge for all parties.

Actions have been taken on a pilot basis in this direction in West Africa to develop a comprehensive approach that could respond better to requests from individual coastal states for Bank assistance. A good example of this would be the approach being proposed to four West African countries by--the Bank, the Icelandic Government, and the legal Department of FAO--to develop a regional MCS. This would be based on existing cooperation mechanisms developed at the initiative of several African coastal states.

### Foreign Fishing under License

Many fisheries agreements exist between institutions in developing coastal states and industrial nations, from both " East and West". Such agreements are often based on subsidies from the developed countries to their fleets. Industrial countries may provide benefits to the coastal state as compensation for real or perceived loss of income to the developing country from the operations of foreign fleets. These types of "assistance" may be in the form of cash and/or an in-kind contribution (possibly based on a percentage of the catch), fellowships, etc. The fleet subsidizing policies practiced by some developed nations by reducing operational costs, however, only encourage entry into the fishery, leading inevitably to over-fishing of the coastal states resources.

Table 3 is illustrative of the extent of international joint venture agreements in fisheries in 1980; indications are that the number is now significantly larger. This shows the complexity of the web of interrelated ventures and national and commercial interests in global fisheries.

A substantial number of the above arrangements generate concerns for appropriate national resources management policies. Where the fishery is valuable enough to warrant it, the FMR is a technically feasible means to administer a management plan for the fishery.

### Development of the Private Sector

The development of shore-based private commercial fisheries to gradually substitute for

the activities of ocean-based largely self-sufficient foreign fleets is of great interest for a number of coastal nations (many of them in Africa). In many countries, particularly developing ones, the spontaneous generation of private sector interest in fisheries cannot be expected to emerge simply by providing the appropriate investment environment. Instead, the implementation of workable programs requires the design of a panoply of new mechanisms as well as considerable institutional and financial creativity. This is an important and challenging issue for the Bank.

The recent developments in East Europe pose a similar problem. Although in Eastern Europe a vast fishing industry exists, it is government owned and notably inefficient, costly, and non-profitable. The privatization process is not a simple exercise given size of the parastatals, the absence of entrepreneurs, capital, collateral and appropriate institutional support infrastructure--both financial and administrative. Creative financial mechanisms and appropriate strategies to promote the development of indigenous entrepreneurs are required.

### Destructive Drift Net Technologies

The limited fisheries resources available on traditional fishing grounds, led a few fishing nations to utilize "drift net" technologies to harvest oceanic resources beyond the extended jurisdiction (200 miles) of any coastal state. An estimated 30,000 to 40,000 miles of such nets are being used for fishing a wide variety of oceanic species.

Many of the nets break loose, and continue to catch and kill fish, porpoise, turtles and other aquatic life long after their intended use has ended.



Table 3

Distribution of Joint Venture Operations By Major Fishing Area

*(see legend)*	1	2	3	4	5	6	7	8	9
Africa	58 5	23 -	22 2	2 -	8 3	- -	4 -	- -	- -
Asia and Middle East	36 70	20 41	23 45	2 21	2 1	- 2	- 1	4 5	- 3
Oceania (So. Ocean)	12 3	17 -	5 3	18 -	- -	- -	- -	1 -	5 1
So. America	31 -	12 -	17 -	- -	1 2	- -	- -	- -	2 -
Central America	6 4	4 -	3 -	- -	2 -	- -	- -	- -	- -
North America	7 2	1 19	- 11	- -	- 3	1 -	- -	- -	- -
Europe	12 77	3 20	- 9	- 1	4 8	1 -	- 3	- -	- 3
TOTALS:									
H 369	162	80	70	22	17	2	4	5	7
F 369	162	80	70	22	17	2	4	5	7

Legend

H = Host (area in which n foreign fleets are fishing)

F = Foreign (n number of area fleets fishing in other, ie. foreign fishing grounds)

Type of fishing:

- |                    |                      |
|--------------------|----------------------|
| 1 = trawl          | 6 = whales           |
| 2 = tuna           | 7 = lobster          |
| 3 = shrimp         | 8 = misc crustaceans |
| 4 = squid          | 9 = other            |
| 5 = small pelagics |                      |

Source: Kaczynsky, Vladimir and Dominique Le Vieil, 1980.

This method of fishing has created a great deal of harm and consequently a great deal of concern. Some bilateral agreements to suppress and discourage the technique have recently been proposed in discussions held at the UN and in background papers submitted to the 1991 FAO/COFI meeting.<sup>13</sup>

But, there is still much to be done to ban the use of this technology. The lack of data on some operations, the lack of specific legislation to deal with the technology, disagreements about the nature and extent of the damage, related sociological and political problems, all have made it difficult to persuade the countries whose fleets use the technology to enact and enforce a ban on the use of such environmentally damaging and stock depleting fishing methods.

Bilateral efforts to link a ban on the technology to broader areas of interest appear to have the best chance of success. The Bank should be alert to the issues and be supportive of any international initiatives designed to ban the use of this fishing technology..

### **Coastal Ecosystem Protection**

Coastal areas are extremely important in the socio-economic development of all countries, particularly in the tropics. The highly productive and complex ecosystems and habitats that characterize the coastal areas provide support to a large number of valuable living organisms and economic activities.

Population growth coupled with economic and social development continues to increasingly place a heavy burden on coastal resources, often resulting in depletion and environmental degradation.

To assure socio-economic development, appropriate planning, integrated management of the use of resources and resources allocation becomes an essential task.

The Bank should play an important role in supporting multi-disciplinary research directed toward developing "wise use" policies for coastal ecologies to be implemented in concert with coastal area projects.

### **Harvest and Post-Harvest Waste Control**

Post-harvest technologies and marketing systems have not kept pace with the advances in catching technology; the losses resulting from waste represent millions of tons yearly, for example, by discarding incidental catches--in single target species fisheries (e.g.,shrimp)--and allowing fish to spoil on-shore.

The primary concern, therefore, is to devise and implement cost-effective programs to reduce waste and improve the uses of the incidental catches. Such actions imply not only the development of new technologies but, more importantly, the adoption of appropriate policies by the countries concerned.

### **Improved Utilization of Pelagic Species**

Fragmented, poorly financed and aborted market and technological research has prevented the development and marketing of a greater number of innovative food-fish products made from small pelagics. These species are for economic and market reasons used mainly for animal feed stock despite the fact that such resources currently represent one-third of total world catches.

Historically the relative proportion of total catch used for feed meal stocks has fallen since about 1970 as world soy bean plantings

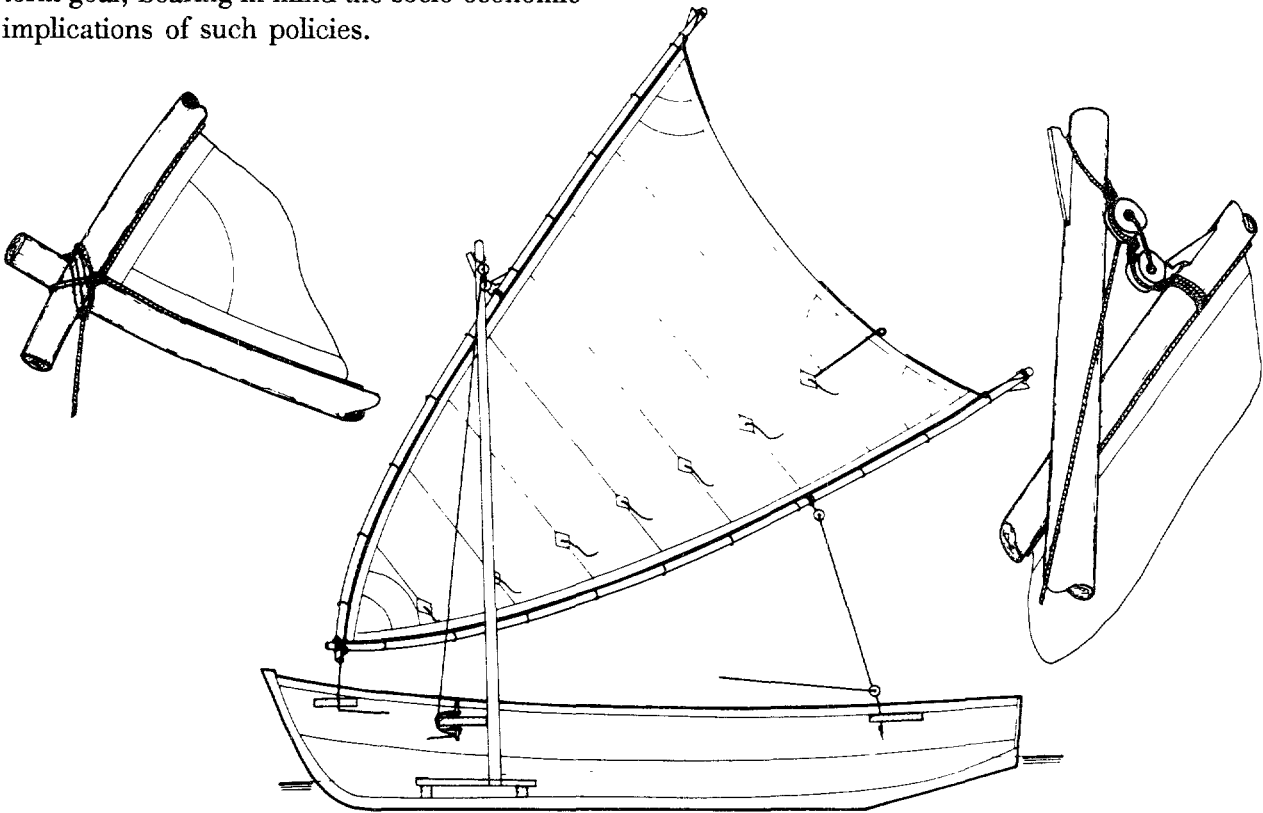
and soy feed meal production vastly increased, as shown in Figure 7, 8, and 9. The market relationship of these meal stocks is demonstrated by the parallelism of their price trends as shown in Figure 10.

However, the recent development of technology to produce far higher-quality fish meals from traditional pelagic resources will produce an inevitable production reallocation from fish meals of low-quality to high-quality, in view of the substantially higher nutritional qualities and prices of the improved meals .

But, higher trophic use of these resources should continue to be a high priority long-term goal, bearing in mind the socio-economic implications of such policies.

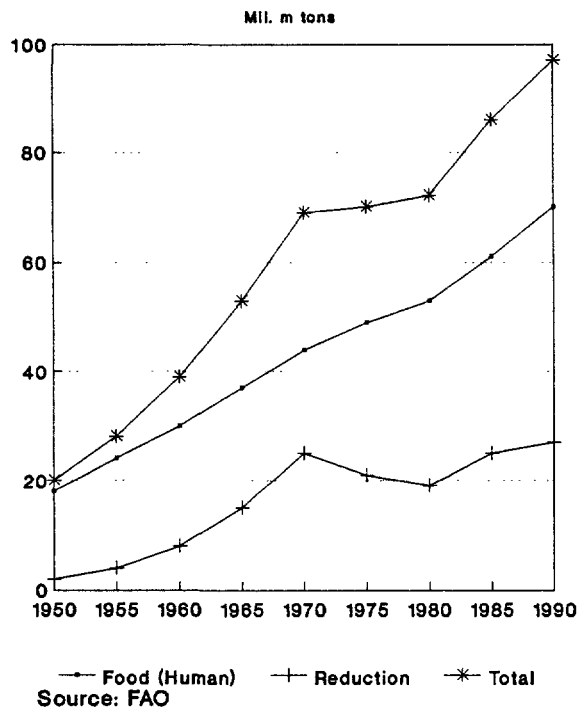
### **Increased Support for Research, Training and Extension Essential for Aquaculture Development**

Aquaculture is still at its infant stages, currently representing somewhat less than 10% of total world production. Development of aquaculture, although extremely promising, is a long-term process. Resources from wild stocks will continue to dominate world fish supplies for several decades. If aquaculture is expected to become a significant source of food-fish supplies, strong support for research, training, and extension should be a matter of priority for all concerned agencies.

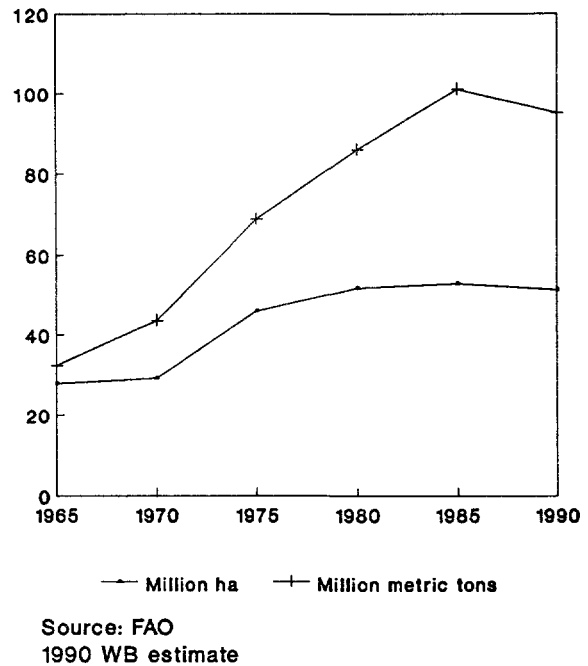


*Fishing boat with sail*

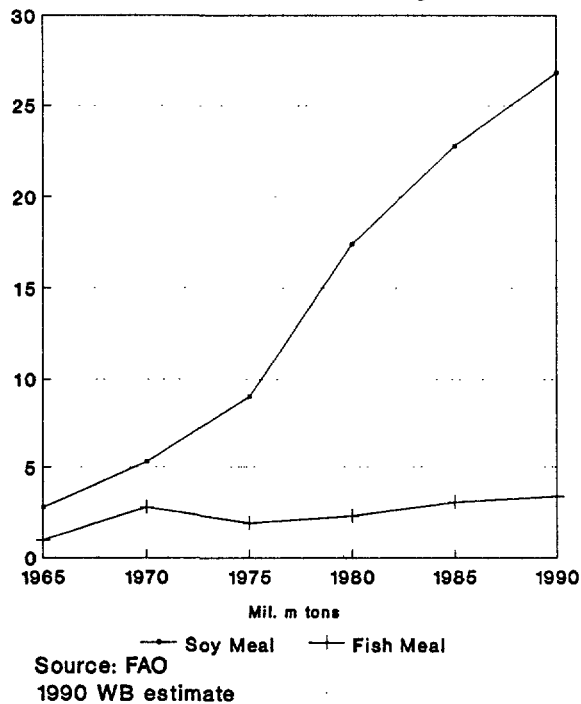
**Figure 7**  
**Disposition of World Catch**



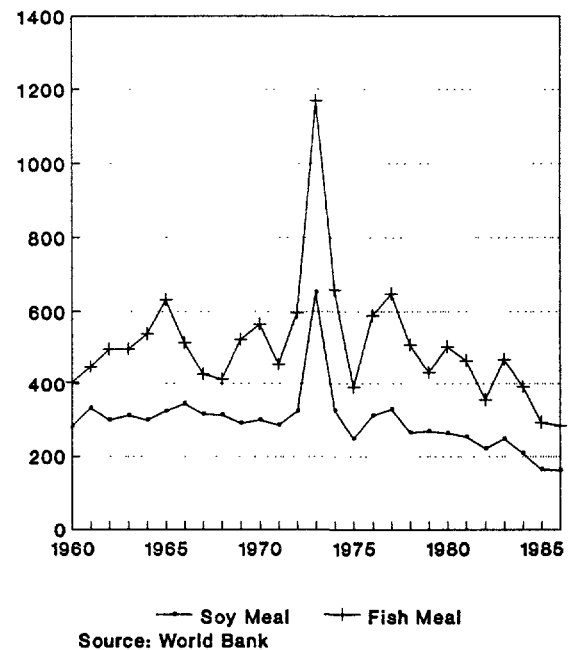
**Figure 8**  
**World Soybean**  
**Area and Production**



**Figure 9**  
**Soy Meal/Fish Meal**  
(Fish meal = 20 % wet weight)



**Figure 10**  
**Soy Meal/Fish Meal**  
**Inflation Adjusted 1980 US \$**



## IV. BANK EXPERIENCE IN FISHERIES DEVELOPMENT

*"Experience is our best advisor..."*

Old Chinese proverb

### Early Sector Experience

The Bank began financing a few fisheries projects in about 1964 in order to gain experience in the sector. For the most part, the early projects were prepared and financed in an ad-hoc manner without the benefit of an overall strategy. Latter in the period from about 1974-1983, the South Asia Region began to recruit professional fisheries staff and developed an informed, structured and consistent approach. Unfortunately, these arrangements, which could have served as a model to other regions, were dissipated as a result of a number of organizational changes within the Region.

### Bank Policy Paper on the Sector

In December 1982, the Bank published a Fishery Sector Policy Paper, whose main recommendations were to:

- give high priority to improving the living standards of low-income fishing and farming communities;
- fund the development of semi-industrial and industrial fisheries through the International Finance Corporation (IFC), development finance companies and other sources;
- develop, in cooperation with the private sector, marketing and distribution systems, aquaculture, fishing technology,

and fish processing, landing and cold storage facilities;

- offer support for fisheries research, training and technical assistance, and strengthening institutions; and
- recognize the Fisheries Department of the FAO and other specialized agencies, as appropriate sources of expertise.

The 1982 Policy Paper adopted a neutral stance, asserting that "the Bank stood ready to provide assistance in those situations where resources and markets were favorable and when interest in such development existed." It emphasized the artisanal fisheries sub-sector as the most important means of developing fisheries in the Third World, following the trend toward rural development that the Bank and the donor community strongly supported in the late 1970s. It also reflected the importance of this activity as a source of employment and food-fish supplies in the developing countries.

The Policy, however, by emphasizing small-scale fisheries, down-played the role of industrial and semi-industrial activities both in capture and culture fisheries, and provided a weak response to the significant differences between developing countries in regard to the levels at which their industries were operated or could operate.

Although the Policy pointed out the role IFC could play in dealing with the industrial

sector, it did not propose a specific mechanism to assure appropriate interaction with the Bank in regard to the sector. In practice, all Bank and IFC lending and/or participation in fisheries activities have developed independently.

The world fisheries sector, however, is changing at a faster pace than the 1982 Policy Paper could envision, precluding it from providing a foundation for answers to many of the questions that now require solutions at the operational level.

### **Bank and IFC Operations in the Sector**

Since 1964, when the first loan for offshore fisheries was approved, the Bank has supported 97 projects in 41 countries. The focus of 35 of the projects was entirely on fisheries; in 62 others, fisheries was a component. Total project costs for these projects amounted to US\$1.59 billion, of which US\$616.5 million was financed by the Bank.<sup>14</sup> In addition, through its Industrial Development and Finance (IDF) activities, the Bank has provided loans to more than a 100 private sector operations (fishing, processing/marketing, etc.) with an estimated cost of over US\$100 million.

IFC reports funding about eleven fishery projects, most of them in capture fisheries, with financing of about US\$25.5 million in loans and US\$5.2 million in equity participations. IFC has under consideration several future fisheries operations.

### **Review of Bank Operations in the Sector by OED**

In 1983, the Bank's Operations Evaluation Department (OED) conducted a "Review of Bank Experience with Fisheries

Development." OED found that the overall performance of the fisheries portfolio had been poor. Almost all the problems encountered could be attributed to administrative and managerial weaknesses in the implementing agencies, technical inadequacies (weak project concept and design), the lack of a coherent Bank approach to the sector, and a shortage of in-house fisheries technical staff.

OED also found that in projects in which fisheries was only a component, with few exceptions, the sector received scant attention, and therefore did not yield acceptable performance.

OED recommended developing a cohesive sub-sector review program in support of future Bank involvement in fisheries operations; strengthening the Fisheries Development Advisor's role in reviewing fisheries-related projects; according the same level of professional consideration to the formulation and supervision of fisheries lending as is done with other sectors; and strengthening Bank technical inputs to project operations.

The OED report, however, did not raise the issue that problems with fishery projects are not exclusive to the Bank; that almost every international or other agency involved in financing fishery projects has had problems which are varied in nature and degree of complexity. On balance, many projects in other sectors, such as agriculture, rural development, irrigation, credit, transportation, and industry, in spite of the wider experience and longer lending history, have also confronted problems and sometimes performed poorly.

Agriculture projects in Africa, for example, have a failure rate of about 70%. Such a

situation appears to indicate that project performance is the result of the interplay of different factors which are independent from the sectoral nature of the activity. Thus, associating fisheries in isolation with potential problem projects would be misleading.

This discussion would not be complete and balance would not be served if successful examples of fisheries lending and Bank operations in the sector were not acknowledged. Although the conventional wisdom, at least within the Bank, points to learning lessons from past mistakes (failed projects receive more attention than successful ones), we believe it is also constructive to review the experience with successful examples.

Excerpts from a selection of evaluation reports of projects which have had a record of highly successful performance follow:<sup>15</sup>

○ **Bangladesh Oxbow Lakes Fisheries Project (1979 - 1987):** Despite some problems, the project findings showed the following: "The technical validity of the improved breeding and lake management techniques introduced under the project has been confirmed through the project experience, with yields and production from project lakes having risen several fold," and further that: "The mini-hatchery technique demonstrated under the project (which was not part of the original design) has been widely adopted by private fish breeders and pond operators, to the considerable benefit of the inland fishing industry."

○ **India Marine Fisheries Projects; Gujarat Fisheries Project (1976 - 1987): and Andhra Pradesh Fisheries Project (1978 - 1987):** "... considers that both projects performed better than has been believed hitherto by Bank staff.

With the exception of two **motorized fishing vessel** credit components, all the facilities, services, and equipment which were intended, have been provided albeit over a longer time span and in some cases a rather higher cost than was planned."

○ **India Inland Fisheries Project (1978 - 1989):** "The overall impact of the project should be considered as highly positive. At macro level the project resulted in a substantial increase in fish supply (about 260,000 mt), and an important employment generation effort (for over 200,000 people). It further contributed to the foundation of a new fish seed industry in the country and benefitted lower income groups (over 46,000 farmers in the scheduled castes and over 3,500 in scheduled tribes). A clear illustration of the project's success is the fact that the Fish Farmer Development Agency scheme has now been introduced into other states; the total number of districts...(originally 58 ed.)...is 300."

"Finally, another element of the project's successful impact has been the demonstration of the favorable impact of the private sector involvement without which the project would not have been able to perform so successfully."

○ **Maldives Fisheries Projects (I; 1979 - 1983) (II; 1983 - ongoing):** "The first fisheries project... substantially increased fish production, fishing efficiency and vessel safety. Its highly effective credit program, with virtually 100% loan recovery, ... contrasted with the negative experience of previous fisheries credit programs executed by non-specialized credit institutions. The technical assistance component succeeded in designing and testing one of the most efficient artisanal tuna fishing vessels in the world, of

which, more than 200 have been constructed. The second fisheries project ... has succeeded in substantially increasing the fish catch and exports in the project area, while vessel productivity has also improved markedly."

The conclusions drawn are that these projects appear to have in common strong Bank technical inputs distributed throughout the life cycle of the projects. In addition, their project concepts were sound; design accommodated both project concept and host government concerns for objectives, and there was a strong sustained commitment by both the Bank and host institutions in the success of the project.

#### **Existing Constraints to Bank Operations in the Sector**

The current practice of using short-term consultants to provide the technical inputs for projects does not appear to meet the needs of the sector or the Bank's long-term best interest.

The lack of a critical mass of fisheries professionals at regional level, coupled with budgetary limitations, prevents providing operations with the proper technical support in order to properly carry out Bank project and sector work (as of January, 1992 only Middle East and North Africa Region has a fisheries specialist).

More often than not, short-term consultants have to be recruited through trust fund

mechanisms, which were designed to complement the inputs of the Bank, not to substitute for them. These practices have led to a lack of continuity, fragmentation and additional time required by the staff to deal with a sector with which they are technically unfamiliar. It is believed that improvements in the above constraints must be overcome in order to improve the performance of Bank operations in the sector.

Attention is also drawn to the discussion paper *Technological Issues in World Bank Lending for Agriculture*, edited by Gnaegy, Suzanne and Jock Anderson, 1991. The paper identifies a number of important issues relating to the lack of technical staff in agriculture which are also reflected, in principle, in fisheries albeit on a much smaller but perhaps no less important scale.

#### **Fisheries Donor Consultations and the Development of a Sector Strategy**

The performance of fishery development projects financed by the Bank and the donor community was assessed at the First Fisheries Development Donor Consultation (FFDDC) held in Paris 1986.

The FFDDC strategy, detailed in Section V, Inter-agency Cooperation, was developed as a partial result of common concerns expressed at that meeting about developments in the sector.



## V. THE DEVELOPMENT STRATEGY

### A. KEY ELEMENTS OF THE FISHERIES STRATEGY

"Give me a place to stand, and I will move the earth"

Archimedes  
212 B.C.

In the light of the complexities of the fishery sector, a single approach to fisheries development would not be the correct course of action. Therefore, an approach is proposed which is both flexible and responsive to the substantially different needs that exist in the sector, within the Bank, and among the countries served by the Bank.

Common problems in fisheries sector lending became the driving force that produced the First Fisheries Development Donor Consultation (FFDDC). The product of that meeting resulted in much better channels of communication among donors. And a coherent multi-agency approach to a range of fisheries sector problems is beginning to take shape.

The strategy proposed in this paper contains elements that provide a fulcrum for sector-specific actions. The strategy depends upon four points:

- Interagency cooperation, since no single agency could satisfy the sectoral needs of the beneficiary countries;
- Sector studies, for a proper understanding of specific problems and for designing sound strategies, action plans and investment programs;

- Fisheries research, to fill many gaps in the knowledge required to achieve fisheries development; and
- Private sector development, since it is clear from observing the performance of projects and the latest world events, that the private sector is pivotal to the achievement of development.

The above conceptual foundation could provide a structure to attract support from a broader audience: in the Bank, among cooperating agencies, the donor community and the beneficiary countries. A series of specific actions are proposed below which encompass a number of themes. Among these are: improving resources management, managing the environment, developing human resources, aquaculture, artisanal and inland fisheries, and developing industrial fisheries.

These proposals include implications about the Bank's role in the present world fisheries scenario and how this role could complement the involvement of other financial and development agencies, donors and the private sector. We believe the proposals provide the best conceptual approach to understanding fisheries development, whether it is focused on an individual country, extended regionally or applied globally.

## Inter-Agency Cooperation

"Interagency cooperation, the key to successful Third World assistance."

Fisheries Development Donor Consultation

Paris, October, 1986.

External assistance to the fisheries sector of developing nations amounts to about US\$700 million a year (in current US\$). However, a common perception in the donor community is that the results of such assistance are often not commensurate either with the amount allocated or with the objectives stated during the preparation phase of the assistance programs.

Until recently, despite the best efforts of all concerned, interagency cooperation both at headquarters and local levels has often been somewhat less than satisfactory, for a number of disparate reasons. This has led to duplication of programs, and misdirected, misallocated and squandered technical, human and financial resources. Therefore, as a result of the (understandably) poor performance of the projects financed by the individual agencies, the sector's image has deteriorated and development agencies have been increasingly reluctant to expand their support for the sector.

Recently a number of highly important steps have been taken to improve performance in this area. In an effort to correct some of the problems noted above, the World Bank and the Commission of the European Communities (CEC) -- soon joined by the United Nations Development Programme (UNDP), the African Development Bank (AfDB), and the FAO -- set in motion steps

that led to the FFDDC held at the World Bank offices in Paris in October 1986. The meeting was attended by 29 agencies and 52 delegates.

### Fisheries Development Donor Consultation Strategy

The FFDDC thoroughly discussed the reasons that may have led to poor project performance and the prospects for coordinating external aid to Third World fisheries development programs. It outlined a plan of action that called for:

- emphasizing long-term sector development planning;
- improving fisheries input in national and sector aid coordination groups;
- assessing the feasibility of international cooperation in fisheries research;
- organizing and setting up a decentralized information exchange system;
- preparing manuals for fisheries project preparation and appraisal; and
- holding a Regional Fisheries Donor Consultation for Africa.

The Consultation for Africa, hosted by the AfDB took place in Abidjan, Cote d'Ivoire, October 13 to 15, 1987. The meeting recommended that action be taken on:

- an interagency approach to preparation of sector studies; and
- the promotion of local and foreign direct private investment in the sector.<sup>16</sup>

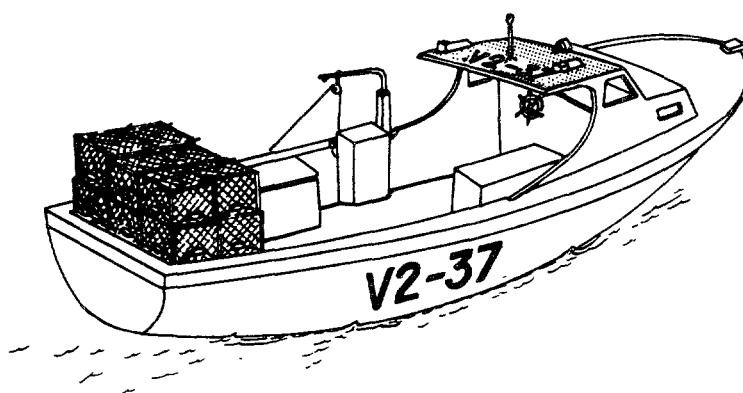
The steering committee (WB/CEC/UNDP/FAO) has taken actions to implement the recommendations from both meetings. The Second Fisheries Development Donor Consultation was held October 7-9, 1991 in Paris to assess the progress of actions taken since the first meeting. The emphasis of the meeting was on: (i) a review of actions taken on recommendations at the first meeting and the formulation of a plan of action for the coming years, (ii) a review, adoption and

follow-up of actions to be taken in regard to the Report of the Study of International Fisheries Research. Also taken up were issues involving; (iii) sustainable development of fisheries, (iv) the need for information exchange, (v) guidelines for sector studies, and (vi) the development of the private sector.

To underscore the importance of the last agenda item, an organization from the private sector was represented at the meeting for the first time.

The strong support that the interagency cooperation effort has attracted is evidenced by the decision of the 1991 Consultation to include representatives from two bilateral agencies (Norway and Canada) as members of the Steering Committee.

The Bank should, as a priority, continue to support the Interagency Cooperation Initiative.<sup>17</sup>



*Pot or Trap Fishing Boat  
Caribbean Type  
Length 6m*

## Sector Studies

"Only he who keeps his eye on the far horizon will find his right road"

Dag Hammarskjöld

A number of reasons are often given to explain the generally poor performance of fishery projects financed by the international community; *inter alia*, lack of understanding of institutions responsible for the sector's management, inadequacies in project concept and design, marketing deficiencies, and even inappropriate boat design.

All of these are perfectly valid, but overlooked more often than not in project preparation, appraisal, supervision and evaluation are broader economic, sociological and environmental issues involving price controls, taxation, credit, regulations on imports/exports and on foreign currency, labor legislation, investment regulations for local and foreign investors, small-scale group organizations, alternative employment opportunities and integrated environmental implications.

Although many of these factors are determined by policies outside the fishery sector, they must be accounted for when designing investment projects. Thus, there is a need for the prior preparation of fishery sector studies, long-term strategies and action plans.

When sector studies have been conducted, they have often responded to program or project development criteria, rather than to sectoral development per se. As such, the studies have not incorporated the qualities

necessary for a long-term planning instrument, critical for sector development.

Thus, the challenges of maximizing the potential benefits, made available by the EEZ and by the new opportunities generated by aquaculture, demand long-term inter-sectoral planning as a fundamental element for successful fishery sector development.

Moreover, the current macroeconomic instability of developing countries, evident by the implementation of structural/sectoral adjustment loans, requires special attention. If national economies are to grow, sectors cannot be viewed in isolation.

Uncoordinated activities and poor cooperation among donor agencies involved in the fishery sector have contributed to the failure of fishery projects. Agencies often have acted, in regard to country development projects, in isolation without the benefit of a detailed sector study, providing financial support to their preferred areas without fully taking into account the long-term prospects of the sector as a whole.

In addition, the national fisheries administrations in most developing countries are small and easily overwhelmed by the requirements of numerous donor agencies frequently requesting the same kind of information. Consequently, fishery projects have often performed poorly, contributing to

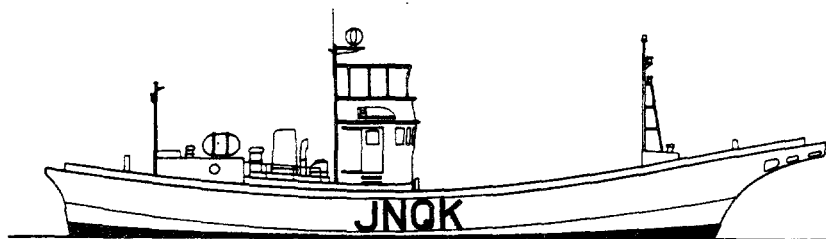
a deterioration of the image of the sector within the donor community. Coordination among agencies is therefore essential.

An added bonus of an inter-agency approach is the impact it may have on the current aid coordination group meetings (Round Table, Consultative Groups). If the donors attending the meeting have jointly participated in a sector study and have carefully designed a fisheries strategy action plan and investment program, they have defined in advance and in a rational manner their eventual involvement. Thus, at such meetings they could avoid making decisions based on a menu of poorly interrelated projects as is often currently the case. Concerted efforts such as these, made early in the project cycle, could help ensure maximum benefits to the recipients at least cost to the donors.

#### **Strategy for Sector Operations in Fisheries**

Based upon the above considerations, the Bank should emphasize the following in its fisheries sector operations:

- use fisheries sector studies as a basis for potential sectoral involvement, and prepare them in cooperation with other agencies seeking similar objectives;<sup>18</sup>
- help governments prepare long-term Fishery Sector Development Strategies with well-defined implementation plans and investment programs;
- link these strategies, when appropriate, with Structural and/or Sectoral Adjustment Operations and Sector Loans, promoting private sector development through its involvement in production and marketing activities, and restricting the public sector to the provision of services;<sup>19</sup>
- help governments prepare sector strategy documents (a spinoff of the sector studies) for submission to national and/or sectoral "aid coordination" groups; and
- improve the representation of fishery sector concerns in aid coordination mechanisms.



*Pole and Line Tuna Vessel  
Western Pacific Type  
Length 22m*

## Fisheries Research

"Research: there is no future without it."

ITT.

### Background

Present prospects for greatly expanding catches from wild resources are poor. Many traditional fishing grounds are exploited at or beyond the maximum sustainable yield. Yet demand for fish and fisheries products continues to grow. The FAO estimates that demand for fishery products is expanding due to population growth and an increase in household incomes at a rate that will require an increase in supply of 30 million tons in the next ten years should fish prices remain at current levels.

In spite of the present somewhat limited potential for increased fish production from **wild stocks, primarily bottom fishes**, it is believed that increases are possible from the following:

- implementation of management practices that would restore existing but poorly managed fisheries stocks to more productive levels;
- improved utilization of some industrial fish and reduction in waste during harvest and post-harvest operations;
- exploitation of the limited number of currently unfished pelagic stocks; and
- improvements in the quality of the aquatic environment.

To accomplish this, new strategies must be designed, including but not limited to the:

- design and implementation of appropriate resources management programs with greater emphasis on social science inputs;
- reduction of waste and development of food products from species now used for animal feed and industrial oil production;
- expansion of aquaculture (marine, brackish and freshwater); and
- protection and rehabilitation of the environment primarily in wetlands, mangrove, and other areas critical to marine and freshwater fish species life cycles, particularly in the early life history stages.

### Research Coordination Requirements

Improved and better coordinated fisheries research both applied and strategic are urgently needed. Such research is currently fragmented, poorly funded and lacks a consistent direction. The international donor community provides on the average US\$44 million per year to assist research projects in the field of fisheries. It is widely believed that such levels of support are not producing the effect desired and that the results are not cost-effective. Many of the proposed strategies

cannot be carried out without appropriate research, and thus, development is hindered.

### **Study of International Fisheries Research (SIFR)**

A Study of International Fisheries Research (SIFR), which resulted from discussions at the FFDDC in 1986, was started in April 1989, with the financial support of the World Bank, UNDP, CEC, FAO (constituting the Steering Committee) and 12 bilateral agencies. Two other agencies, including a private sector organization, contributed by sending representatives to the study's Advisory Committee.

The study, completed in mid-1991, was submitted by the Steering Committee for the consideration of the donor community at the Second Fisheries Development Donor Consultation (representing 27 Donor Agencies and Chaired by the Bank), in Paris, October, 1991, where it was approved.

The approval by the 1991 Fisheries Development Donor Consultation (FDDC) of the SIFR strategy and action plan automatically made the plan and integral part of the Banks strategy for fisheries research.

The research study, the most comprehensive of its kind ever attempted in the field of fisheries, involved input from about 100 working level scientists from all major regions of the world, and produced a diagnosis, a strategy and an action plan. The goal of the action plan is to assure proper and timely implementation of the findings and recommendations, thus improving the development prospects of the fisheries sector.

The Report of the Study on International Fisheries Research will be available as a

World Bank Publications early in 1992, consequently only certain highlights are presented here to provide the flavor of the Plan.

When considering research strategy it is useful to keep in mind the categories of research based on the nature of the investigations involved. The categories as used in the SIFR strategy are: 'strategic research' involving investigations of basic scientific relationships for the purpose of solving specific problems of practical importance which cannot be solved with existing knowledge; and 'applied research' involving the application of existing scientific knowledge to specific problems, including in this context adaptive research.

### **Summary of SIFR Strategy**

#### ***Levels of Research***

SIFR suggests three levels of research;

- National, topics considered by the donor agencies and developing countries to be the highest priority;

- Regional, issues that can best be addressed cooperatively by institutions in more than one country which share aquatic resources, knowledge, and equipment; and

- International, topics of global significance, and issues which involve significant inter-disciplinary efforts.

#### ***Focus of SIFR Study***

The plan calls for SIFR to focus its efforts primarily on national and regional research, essentially applied research, whereas a proposed fisheries institute (International

Centre for Living Aquatic Resources Management, ICLARM) within the framework of the Consultative Group on International Agriculture Research (CGIAR) will focus its main efforts on the management of aquatic ecosystems, essentially strategic (basic) research. However, several areas of strategic research fall outside the proposed scope of the CGIAR institute, and SIFR proposes that these be handled by twinning arrangements between developed and developing countries.

### **Main Research Areas (Highlights)**

#### ***Resource Conservation and Management***

**Global Trends.** Environmental management issues on regional, national and sub-national scales lead to substantial research requirements, which imply collaboration with research institutions not primarily concerned with fisheries. Understanding the causes and process involved in various forms of environmental pollution, and their impacts on stock and recruitment and the production of adult stocks, will be essential to the elaboration of measures to mitigate these problems.

Perhaps the most complex issues are the interaction of fisheries and non fisheries economic activities particularly in the coastal zones. Research on the relationships among, for example forestry, agriculture, industrial and human waste disposal, hydrology and water use, recreation facilities and fisheries within particular coastal ecologies is critical in determining the best policies for the management of economic development.

**Genetic Diversity.** FAO and a number of other organizations are developing and expect to maintain a data base of information about

all known aquatic species which would be made available in CD ROM format. At national levels the importance of this issue would be appraised and trends in genetic diversity determined with a view to determine the advisability of interventions on behalf of subject species. Where necessary and practical, steps may be taken to conserve germplasm of such species through; (i) the preservation of habitat, (ii) the maintenance of cryogenic-preserved sperm, or (iii) the establishment and maintenance of captive species brood stocks.

**Capture Fisheries.** For most countries with strong fisheries interests, the largest production comes from coastal capture fisheries, and the greatest scope for making gains in production (or preventing losses) over the short and medium term comes from these areas.

A high priority task for research at the international level is to develop multi-species models for tropical resource systems. With a high degree of interest in developing socio-economic impact models in concert with the purely biological ones.

The parallel development of policies and programs which would make possible high sustainable yields of aquatic resources consistent with other national policies and purposes is also of the highest priority.

**Private Sector.** The role of the private sector will be important because of the need to cooperate with the public sector, of its contribution to financial and intellectual support for research, and in directly carrying out certain areas of research in which it has a marked comparative advantage.



### ***Fish Productivity***

**Aquaculture.** The strategy to follow for short and medium term development-oriented research would be the creation of mechanisms to organize and assist networks of national research institutions supplemented by external assistance when required.

**Enhancement.** The improvement of production by supplementing recruitment, by stocking or manipulating the physical or biotic environment in favor of the desired species.

At the international level the priorities for this research are: (i) to assemble data on successful technologies, to determine or improve their cost effectiveness, and minimize their environmental impact; (ii) to elaborate new or improved technologies for particular species. At the national level efforts should be directed towards introducing or extending such technologies.

**Commodity Conversion and Utilization.** Research dealing with all aspects of the conversion of a fisheries resource into food including capture, handling, distribution, processing and marketing offers one of the most important areas of research because most gains in this area would be made within the present resource base. There is scope for a major international research effort in the areas of post harvest losses alone.

**Human Linkages, Socio-economics and Policy.** No topic is more important, or less studied, in the whole field of fisheries research than the socio-economic interaction between people and the resources they use. A major challenge is to link social science research with biological and technological

research in a mutually supporting environment.

### ***International, Regional Cooperation.***

Opportunities for multi-disciplinary studies of some complexity could best be dealt with in the context of internationally or regionally organized units. Since resource management issues are not confined to national boundaries they are logical candidates for such an approach.

### **The Plan for Action**

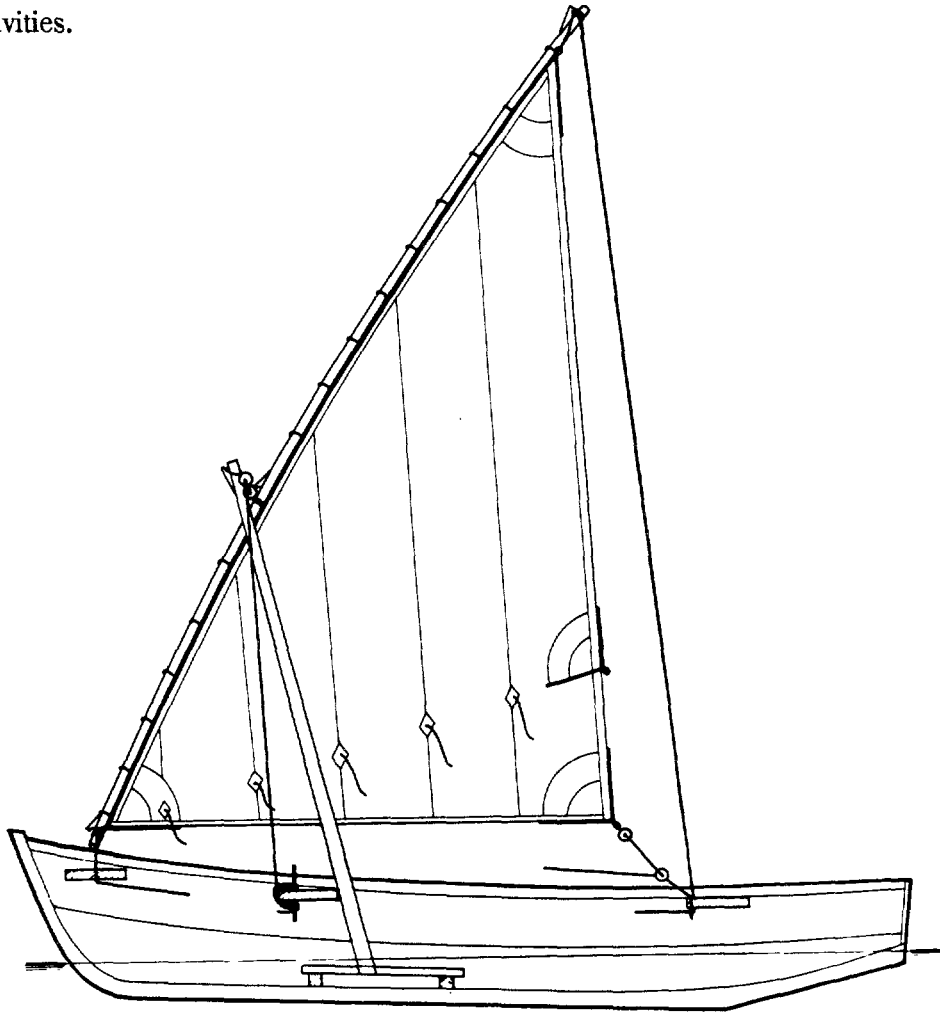
The SIFR report suggests a number of courses of action directed to the donor community. In outline form they are to:

- communicate the study results;
- provide support to CGIAR fisheries research;
- provide complementary support to fisheries research; A draft indicative plan for research is included in the Plan for Action Report. It calls for:
  - strengthened national research;
  - strengthening of the capabilities to prepare national policies and programs;
  - linking national institutions to networks (or creating them);
  - developing criteria for the selection of institutions to support;
  - strengthening access to scientific information;

- promoting the transfer and adaptation of technology resulting from research to policy makers and the fisheries community;
- providing support for research conducted by universities and advanced scientific institutions; and
- stimulating research in the private sector, and supporting the exchange of information about fisheries research activities.

### Implementing the Plan

It is expected that the expanded 1991 Steering Committee: Bank, UNDP, CEC, FAO, Norway and Canada will soon establish a mechanism to channel integrated donor support to key problems in the sector and lay the ground work for remedial action to be taken on the most pressing national, regional and international fisheries research problems.



*Fishing boat with sail*

## Private Sector Development

"...the power of free enterprise..."

U.S. President George Bush  
May 1991

Important among the long-established objectives of the Bank as set forth in its Articles of Agreement is the promotion and encouragement of private investments for productive purposes.

Private sector development has as its goal the growth of an efficient private sector capable of making a positive contribution to national economic development. The practical distinction between private sector and state owned enterprises is often subject to a case-by-case definition since ownership and control by the state may vary in degree and from time to time. The characteristics of the private sector also may vary greatly on a case by case basis. Because of important political, social and economic differences among countries, efforts to support private sector development need to be specifically suited to the needs and circumstances of the country in question.

As recently as 1989 the Bank reviewed its strategy to support the development of the private sector.<sup>20</sup> Key elements of that strategy, all of which apply to the development of the fisheries sector, are summarized as follows:

- The development of the private sector is integral to the work of the Bank, not a separate topic requiring special treatment. Nevertheless, a sharper focus is necessary to insure that the

contributions the private sector can make to development are fully utilized;

- Growth and economic efficiency, complemented by the need to alleviate poverty, should be the main criteria for determining the correct boundaries for the private and public sectors; and
- The Bank's approach to private sector development must be pragmatically tailored to country circumstances.

In developing country-specific strategies a mix of five possible approaches should be considered, as follows:

- the *incentive approach*, achieved through macroeconomic reforms and stressing the reduction of sectoral distortions introduced through tax, trade, marketing, or similar policies;
- the *deregulation approach*;
- the *promotion approach*, through credit, research and extension services;
- the *development approach*, the creation of required physical and human infrastructures; and
- the *privatization approach*, transferring functions and enterprises from the

public to the private sector through the divestiture of state-owned enterprises, contracting or leasing of activities or functions and generally reducing public involvement in particular areas while permitting greater private initiative.

Also, it is extremely important to emphasize the technical and economic analytic work needed to support recommendations regarding the applications of the above strategies to individual circumstances.

In the fisheries sector the need for economic and social sector studies and research to support a number of sector recommendations to implement one or another of the above strategies is clearly of high priority.

Some applications of the above elements, specific to the fisheries sector, could serve as examples:

- most notable perhaps are efforts to restructure the operations of parastatal organizations and of fisheries cooperatives; and
- numerous other examples with an impact on the fisheries sector may be found in the broader policy-affected areas of: tax, trade, marketing infrastructure, labor, pricing, distribution, transport, banking, and rural credit.

The Bank organized a World Bank Group - Private Sector Fisheries Development Working Party, held in Washington, September 4 - 5, 1991, as a first step toward bringing the broad experience of the private sector together with elements of the World Bank Group. The meeting, supported in part by contributions

from the Danish International Development Agency (DANIDA) and the commercial Amsterdam Rotterdam Bank (AMRO Bank), brought together a group of distinguished fisheries entrepreneurs from both developed and developing countries, as well as respected representatives from governments and donor agencies.

The goal of the meeting was to more formally encourage and improve the existing informal and fragmented dialogue and facilitate interaction between the participants as well as to encourage new approaches to local and foreign private investment in the fisheries sector of developing countries.

A consensus was reached on broad guidelines for guiding the discussion as to the roles of government and the private sector. It was generally agreed that governments have the responsibility to provide infrastructure facilities, training research, statistics, and an appropriate climate for financing. It was also agreed that protecting the indigenous industry and on occasion the establishment of mechanisms to provide export incentives and fuel price adjustment were legitimate areas for government intervention. But the role of government at the operating level should be minimal and this aspect of the sector should be in the realm of the private sector. Where parastatal companies are necessary, they should be managed on a commercial basis, and operated outside of government constraints, albeit acknowledging the social issues involved in many such cases.

A significant number of constraints to active development of private sector participation in fisheries development were identified. These constraints were made explicit with the objective of creating a framework for future actions to remove as many of the constraints

to the participation of the private sector in fisheries development as possible.

Among the constraints identified, the following require special emphasis and have a singular relevance to this discussion paper:

- **Sector Policy Framework.** The frequent lack in developing economies of consistent fisheries policies, resources management plans, clear licensing criteria, consistent enforcement of fisheries and monetary regulations, fiscal policies which create a stable economy and exchange rates, and policies which serve to attract private sector investment, all act as constraints to development.
- **Bureaucratic constraints.** It is accepted that there would frequently be cultural, social, economic and political constraints. But, common bureaucratic constraints requiring a multiplicity of permits could be significantly improved by centralizing the permit process.
- **Sector Fragmentation.** Despite its overall importance, fisheries is recognized by its practitioners as fragmented both in terms of commodities and geography. The effect of this fragmentation is to seriously dilute the influence of the sector on the policy framework.
- **Sectoral Priorities.** Furthermore the commercial interests of the catcher, processor, and retailer seldom correspond, which results in further fragmentation. These and other factors often result in the sector receiving a low priority in the programs of governments and development assistance agencies.
- **Financial and Economic Constraints.** The world is in the midst of sweeping economic and political change, more restrictive lending approaches on the part of commercial banks, and a worldwide shortage of capital. All these trends will require new ways of approaching the structure and financing of new investment.
- **A More Complex Investment Environment.** Because it is now necessary to consider the social and environmental factors inherent in investment in development as well as financial and economic ones a greater need for more complex project analysis is called for than may have been true in the past. This presents a constraint in many developing countries where the basic data required for such analysis does not exist in a form accessible to the private sector or does not exist at all.
- **Operational and Commercial Constraints.** There are many operational and commercial constraints to be overcome. Among the constraints identified, the following appear to be the most important: high import duties--archaic customs regulations and practices--difficulties in securing spare parts--lack of appropriate infrastructure--shortages of trained personnel--sometimes the lack of an enterprise culture or the presence of a political culture actively hostile to enterprise--failure to perceive the importance of fisheries as a major contributor to food supplies, employment, and foreign exchange--and a banking system that is often unfamiliar with the dynamics of

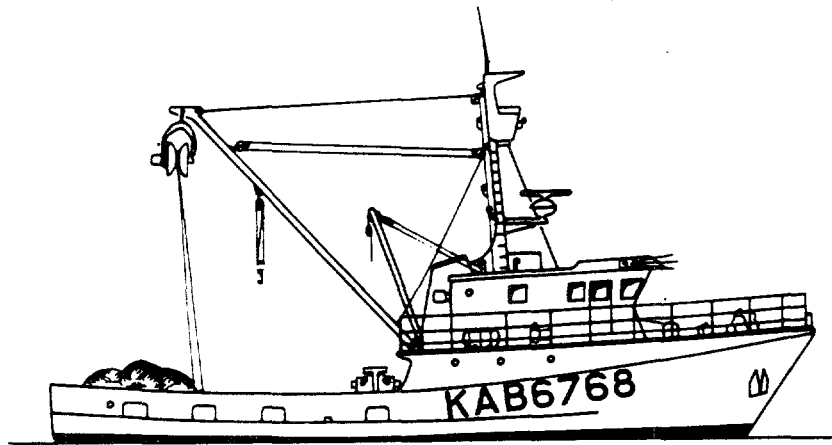
fisheries and lacks understanding of the cyclical nature of fisheries production.

- **Eastern Europe.** The emerging situation in Eastern Europe represents a particular challenge for fisheries development and private sector participation, along with a set of special constraints. Opportunities for access by Eastern European fleets to the fishing grounds off foreign countries is declining, severe shortages of capital exist, along with high interest rates, problems with loan guarantees, and a lack of management personnel and a lack of a stable economic and political climate, all act as constraints to investment.

A number of informal recommendations were made by consensus and among them the following are of importance:

- The World Bank Group should give greater emphasis to: (i) intellectual and financial support for resources management programs; (ii) monitoring control and surveillance programs; (iii) using its influence with some countries to urge a more responsible attitude toward the development of the fisheries sector; (iv) encourage clearly drawn fishing agreements and fisheries licensing policies; (v) promote and support investment in improved processing and marketing facilities, particularly for high value-added products; (vi) continue its role in providing physical infrastructure, training and institution building. It was encouraged to consider a more flexible policy regarding the sizes of loans (smaller) and the financing of second-hand equipment in some situations.
- The Bank should take into account the need for more technical and training inputs in the growing number of world-wide aquaculture projects, as well as to keep in mind the problems which might occur if excess production of aquaculture products entered global markets, particularly for shrimp.
- IFC should be encouraged to increase its involvement with smaller sized projects. Currently the Corporation has the following mechanisms to deal with smaller projects: (i) through trust fund arrangements it can provide assistance in the preparation of feasibility studies; and (ii) the three IFC sponsored regional organizations--The African Project Development Facility, The Caribbean and Central American Advisory Service and The South Pacific Project Facility, as well as the IFC local/regional offices administered Africa Enterprise Fund. All these have guidelines which will accommodate loan minimums in the range of US\$1.5-2.0 million. More conventional IFC lending usually involves a total IFC commitment of not less than about US\$5.0 million (total project cost then equal or are greater than about \$10.0 million).
- The amount of information relevant to fisheries development in the data banks of multilateral agencies is vast, but such information often does not reach end users, and it is recognized that much of the responsibility for this lies in the hands of governments. But for the purposes of better information exchange it was recommended that a continuing dialogue be established between the agencies and the private sector.

- It was urged that multilateral and bilateral agencies develop closer associations with the private sector and that the projects in the fisheries sector have greater commercial applicability than in the past.
- The Bank should continue its efforts to develop a coordinated approach to the views and concerns of the various agencies, and representative private sector participation should be permitted in some interagency deliberations.
- The Bank should give particular regard to the problems of the fishing industries of the Eastern European countries.
- The Bank should continue its initiatives in respect to increased private sector development.
- The Bank should periodically convene a follow-up to the Working Party Meeting, including a broader representation from industry and development agencies.



*Small Purse Seiner  
Length 22m*

## B. SUB-SECTORAL STRATEGIES

While the overall strategy introduced above fits well into a four-part set and provides a good foundation for the overall concept for the sector, the sector does not conveniently fit into such categories. Therefore, this section assesses important sectoral elements, many of which may overlap, in a way which associates recommendations about strategies with

individual sectoral elements. The elements are as follows:

- Improving Resource Management
- Managing the Environment
- Developing Human Resources
- Developing Aquaculture
- Developing Artisanal and Inland Water Fisheries
- Developing Industrial Fisheries

### Improving Resources Management <sup>21</sup>

"To manage or not to manage.  
'The future of capture  
fisheries' hinges on it".

Anonymous

In 1981, FAO estimated that 20-30 million tons of fish could be added to the world catch -- at least half of that through better resource management.

The potential for major increases in the harvest of fish from the industrialized fisheries and those from many semi-industrialized fisheries is limited, as discussed in Chapter III. The potential for increase in harvest from artisanal fisheries is not as well known because of limited resource surveys and unreliable landing records. But, most knowledgeable observers believe that the potential is sharply limited for increase among most artisanal capture fisheries.

The causes of the problems with common property issues, over-fishing, environmental degradation, etc. are imbedded in the social, economic, and political environment in which

they occur. To be effective, policy and management solutions must address the same environment.

### Addressing the Issue of Tenure

The fact that worldwide capture fisheries do not offer significant opportunities for expansion of catch through present harvesting technologies should not be interpreted as implying that fisheries lack the capacity to make a major contribution to national economies. The potential net benefits of capture fisheries could become extraordinarily large provided the most important constraints to the sector's development are properly addressed.

Experience acquired in a number of countries, e.g., Australia, New Zealand, Iceland etc. which are successfully addressing



the "open access" or tenure issue, are a clear example of the validity and importance of resources management in the sector's development. But, in order to translate the experiences acquired in the implementation of a variety of management regimes to the circumstances of the developing countries, much more adaptive research is needed including elements drawn from the biological, physical and social sciences.

While the above problem may be viewed as one of open access, due to the present level of resource exploitation, solutions appear to lie in the area of exit. By this we mean that for the most seriously affected fisheries the problem of reducing effort among already heavily invested participants is a daunting one, and will require the strong support of research to find appropriate solutions.

### **Aquaculture and Small-Scale Fisheries**

Aquaculture also offers major economic, social and nutritional development prospects if approached correctly. Management and research strategies in this case should focus on mixed-farming systems and small-scale fish farming.

The economic and social development of small scale fishing communities is an issue of considerable significance since no ready-made solution exists to the problems of increasing population growth among those who attempt to harvest near-shore fisheries. Such growth occurs both by increases in the natural population of fisher-folk as well as migration from other areas due to other sectoral resource constraints. High priority should be given to research on this topic with a strong sociological component for a proper understanding of the parameters that govern

the development prospects of such communities.

### **Conservation of Natural Aquatic Resources**

Conservation of the aquatic environment is key to the sustainability of fisheries and aquaculture. It hinges on the ability of the society to deal with a highly complex problem: how to reconcile market forces with conservation of natural ecosystems which cannot be allocated individually. Management and research models should be developed for testing new concepts, approaches and methods.

### **Artisanal Fisheries**

For the artisanal fisheries particularly, many, perhaps most, of the structural problems with this sub-sector fall outside the sector in the larger framework of society. Until some of the fundamental issues of poverty and employment are successfully addressed it will be difficult to see much improvement in the fundamental aspects of artisanal fisheries management. However, on a case by case basis, solutions have emerged.

### **Destructive Fishing Practices**

In most of the more densely populated countries, there is over-fishing by artisanal and semi-industrial fishermen and competition for access to the same fishing grounds. In addition, the highly deleterious use of environmentally damaging, mostly illegal and destructive, fishing methods, such as dynamite and cyanide, are extremely harmful to both the fishermen and to the fisheries.

The use of dynamite and cyanide threatens the long-term productivity of the resources as

well as the livelihoods of the persons who depend on them, but the short-term gains are often persuasive to poverty stricken fishermen, and appear to be similar to the forces which cause farmers to consume seed grains during famine.

Another example where management and technological improvement could prevent waste is in fisheries that use very small mesh size nets which kill fish before they reach sexual maturity, as well as killing many small species in multi-species tropical fisheries. Often, the incidental catch of nonselective fishing gear is simply dumped overboard, and only the targeted species are kept. The best general examples are the fisheries for shrimp. In other worst case scenarios, the roe of some species is the target and once obtained, the remainder of the fish is thrown back to the sea (e.g., herring and more recently Alaska pollack).

Resource management in many of these cases could result in significant increases in yield if fishing effort was substantially reduced, the use of damaging fishing methods was brought under control and incidental catches reduced by using selective gear.

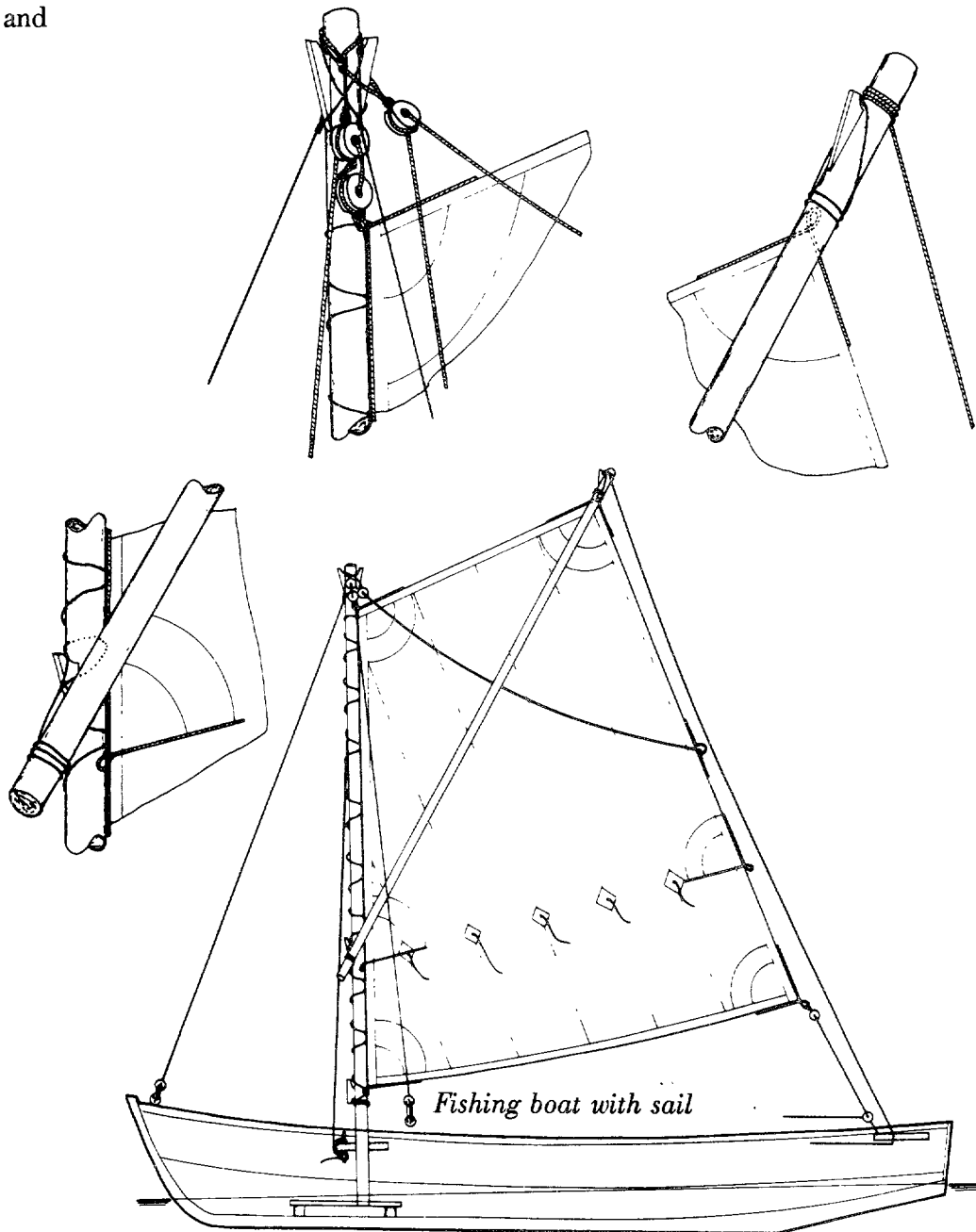
### **Strategy For Improving Resource Management**

In formulating sectoral plans, research programs, or institutional development projects, the Bank should support the design and implementation of:

- fisheries legislation with emphasis on a Fisheries Management Regime, encouraging a Fisheries Management System, a Monitoring Surveillance and Control System and a Fisheries Judicial System;
- programs to strengthen or create local or regional research facilities, and provide necessary training and equipment to support resource management;
- systems for monitoring control and surveillance of local and/or foreign fishing activities, including the establishment of appropriate data collection facilities, statistical training, hardware and software, and technical assistance;
- policy measures designed to resolve local fisheries tenure issues and the establishment of satisfactory property rights and/or other measures, including practical alternative regulations to prevent an unwarranted increase in fishing effort;
- options which may provide viable solutions to the problems of "exit" which is perhaps the major issue resulting from open access policies. The results of the assessment being carried out as indicated in the Introduction would be integrated into the strategy for resource management;
- programs to insure greater involvement of producer fishermen and processors in the development of regulations which affect them. -- Perhaps the greatest source of failure of many existing management regimes is that they are often conceived, drawn up, implemented, and enforced by persons with little intimate knowledge of the day-to-day realities of the production system,

and the human interactions at work in it. Such regulations are often perceived as being unfairly imposed on the users and generate little support for their implementation. The immediate consequence of this is that they fail. It is for this reason, among others, that more sociological and social science research on these questions is needed; and

- programs to support management strategies at the artisanal, semi-industrial and industrial levels, such as vessel buy-back programs, transferable quotas, and tax schemes, coupled with and provided that concerted actions are taken to improve employment opportunities in other sectors (e.g., through training and education).



## Managing the Environment

"There is only one earth. It is a tiny, precious stone.  
Let us treasure it; there is not another one."

Michael Collins  
NASA Astronaut

The impact of development projects on the aquatic environment has often been neglected, largely due to a lack of understanding about the fragility of the aquatic environment and its relationship to terrestrial environments.

During the last few years, however, there has been growing awareness of the scope of environmental problems with international implications. Such examples are: global warming (where the oceans may play an important role as a sink for CO<sub>2</sub>), the use of the oceans as dump sites for urban garbage, chemical, biological and nuclear wastes; ozone depletion (particularly the ozone "hole" over the Antarctica and its possible effect on the ecosystem); acid rain (with devastating effects in aquatic life in freshwater rivers and lakes); and "drift net fishing" in international waters.

Such systemic malfunctions pose a serious threat to aquatic ocean resources. These and other hazards have created the need for concerted local, national and international actions to deal with the resultant environmental threat to the global environment.

The lack of appropriate resource management policies, programs, and the means to enforce them has often resulted in abuse of the aquatic environment. The example of over-fishing has already been discussed.

Developers of culture fisheries have also been guilty of abusing the aquatic environment. Mangrove swamps, which are highly complex, productive natural systems, have been destroyed to build ponds for rearing fish and shrimp.

The stocking of alien species has been practiced in lakes, reservoirs and bays, with the result in a number of cases that native populations have been destroyed, impacting negatively on bio-diversity.

Recently the intensification of cage culture in the open sea has begun to create pollution problems from the accumulation of detritus on the bottom when there are poor water circulation conditions.

The spreading of diseases in open sea cage culture is also becoming a matter of concern.

Fisheries habitat has been harmed or destroyed by activities outside the fisheries sector. Examples include the discharge of mine tailings into rivers, the runoff of herbicides, pesticides and fertilizers from agriculture areas, the release of industrial pollutants directly into nearby waters and indirectly through acid rain, and the building of dams for irrigation and hydroelectric power disregarding their effect on the stream fauna.

The lack of appropriate management of coastal zone areas, which still requires a great deal of research work to fill knowledge gaps, is in many areas leading to a degradation of the environment and depletion of the resources.

It is widely believed that the increased release of carbon dioxide (CO<sub>2</sub>) into the atmosphere due to man's activities may directly affect the earth's climate and the levels of dissolved CO<sub>2</sub> in the oceans.

Global warming may also have an effect on the chemical and physical properties of the marine environment by altering temperature, ice cover, turbulence and current patterns in the upper layers of the ocean.<sup>22</sup> The effect of such changes on fish stocks would undoubtedly be great, but the details are considerably beyond the scope of our present understanding of the system.

Some of the best evidence of the kinds of damage that massive alterations in the marine environment could bring is demonstrated by natural phenomena, such as El Niño<sup>23</sup> -- the warming of the South Equatorial Pacific that occurs periodically about Christmas time.

El Niño has varied greatly in intensity, and has had sometimes devastating effects on fisheries and other economic sectors. The 1982/83 El Niño caused substantial changes in world climate and affected the fishing industry from Chile to Seattle, Washington. The most affected areas were Ecuador and Peru, where the estimated damages to fisheries amounted to around US\$230 million.<sup>24</sup>

Red tides, the causes of which are not well understood, but are increasingly being attributed to fertilizer and other chemical runoff, are another example of natural occurrences due to environmental anomalies. They can have devastating effects on some fisheries, particularly on extensive aquaculture of filtering species (oysters, mussels, etc.) The economic impact of red tides on established fisheries has been more severe than all the oil spills known to date.

### **Strategy for Managing the Aquatic Environment**

The importance of the environment to the fisheries sector cannot be overemphasized. Thus, the Bank should provide assistance in its operations to:

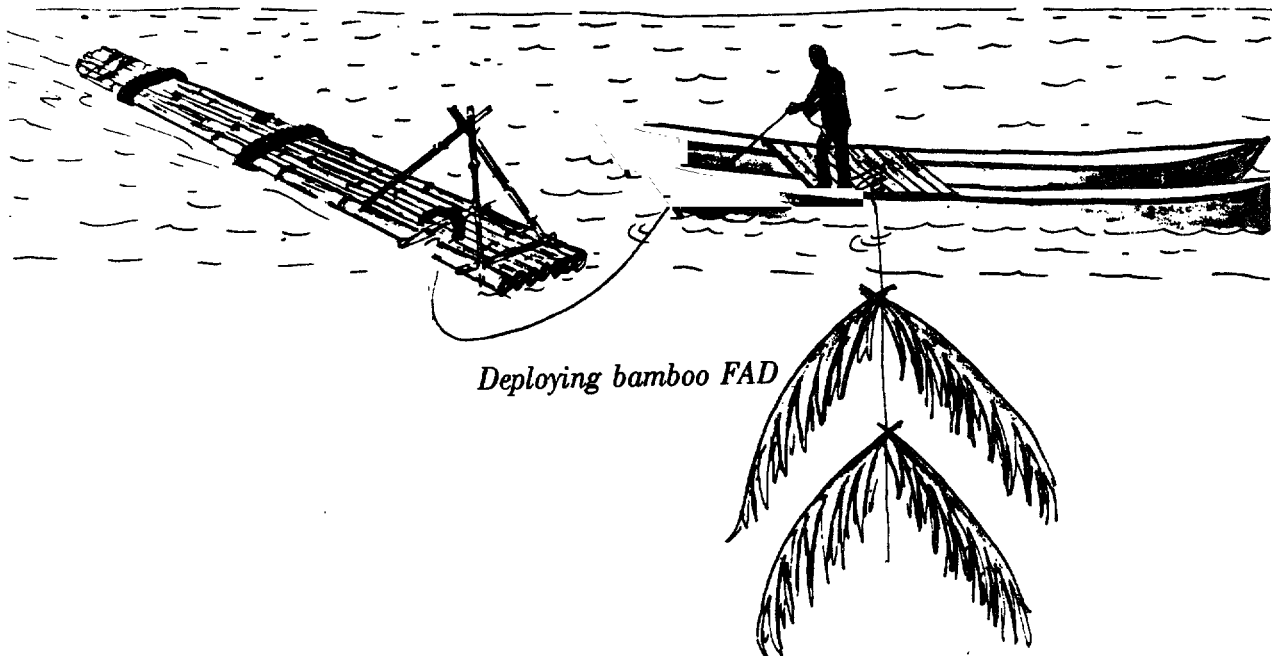
- design and implement appropriate national policies, strategies and legislation to prevent damage to the environment due to fishery development;
- assess the damaging effects that projects outside the sector may have on aquatic life and design ways to prevent or reduce them;
- support national efforts to rehabilitate damaged estuaries, streams, rivers, coral reefs, etc. Any associated research programs should be coordinated with the Research Initiative mentioned in the discussion of fisheries research;
- support experimental work needed to analyze the cost-effectiveness of improving fisheries habitat using techniques such as artificial reefs.

Should research work be required, this should be linked to the Research Initiative. The Bank should continue its involvement in international forums to bridge the gap between experimental habitat improvement and large scale applications by the public and private sectors<sup>25</sup>;

- promote an integrated approach to river basin and delta management, drawing *inter-alia* from successful examples as the Tennessee Valley Authority and the Thames Water Authority, taking into account the differences between North and South and the viability of applying such experiences in the developing world.
- encourage international agreements, between riparian states, when water courses go through more than one country, to avoid isolated and uncoordinated actions leading to waste. The preparation of guidelines for

irrigation, forestry, drainage, transport and fisheries, in connection with coastal zone development, should be strongly supported;

- support coastal areas' integrated-management research programs, encompassing all other activities that have an impact on coastal zones; and
- support programs associated with the conservation of bio-diversity in the aquatic environment (the Lake Malawi Conservation of Bio-diversity Project is a good example).
- support such organizations as "The Tropical Ocean and Global Atmospheric Programme" (TOGA), the objective of which is to determine to what extent the climate can be predicted. One of TOGA's targets is to better understand and forecast El Niño phenomenon. Association with such a program would be therefore highly desirable.



## Developing Human Resources

### Recognizing the Role of Women in Fisheries

"...coping with an extraordinary occupation."

ICMRD University of Rhode Island

The role of women in development has been systematically neglected. When financing artisanal fisheries projects, there has been a tendency to provide support to fishermen on the assumption that benefits would trickle down to the women. The truth is that it hasn't -- although women occupy an important part of the fisheries work force, from processing through sales to financing fishing activities.

In small-scale aquaculture activities, women are generally responsible for fry collection and the day-to-day care of the fish pond(s).

In fisheries, a large number of activities are traditionally performed by women. For example, in the processing industry women are more often employed than men, carrying out filleting, canning, grading and packing.

There is a widely held perception throughout the industry that women are more careful in carrying out certain steps of the fish processing activity than men are. In addition, salaries go directly to women many of whom are single mothers.

At the fishing village level, women are involved in a broad range of activities which include marketing, processing (e.g., smoking) and at times even financing (e.g., West African mammals). Women have traditionally played an important role in the wholesale and

retail marketing of fish. Indeed around the developing world, butchers are generally men but by and large the people selling fish at wholesale and retail levels are women.

One important constraint that hampers an increased role for women in fisheries is the lack of opportunities to benefit directly from knowledge transferred through government extension services or training. The reasons for this are varied and may include cultural bans against women being in contact with male extension agents and the choice of socially and culturally inappropriate hours, duration and location for training which do not take into account the other responsibilities of women.

#### Strategy for Human Resource Development

The Bank recognizes the important role that women play at all levels of the fishery sector, and should direct its development activities to:

- encourage countries that are in the process of developing the fishery sector to support the participation of women in activities where their skills can be effectively utilized;
- determine the current role of women in the fishing industry and related activities, the way in which labor is

allocated by gender in the industry, and the attitudes of women toward change if change is deemed necessary or desirable;

- determine the degree of awareness on the part of individuals responsible for promoting change in society and how to fully involve women in the desired changes;
- devise mechanisms at the fishing village level to fully inform women (routinely ignored in project design and implementation) of the financial, labor and other requirements of the proposed projects, and reflect to the greatest degree possible any suggestions which they may have about the requirements. Since women normally participate in

household financial decisions and do much of the post harvest work, as well as in fish farming operations, their views could prove to be most helpful to project success;

- encourage and support women's groups (e.g., self-help, savings and credit) organized to improve their benefits from processing and marketing activities at the fishing village level;
- explore the use of organized women's groups to funnel credit to the different activities that require financial support at the fishing village level; and
- support programs and projects designed to improve the wholesaling/retailing of fish, with emphasis on the benefits that may accrue to participating women.





## Aquaculture

"...a multi-story food factory."

Woods Hole Oceanographic Institution

The last few decades have brought a great number of technological advances in aquaculture; the most important one is the use of hormones to control fish breeding. This significant breakthrough has allowed spectacular increases in supplies of fish seed. As a result, it has been possible to bring many species under cultivation -- e.g., trout, tilapia, carp, shrimp, sturgeon, catfish, salmon, and sea bass. Other technological advances, such as cage culture, have also been made possible by technical advances in the production and feeding of fingerlings.

Production data from aquaculture is somewhat inaccurate due primarily to (a) the low value placed by most countries, until recently, on the production of inland fish, which has led to low priorities for data gathering systems in many countries, and (b) the practice of including aquaculture statistics in the landing records of wild fish from inland waters.

Aquaculture has grown significantly in recent years as shown in table 4. According to FAO, **fin fish production** from aquaculture has grown from about 4.3 million tons in 1984 to about 7.1 million tons in 1988, an increase of 64.24%. **Crustaceans** have increased over the same period from about 227 thousand tons to about 608 thousand tons and increase of almost 167%. Total 1988 production from fish, crustaceans and molluscs was about 8.4 million tons. In addition about 3,5 million

tons of cultured seaweeds were produced annually.<sup>26</sup>

Polyculture (aquaculture of more than one species which feed at different depths of the water column) allows for an efficient use of land space and high yields. Asian carp culture is an excellent example of this type of culture system.

Because fish do not require energy to maintain body temperature and are less affected by the forces of gravity, they tend to be more efficient feed converters than mammals and birds,<sup>27</sup> giving them a competitive production advantage.

Extensive aquaculture in bays and close to shore, e.g., oysters, mussels, clams, scallops, represents a substantial portion of total world production, estimated at 50% in volume of total current aquaculture production. Feeding through filtering nutrients from the water (plankton), the farming of such sessile species is very promising in many areas of the developing world.

In terms of yield, aquaculture has considerable potential. For example, natural pasture can produce 50-100 kg/ha/yr of range cattle or sheep, and improved rich pasture 300-700 kg/ha/yr. In inland waters, lakes and large reservoirs, natural fish production ranges from 50-150 kg/ha/yr. However, traditional tilapia or milkfish farming in the

Table 4

Indicative Estimates  
Aquaculture Production  
1984 - 1988  
Fish, Crustaceans and Molluscs  
Million m. tons

Species Group	Years				
	1984	1985	1986	1987	1988
Total Fin Fish (carp etc.)	4.3	5.0	5.7	6.5	7.1
Total Crustaceans (shrimp etc.)	0.227	0.276	0.389	0.589	0.608
Total Molluscs (mussels etc.)	2.3	2.5	2.8	4.7	3.7
Total Fish, Crustaceans and Molluscs	6.8	7.7	8.8	11.7	8.4

Source FAO.

Philippines and Indonesia can produce 300-1350 kg/ha/yr. Carp culture in Taiwanese ponds reaches 700-3500 kg/ha/yr.<sup>28</sup>

Much higher yields have been reported for some intensive operations. Such high yields, however, also require extraordinary production inputs, management, feeds, and pure water. High-intensity production systems are also subject to disease outbreaks and environmental shocks at a greater cost per unit than extensive production methods.

High-intensity production systems are also subject to great financial risks. For example, the high cost of production can be devastating

to the producer when prices drop due to market forces, disease strikes, or floods damage the ponds and release the crop. Because at harvest it is not uncommon for the producer to have invested as much as 75%-85% of the wholesale value of his crop in feed, salaries and energy costs, if the crop is ruined, so frequently is the producer. On the other hand, the costs of feed, salaries and energy for extensive area culture are among the lowest cost inputs.

#### Classification of Aquaculture

There are many useful ways to divide or classify aquaculture, which could lead to a

better understanding of the activity. For the purposes of this paper, aquaculture has been divided into two broad areas: culture-based fisheries, including extensive area culture and aquaculture as traditionally defined.

### **Culture-Based Fisheries**

#### ***Lakes and Man-Made Reservoirs***

Large, short-term increases in fish production can be attained by the stocking of natural and man-made water bodies with hatchery-reared fingerlings. Release of hatchery-reared salmon which return to their point of release after several years has been a traditional commercial practice in the U.S., Japan, Scotland, Finland, etc. Chile has recently joined the northern hemisphere producers following a period of successful adaptive research.

The success of culture-based fisheries in increasing production will depend on where the fish are released -- in lakes, man-made reservoirs, flood plains, or the ocean -- as well as on the production techniques and the timing of fingerling releasing.

Since man-made reservoirs alter the habitat of naturally occurring species in the area by preventing migration up and down stream, there is a great reliance on culture-based fisheries to restore or replace these fisheries.

Damage to downstream fish habitat can be minimized if there is a careful assessment at the planning stage of the effects of river barriers on native fauna. The reservoir itself can be made productive with careful selection of species to be stocked and management of their harvest. In a number of cases, the stocking of appropriate species in a new reservoir followed by the development of

aquaculture has resulted in a significant improvement in the income of the displaced farmers that operated in the flooded area<sup>29</sup>. Such examples are worth emulation since one of the biggest problems in reservoir development is involuntary resettlement of the farmers of the flooded area and the eventual drop in income for those displaced.

An estimated million hectares of reservoirs will be developed by the year 2000, 85% of them in Third World countries.<sup>30</sup> Properly stocked and managed, these reservoirs could contribute an additional 400,000 tons/yr of fish, based on a conservative estimate of 35 kg/ha/yr. The total gain would be reduced somewhat, however, by the loss of downstream production.

Production from lakes and man-made reservoirs is greatly influenced by rainfall patterns as seen in Lake Chad, Mweru Wantipa (Zambia) and the Kariba reservoir shared by Zimbabwe and Zambia. Close monitoring of rainfall should be an important determinant in managing fishing effort to avoid over-fishing.

In addition to large reservoirs, many smaller bodies of water used for domestic water supplies, cattle watering and irrigation can be turned to fish production if appropriate stocking and management practices are implemented. Productivity of small reservoirs could be higher than large ones due to more rapid nutrient cycling. There are hundreds of thousands of small reservoirs in the developing world, a few of which have been used for fish production and many more could be.

#### ***Extensive Area Culture: Flood Plains***

Large flood plains are particularly abundant in tropical areas. There are millions of

hectares of flood plains in the developing world. In Bangladesh, for example, where flood control, drainage and irrigation development have reduced the area of flood plains, there remain an estimated 5 million hectares of flood plains. Tropical flood plains are known to produce wild fish in great abundance. The potential of this environment to increase production through culture-based activities is believed to be high. The current knowledge about this form of production is, however, somewhat limited. Development of this knowledge base is therefore necessary prior to venturing into large flood-plain based investment projects.

In the Amazon Basin, a complex interaction between the seasonally flooded forest and aquatic life, including important fish stocks, has developed undisturbed through many thousands perhaps millions of years. Great caution should be exercised when consideration is given to altering the ecological balance through the introduction of hatchery-raised fingerlings, or the use of non-native (exotic) species.

Special consideration should also be given to the development and use of native species, avoiding the introduction of exotic, perhaps superficially more productive species. The introduction of the North American game fish species *Micropterus salmoides* (Black Bass) devastated the natural populations of fish in many lakes in Central America in the early 30s and their natural fauna has not yet recovered, and probably will not.

#### ***Extensive Area Culture: Sea Ranching***

Sea ranching (the release of hatchery-produced small fish to the open ocean) has been practiced with salmon in Japan, the United States and other countries. In recent

years, the improvement of production techniques and the timing of fingerling release has substantially increased the recovery rates for adult fish.<sup>31</sup>

In Japan, sea ranching of a number of species has provided employment to fishermen operating in areas where stocks have been heavily exploited. The economics of such activities, however, have not been fully evaluated. Further studies will be required to determine the technical and economic viability of sea ranching with a variety of fish species in developing countries.

#### ***Herding***

A new experimental technology in the process of development in Japan has introduced the concept of open sea fish culture by associating the production of underwater sound with feeding. Fish are conditioned from early stages to associate specific sounds with feeding. Once released in open bays and allowed to grow, they apparently continue to respond to this early conditioning. Feeding then becomes supplementary to the naturally available food. Fishermen then catch the fish at feeding time when they reach commercial size. The economic, financial and commercial feasibility of this technique is still being assessed.

#### ***Strategy for Culture-Based and Extensive Area Fisheries***

On matters related to culture-based and extensive area fisheries, the Bank should:

- help countries in the early stages of reservoir planning to reduce the downstream environmental impacts and enhance fish production in the reservoir.<sup>32</sup>

- help in the establishment of appropriate reservoir parameters -- e.g., stocking requirements, sources of fingerlings, hatcheries, number of fishermen, quantity and kind of fishing equipment and need for government services -- once the physical characteristics of the reservoir have been established and the geochemistry of the watershed and related factors identified.
- help assess hydrological and socioeconomic implications of current flood plain activities for the purpose of establishing rational culture-based fisheries development programs.
- in the short and medium term, limit the size of culture-based flood plain fishery projects to areas of 100,000 ha or less until better knowledge of this activity is acquired. Give high priority to socioeconomic and environmental considerations in project rationale.
- support research into the technical and economic viability of sea-ranching and herding operations.

#### **Aquaculture as Traditionally Defined**

For the purpose of this paper we will discuss separately:

- large scale, profit-oriented aquaculture designed to meet increased demand for high-priced fishery commodities; and
- small-scale, socially-oriented aquaculture, associated with the high priority that Third World countries are attaching to rural development.

#### **Large-Scale Aquaculture**

Commercial viability of aquaculture of species, such as trout, salmon, mussels, milkfish, carp, catfish and shrimp, has allowed private industry to take the lead in their development. For species such as salmon and shrimp with well established markets and growing demand, aquaculture has allowed supply to increase despite the limited catch from natural stocks.

Motivated by the prospects of high financial returns, relatively large private sector salmon firms in Norway, Scotland, and Chile<sup>33</sup> and shrimp, milkfish and carp farmers in developing countries have done the necessary research, developed the appropriate technologies and provided the necessary investment.

IFC, the private investment arm of the World Bank Group, is currently involved in several shrimp farming operations<sup>34</sup> and is entertaining several other proposals.

Shrimp culture projects can be found all over the world, from industrial nations to tiny island states, but most activity in the next 15 years will probably occur in Asia and Latin America.

Some other species that promise high returns, and that have attracted the interest of the private sector, are abalone, scallops, sea bass, sea bream, flounder and turbot. There will likely be significant progress on the culture of these species in the near future.

#### **Strategy for Large-Scale Aquaculture**

Private initiative in developing countries has relied on commercial banks and other private financing sources to meet its investment

needs. However, the flow of commercial credit to fisheries has been severely restricted due to the reduction in overall credit levels, the non-market rationing of credit, and the growing debt of the public sector. Also environmental considerations have seldom received adequate attention in large-scale aquaculture projects.

Therefore, there is an increasing opportunity for development institutions such as the IFC, the IFC Project Development Facilities (Caribbean, African and South Asian) the IFC African Enterprise Fund and the Bank's Industrial Development Finance (IDF) complex (all finance private investment) to expand their assistance to large-scale aquaculture for environmentally sound development.

Whenever the World Bank Group participates or promotes private investment in aquaculture, it should:

- assess the environmental impact of the proposed venture;
- conduct appropriate market surveys;
- test the technical, financial and economic viability of a proposed venture by applying pilot scale trials before implementing full-fledged investment projects;
- confirm the availability of commercially viable technology, including hatcheries when appropriate; and
- confirm the availability of skilled manpower and assess existing or needed training capabilities and timetable requirements.

### Small-Scale Aquaculture

Like small-scale fisheries, rural aquaculture is gaining interest among governments and development institutions due to the potential impact for diversifying and integrating rural production, creating alternative employment opportunities, producing high protein foods, improving the living standard of the rural poor, and generating export earnings.

Depending on the species involved, and local social, economic and environmental conditions, rural aquaculture may take a variety of forms -- from low-input extensive systems producing food for local needs to intensive but small-scale operations aimed at urban or export markets. Both types can contribute significantly to the welfare of rural communities.

Consistent with its policy of privatization and promotion of private investment in production and marketing activities, the Bank should:

- support small-scale aquaculture development, taking into account the diversity of problems and the levels of development on different continents, in different regions, and even within the same country; and
- encourage, whenever possible, hatchery production of fish seed by the private rather than the public sector, because the private sector is better suited to provide a sustainable production of seed supply in most circumstances.

### Constraints to Overcome

In Asia, for example, some of the most significant problems are: (i) how to improve

old ponds with multiple owners, (ii) what leasing terms to arrange for public waters, (iii) how to increase the number of hatcheries and skilled personnel to run them, (iv) how to increase the base supplies of feed and fertilizers, and (v) how to strengthen the legislative base to support aquaculture.

In Central and South America, sudden growth in aquaculture has been associated with high value species such as shrimp. The main problems are insufficient diversification of the production base to include other species for export or for the domestic market, particularly in countries which are net importers of fish, and inappropriate legislation to promote aquaculture.

In Africa, aquaculture development has been extremely modest. At all levels, the lack of skilled manpower is the most acute problem, due to the absence of a traditional base for fish farming, therefore training is an urgent need. Lack of local capital and appropriate mechanisms to promote foreign investment are also hampering development.

### Strategy for Small-Scale Aquaculture

Rural aquaculture requires relatively more technical staff inputs than its large-scale counterpart, therefore, the Bank should make extra efforts to:

- coordinate its actions with other agencies, paying particular attention to the possible assistance of NGOs.

Subsistence fish farmers face a shortage of capital and practically no access to formal credit; their integration with the cash economy

is weak, and the transfer of technology relatively slow. To make fish farming a successful rural activity, the Bank should, provide assistance to:

- conduct national and regional surveys (sub-sector surveys) focused on country problems and perspectives for aquaculture development. The appropriate use of Geographic Information Systems and remote sensing technologies in close cooperation with FAO would be highly desirable;
- develop testing units or demonstration facilities specifically designed to provide information on such topics as pond design, farm size, species to be cultured, expected yields, feed conversion rates, growth rates, market prices and consumer acceptance;
- develop an appropriate pace for introducing new technologies, stressing the improvement of present practices and emphasizing awareness of sociological implications;
- develop strong aquaculture extension services supported by appropriate training programs, which should include women, an important component of small-scale aquaculture;
- design mechanisms to link fish farmers with formal sources of credit; and
- support research on seed production, feed formulation, pond design, fish farm management and integrated farming systems utilizing mixed aquaculture/agriculture methods.

## Developing Artisanal and Inland Water Fisheries

"Put People First."

Michael Cernea

October 1985

Successful development of artisanal fishing communities is the biggest challenge institutions face in fisheries development. Worldwide, these communities contain more than 80 million people, often the poorest of the rural poor. The organizational, technical, marketing, managerial and political aspects of developing these artisans demand a well-thought out strategy based on the fundamental need to integrate the individual, family and community into the national economy.

Governments and development agencies have provided substantial assistance to artisanal fishermen. External assistance increased from about US\$21 million in 1978 to about US\$65 million in 1983. Since the mid-1970s, investment and technical assistance have been channeled through a wide variety of local organizations, including ad hoc fishermen's cooperatives. But these cooperatives were modeled on farming cooperatives, transplanted unchanged to coastal communities and with rare exception all failed.

Ambitious short-term investment projects demanded technical and organizational activities that were completely new to these communities. The fishermen and their families were inadequately consulted in planning of many projects, which were often oversimplified in design and insensitive to social constraints in the fishing communities. The operational capabilities of the

implementing institutions were weak, and the time needed for technical and organizational changes was too short to be accepted and sustained. With some valuable exceptions, from which lessons can be learned, project results have uniformly been poor.

The FAO, with funding from DANIDA and Norway, is implementing a novel program on Africa's west coast that is intended to overcome these deficiencies. An FAO strategy study points out that promoters of fishermen's cooperatives must take into account that "small-scale fishermen on different boats are in direct competition with each other for capturing fish and in most cases selling them also. Cooperation in production and mutual loan guarantee schemes may therefore conflict with the fishermen's perception of his own economic interests. They must be shown how cooperation (e.g., voluntary reductions in catch) can improve their economic well-being."

Extension services for fisheries, unlike those for farmers, do not have a simple "crop production package" to promote. Small-scale fisheries need a wide range of technical knowledge -- e.g., boat building, gear construction, seamanship, and fishing methods which may vary due to the species harvested - - and a skilled multi-disciplinary team to apply it. Only time will tell if the FAO program is effective, but the strategy of designing socially responsive technical assistance to pave the



way for investment projects fits the recommended fisheries strategy.

### **Strategies for Both Artisanal and Inland Water Fisheries Development**

In designing and recommending support for artisanal and inland water fisheries development, the Bank should emphasize the following:

#### ***Long-Term Development***

Financial assistance can only partially influence the pace of small-scale fisheries development. A single project will not make modern entrepreneurs of traditional artisans. Artisanal fisheries development requires a long-term approach -- a series of coordinated projects, or time slices of a program, over 15 to 20 years.

- Social and cultural feasibility studies should be carried out to develop a basis for the knowledge needed to develop project concept and design. Such socio-economic studies should constitute the first phase of almost all such projects. Socio-economic information would be crucial to the development of a successful project concept and design. If one had information about, for example, the structure of work groups, the division of labor by gender, kinship relationships in work group determination, the structure of local and regional organizations and their attitudes toward development projects, data on residential mobility, and the structure of local marketing arrangements and a number of similar questions, it would be far more likely that costly errors in design could be avoided.

- Technical assistance should precede any investment activity to pave the way for sound, bankable projects, and should be provided all the way from the steps outlined above through implementation and beyond completion as necessary to assure sustainability.

#### ***More Effective Interaction with NGOs***

Technical assistance should be designed to improve the living standard of small-scale fishermen as a priority above the traditional technology transfer approach. This is one reason technical assistance should not be provided only through consulting firms or individual consultants. Consultant costs are high, making a long-term approach expensive, and consultants are generally not willing to be stationed in the fishing villages.

It would be more cost-effective to use non-governmental organizations (NGOs) to provide non-financial assistance to small-scale fisheries. One approach would be for the Bank to organize a series of consultative meetings with the most representative NGOs to establish a program specifically designed for small-scale fisheries.

- Consultations should be geared to pooling human and financial resources, and to joint problem-solving, not just to assigning NGOs the work that would otherwise be carried out by consultants. A number of NGOs have indicated that they would favor such an integrated approach.
- To be successful, this too, would require a sustained commitment -- meetings and follow-up -- to continually monitor problems and develop the means to address them effectively.

### ***Aid Coordination***

Bilateral assistance to fisheries has proliferated during the last decade and has particularly focused on artisanal fisheries, where most of the problems of the rural poor appear to occur. The number of bilateral agencies, NGOs, charitable organizations, etc. tend to increase in a direct proportion to the level of under-development of the recipient country. This flood of assistance generally leads to a result in direct opposition to the objective that motivated the financial or manpower support in the first place, by overwhelming the fragile institutional base of the sector.

Clearly there is an urgent need for coordination in these circumstances. This can be achieved better if there is a well-defined strategy and an entity that can coordinate the assistance. The Bank should selectively take up such a role to:

- have a broad impact on development, since bilateral grant support has much to recommend it to recipient countries and appears more appropriate for small-size operations, which characterize artisanal fisheries projects.

### ***Cooperating with World Food Program (WFP) to Develop a Marketing Program***

Efficient marketing is important with a perishable commodity such as fish. Failure to develop and service low cost local markets has limited the development of local artisanal, semi-industrial, and industrial fishing. An understanding of this limitation has motivated the WFP and the FAO to develop ideas that may be useful in the early stages of developing fish marketing programs. The

Bank should cooperate and provide assistance in schemes that feature:

***Local Fish Used As Food Aid.*** The purchase by WFP of locally caught and processed fish for use as food aid, thereby providing the local industry with an outlet over an initial period until alternative markets are developed, and a self-supporting level of activities is reached.<sup>35</sup>

***Rural Transport.*** The development of a physical distribution and transportation system to move fish from surplus to deficit areas, developed by WFP.

### ***Reducing Waste; Insect Damage.***

Insect infestation losses of dried-fish are estimated to amount to millions of tons of fish a year, mostly concentrated in Africa. Despite extensive work to reduce the problem, no generalized solution can be applied. The chief difficulty is lack of knowledge, not poor implementation.

- Appropriate technologies should be developed through research and guidelines should also be developed regarding how much (or whether) insecticides should be used, and what level of chemical residues are safe in food products.<sup>36</sup> Since fish is dried at widely scattered sites, solutions like the use of insecticides would require substantial extension work and follow-up.

The Overseas Development Agency (ODA), the development assistance agency of the United Kingdom, has conducted a substantial amount of work in Malawi on the use of insecticides in controlling fly larvae infestation of dried fish. The commercial use of these

methods is now common in Malawi. Lessons learned from these experiences should be used to guide the use of such technologies elsewhere.

### ***Reducing Waste; Losses Due to Spoilage.***

An estimated 2 million tons per year of fresh fish landed mostly by artisanal fishermen in the developing world never reach consumers; the fish spoil in transit. The fundamental reason for this loss is poor handling and preservation facilities on board small vessels, inadequate marketing systems and supporting infrastructure. Governments that have established substantial development plans for the fishery sector have usually emphasized production. Boat building and motorization programs have received high priority, but handling and preservation have generally been overlooked, or managed poorly by government parastatals.

- Support should be given to the private sector through the design and implementation of marketing systems and infrastructure from landing through retailing. This applies to both large-scale and small-scale projects.

### ***Reducing Waste: Improve Poor Wholesaling/Retailing Facilities***

Distribution and sales of fresh fish in developing nations, particularly in urban areas, is very poor. As a rule, wholesale markets are unhygienic, undersized and poorly designed. They are often located at inappropriate sites that lack the required service facilities, therefore, enforcing reasonable standards of hygiene and quality control becomes difficult if not impossible. The fact that fish are highly perishable exacerbates hygienic problems associated with

transport and the wholesale and retail trade of fish.

- The common lack of an orderly domestic market means that support for a combination of policy and investment initiatives, along with local involvement, should be provided to develop an improved marketing system.

### ***Pre-Investment Studies***

Considerable pre-investment work will be required to analyze current activities and to design more efficient market systems. The strength and interests of different agencies should be incorporated in this work. Dialogues with governments should stress the importance of this issue and the urgent need to integrate marketing systems in fisheries development strategies, rather than approaching the problem in an ad hoc manner and treating it in isolation. Bank projects that include wholesale markets or similar installations with fresh fish facilities should:

- incorporate fish marketing expertise at the design stage.

### ***Setting Up Credit Programs for Low-Income Groups***

Poor recovery rates for credit programs are historically common in the fisheries sector, mainly because of difficulties institutional lenders encountered in dealing with many very small accounts in a sector accustomed to informal credit and inclined to view government credit schemes as grants.

Recovery of sub-loans is certainly more difficult when sub-lending is geared to low-income groups that require a lot of costly supervision. As a result, small fishermen,

agricultural laborers, landless people and artisans tend to be excluded from conventional sources of credit. These low-income groups often resort to informal sources of credit such as middlemen or moneylenders, whose supervision and credit recovery costs are low and interest rates high.

In the fisheries sector, a special relationship sometimes develops between the fishermen and middlemen, who know them personally and whose catches they market. Middlemen may absorb the risk in fish marketing and meet the fishermen's need for a regular market. In some such situations, the fishermen's access to informal credit through a middleman may constitute a desirable relationship.<sup>37</sup>

There is no easy solution to the problem of poor recoveries for institutional credit. To arrive at a viable solution, the Bank should support the:

- review of formal and informal credit arrangements for different geographical areas;
- establishment of self-help groups and savings and credit groups with strong NGO involvement;
- development of mechanisms to operate with existing networks of credit unions or similar organizations, which already deal with small loans and the rural poor; and
- exploration of mechanisms to utilize processors, middlemen and money lenders as intermediaries in credit schemes. (Such schemes are often criticized as giving such groups an unfair advantage over the fishermen.

But, if fish prices at the wholesale, retail and export level are regularly broadcast over the local radio station, everyone benefits from a more open and competitive market because such information is a powerful deterrent to potential abuses.)

### ***Strengthening Institutions***

Weaknesses in fisheries administration have often been identified as a primary cause of project failure. To ameliorate this problem, investment projects as a rule carry a component for strengthening institutions (e.g., train personnel and restructure public administration). Despite some beneficial effects, these components often lag far behind project implementation, and thus fail to provide the expected support. To make institutional strengthening more effective, the Bank should:

- implement in advance, preferably in cooperation with other donors, the technical assistance required by the fisheries departments and credit institutions that will carry the responsibility for executing future investment projects; and
- prolong the assistance as appropriate to assure sustainability beyond the life of the investment projects.

### **Strategies With Specific Applications for Artisanal Fisheries**

#### **Areas with Under-Exploited Resources**

Many inshore waters in developing countries are isolated from markets and lack the services needed to handle perishable commodities. Catches could sometimes be

increased substantially should these services be provided. However, to prevent the over-fishing that might result due to higher fish prices, resource management practices -- although difficult to implement in this type of fishery -- should receive special attention from the outset. Development in under-exploited areas could be achieved through the following:

**Infrastructure.** Improved transportation would encourage traders/transporters to serve fishing villages more effectively. Fishermen would respond to this increased demand by increasing quantities supplied. Where feeder roads to isolated villages are too costly, sea-collecting systems may provide an alternative marketing route. Where electricity and water are too expensive for producing ice and operating cold storage facilities, traditional processing by drying, salting or smoking should be encouraged. The Bank should also cooperate with other agencies to:

- support testing new technological approaches (e.g., wind turbine or solar power) to providing energy for ice and cold storage needs.

**Improving Fishing Gear and Methods.** Many artisanal fleets have begun motorizing because gasoline outboards offer simple, fast transport to and from fishing grounds. While outboard engines do not increase the efficiency of tasks such as hauling nets and traps, they have allowed fleets to expand their range and/or increase the number of fishing trips. The long-run net benefits of outboards will eventually be diminished because of the decrease in the fish stock due to greater fishing effort. The Bank, in coordination with other agencies and private sector interests, should encourage development work geared to:

- improve boat and sail design combined with fuel-efficient outboards or inboard diesels, and develop simple line hauling mechanisms for small craft; and
- develop fuel-saving passive or stationary fishing gear (i.e., gill nets, pound nets, traps, etc.) which is competitive in cost with traditional active gear.

### Areas with Fully Exploited Resources

**Limit Harvesting Capacity.** Development agencies should exercise caution in supporting recommendations about improvements in boats and fishing methods in areas where fish exploitation is at maximum sustainable levels. Improvements at this point, without limits on fishing effort, lead to over-fishing. Improvements can discriminate against those fishermen without access to the new technology. Development agencies should consider:

- any proposed changes in the light of resource capacity and the probable impact of improvements on local employment.

**Reduce Waste.** The Bank should devote greater efforts to support the reduction of post-harvest losses and improved handling and processing of fish. Support should be provided to:

- improve methods of onboard handling and preservation of fish without proposing such technological leaps that fishermen would either be unwilling or unable to use them;
- improve onshore handling through simple installations that allow gutting and washing of fish, whatever

preservation techniques are subsequently used;

- improve preservation methods, but avoid industrial technologies that are unrealistic for small-scale fisheries in developing countries; and,
- improve marketing mechanisms through a coordinated approach with fish traders who operate at the village level, and the participation of the WFP with its proposed schemes.

### **Areas With Over-Fished Resources**

Care in financing fisheries in such areas is required, because in the past, some poorly planned fisheries projects, rather than increasing overall production might have inadvertently fostered over-fishing and helped reduce total production and catch per unit of effort.<sup>38</sup>

When resources are seriously constrained, difficulties in defining the fishing grounds for industrial and artisanal fleets have occasionally produced violent conflicts between the parties concerned.

Often the lack of alternative employment opportunities prevents the application of sound resource management practices that would bring about an increase in catch per effort by reducing effort.

Financial institutions, however, can support such developments as artificial habitats (reefs) and aquaculture. These developments can sometimes be well used in artisanal fisheries, regardless of whether or not they are over-fished.

### ***Artificial Habitats (artificial reefs).***

Fishermen have known for centuries that structures that add vertical relief to the sea bottom, such as sunken logs or shipwrecks, often improve fishing in the area. Even oil rigs attract sea life. Prompted by over-exploitation of its waters, Japan has launched aggressive artificial reef programs in an attempt to regain lost fisheries habitat. It remains to be seen, however, whether such reefs simply aggregate fish or in fact increase the productivity of the area. Either way, fishing costs are lowered as a result.

Artificial habitats may also serve to physically protect and exclude the fishing grounds of artisanal fisheries from the intrusion of larger vessels. These areas of exclusion may also serve as a sanctuary for juvenile fish which later migrate out of the area and become available for harvest.

Because artificial habitats may aid artisanal fisheries by increasing their productivity, the Bank should provide strong support for:

- research work, needed to pave the way for investment projects, incorporating artificial habitat technologies; and
- conferences and seminars on the subject.<sup>39</sup>

***Brackish Water Aquaculture.*** In the absence of alternative employment for artisanal fishermen, brackish water aquaculture may in some cases be a viable alternative for fishermen displaced in an attempt to reduce fishing effort. But the potential high rate of return of brackish water shrimp culture has led to pressure to develop areas of mangrove forests.

These developments require a high degree of technical input and careful consideration of environmental, technical, social and political factors in the design and construction of such projects, if they are to have the desired outcome.

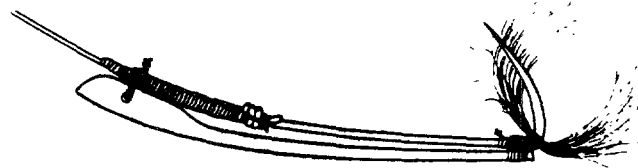
It is not widely appreciated that on the average, only 12%-18% of any given mangrove forest is potentially suitable for the development of shrimp farms because of the common and widespread occurrence of near surface acid sulphate soils in such environments and other physical and chemical problems. Acid sulphate soils poison ponds constructed for the purpose of growing fish or shrimp. The private sector seldom ventures into such areas, but governments are often inclined to do so.

Therefore, brackishwater aquaculture projects, which seek to provide alternative employment for coastal artisanal fishermen, require the highest standards of technical preparation and appraisal before they are financed.

The Bay of Bengal Programme (FAO, ODA, Swedish International Development Authority (SIDA), and DANIDA)<sup>40</sup> for small-scale fisheries development has had some early results that have encouraged artisanal fishermen to become brackishwater fish farmers.

Following this example, the Bank should:

- help develop means to reduce the risk of failure that may result from the substantial changes in the displaced fishermen's lifestyle, through the provision of sociological expertise in the development of such projects; and
- coordinate with other agencies to conduct the needed pre-investment work, and to evaluate and consider the technical, environmental and sociological costs and benefits.



*Surface lure, coconut fibre line,  
pearl shell, boar bristle, wire  
Polynesian Archipelago*

## Developing Industrial Fisheries

"Industry:...the unrivaled wheel of progress."

Anonymous

Marine finfish catches rose from about 20 million tons shortly after World War II to slightly over 60 million tons by 1970 and further to an estimated 86 million tons in 1990, as industrialized nations expanded their ocean-going fleets. Increasing demand for fish in home markets, sometimes coupled with declining yields in local waters, created the economic incentive for developed nations to exploit distant water fishing grounds. This was facilitated by factors that kept distant water fishing costs relatively low, such as onboard freezing capabilities, low fuel prices, and open and free access to rich fishing grounds.

After most coastal states adopted the 200-mile extended jurisdiction during the 1970s and signed the Convention of the Law of the Sea in 1982, the pattern of exploiting marine resources began to shift towards the coastal states, away from the distant water fleets. Coastal states with a long history of fishing were able to quickly replace foreign fishing in local waters. But others were unable to follow. Those states that lack the means (for a variety of reasons) to develop an indigenous industry, but have abundant resources and permit a significant amount of foreign fishing, may obtain significant incomes from the leasing of fishing rights to foreign countries.

Over 50% of the world's commercial catches and most unexploited fish resources are found off the coasts of developing states.

Those developing coastal states who have the potential and desire to develop their under-utilized resources, or profitably replace foreign fishing effort, must develop a fishery at the level of industrial-scale operations.

The Law of the Sea has made coastal states accountable for the management of fish resources within their EEZ. Many developing nations, however, lack the means and knowledge to assume those responsibilities and must rely heavily on outside expertise and financial assistance to develop the capability of managing their resources. The Bank and other development agencies have an important role to play in providing assistance through the private sector in this area.

### Strategy for Industrial Fisheries

To this end, in its strategy for industrial fisheries, the Bank Group should provide assistance through the private sector to:

- develop unexploited fish resources;
- rationalize foreign fishing;



- develop Fisheries Management Regimes(FMRs) and Monitoring, Control and Surveillance (MCS) Systems;
- develop fishing capabilities of coastal states;
- make better use of incidental catches;
- make better use of industrial catches; and
- improve international trade.

### *Developing Unexploited Fish Resources*

Several marine areas could sustain much higher levels of fishing effort, particularly in the Indian, Southeastern Pacific and Southwestern Atlantic Oceans.<sup>41</sup> The Bank has assessed under-exploited resources and considered how to harvest them. An estimated additional 3 - 4 million tons of resources could be under commercial exploitation by the turn of the century, but on the basis of present FAO projections, these gains are likely to be offset by declines in other older more heavily fished areas.<sup>42</sup>

The species with best prospects for increased commercial harvests are the small pelagics (i.e., anchovies, mackerels and sardines), and a few species of groundfish, particularly hake.

The structure of the industry necessary to harvest these resources efficiently depends on the economies of scale relative to industry demand. Species such as anchovies and mackerels are principally used for reduction into fish meal and oil.<sup>43</sup> Due to the enormous schools in which these fish are found and their relatively low price, the economies of scale for harvesting these

resources require extremely large output per firm. But there are a few exceptions, notably, for example, the West African sardinellas which are caught in relatively large numbers, using traditional pirogue with seine nets (as in Ghana and Senegal), and marketed as a food fish in the domestic market.

Low demand coupled with large economies of scale means that the most efficient industry will consist of a relatively few large firms. The exploitation of hake is a good example. Since hake is caught at considerable depths (100 fathoms or more), which requires heavy equipment, the fishery requires large-scale operations with onshore freezing and large processing facilities.

The market economy will be the dominant factor in the development of under-exploited fish resources. As demand for traditional seafood continues to grow faster than supply, the increasing price will cause an increase in demand for the under-exploited species. When the price is high enough relative to the cost of harvesting, their exploitation will become profitable and attract private capital. In many Third World coastal states, however, -- with little or no tradition in the sector, limited entrepreneurship capabilities, and insufficient capital -- little, if any, sector development will take place without assistance from development organizations. The Bank Group has a crucial role to play in promoting private sector development in these countries.

To this end, in policy lending operations involving the industrial fisheries sector, the Bank should:

- emphasize policies aimed to attract direct foreign investment and bring capital and know-how to the fishery sector;

- promote private investment, in cooperation with IFC, in specific projects by establishing pilot companies that, if proven viable, could later become operational companies; and
- design and implement programs to develop entrepreneurship and related skills in the fisheries sector.

### ***Rationalizing Foreign Fishing***

Licensed fishing operations and joint ventures off the coast of developing countries account for yearly catches of 6.1 million tons worth at least US\$4 billion.<sup>44</sup> The benefits from these catches accrue mainly to the foreign fleets because the contracts under which they operate typically favor the fishing nation. The coastal nation should receive benefits equal to the economic rent of the resource from the fishing nation. Gradually transferring these rents to the coastal state could contribute to development of its fishery without over-exploiting the resource, or the funds could be used for development in other high priority sectors.

In the short and medium term, licensing, joint ventures (see Table 3) and other contractual arrangements are appropriate mechanisms for the developing country to extract rents from their resource. This allows fishing to continue by the foreign nation until the coastal state obtains the capital and skills to exploit the resource itself. At the same time, the coastal states need accurate information to be able to manage the resources in their jurisdiction.

The Bank therefore should:

- help develop better contractual arrangement among parties to fishing

agreements, most of which are currently unfavorable to developing coastal states; and

- provide guidance and support to establish resource management programs, including software and hardware needed to establish resource data bases.

An example of this type of assistance is discussed in Chapter III, Ecosystems and Political Boundaries.

### ***Developing Fisheries Management Regimes (FMRs) and Monitoring, Control and Surveillance (MCS) Systems***

Foreign fishing will continue to play an important but diminishing role in harvesting the resources off the coast of many developing countries. Since long-range, self-sufficient fishing fleets do not have to call at local ports, they can easily evade quotas and size limits specified in licensing or other fishing agreements. This may allow over-fishing to continue despite management attempts. Since fishing fees usually depend on the quantity harvested, foreign fleets have an incentive to under-report their landings.

Local fleets may also ignore management regulations when enforcement is inadequate. Besides over-fishing, inadequate enforcement of fishing regulations allows frequent conflicts, sometimes violent, between industrial and artisanal fishing fleets operating on the same fishing grounds. Lack of surveillance and control systems for inshore waters allows the use of destructive fishing practices such as dynamiting.

Because coastal states must implement mechanisms to help them be accountable for

resource management, collect access fees from foreign fleets, and prevent illegal fishing, the Bank should:

- help developing coastal states design appropriate FMR and MCS systems, responsive to local budgets and abilities for operations and maintenance, as part of an overall development strategy for the sector;<sup>45</sup>
- provide appropriate financing to implement MCS, including software and hardware, a statistics unit, data base centers, training and appropriate equipment for aerial surveillance, telecommunications and patrolling;<sup>46</sup>
- provide the technical assistance required to launch these programs and operate them until local capabilities have been developed; and
- devise regional strategies, where applicable, based on existing or new agreements among neighboring countries and selectively create mechanisms in the Bank to deal in its lending operations with regional organizations.

### ***Developing Fisheries Capabilities of Coastal States***

Any long-term strategy for fisheries development must have as a goal the intent to help the coastal states of developing countries develop the capital and know-how to exploit their fisheries resources in the most effective manner. The Bank and other agencies can provide help with planning, technical assistance and financing.

The Bank conducted a preliminary assessment of long-range foreign fishing

activity and estimated the pace at which local capabilities might be developed.<sup>47</sup>

The pace will differ among countries depending on what is needed. Some countries only require financing, others a prototype vessel for shore-based operations, or landing infrastructures; others may need design and implementation of development policies, draft legislation, codes of investment, etc. The Bank, however, concluded that in almost all cases, local fisheries development will be a long-term task. The coastal states will need strong support in the preparation of long-term fisheries policies with clearly defined implementation plans if orderly development of the sector is to be achieved.

The phasing in of local capabilities to replace foreign fishing for many of the resources will require an industrial approach. Some resources, now being harvested by foreign fleets, can efficiently be harvested by artisanal scale fisheries (e.g., pot-fishing of octopus, squid jigging, and lobster traps), and efforts should be made to develop them. Most development of local capabilities, however, will be on the semi-industrial or industrial scale with shore-based processing supplied by local vessels. In some areas (especially Africa), this is one of the most important issues in fisheries development, and special emphasis should be placed on adopting implementing strategies appropriate to the specific regional situation.

Considering the importance of private-sector participation in development of local capabilities, the Bank -- in cooperation with the IFC, Multilateral Investment Guarantee Agency (MIGA), Project Development Facilities, specialized agencies such as United Nations Industrial Development Organization-

Private Investment Promotion and multilateral and bilateral donors -- should:

- diagnose local and foreign private investment in fisheries in selected priority regions, preparing reference documents for consultations with local and foreign private investors;
- consult with the Chamber of Commerce and private organizations in selected countries to learn of the problems that private investors perceive in the fishery sector;
- improve the dialogue between the Bank and the private fisheries industry from developed and developing countries;
- establish appropriate plans of action to overcome limitations and constraints to private initiative through different mechanisms available at the World Bank Group; and
- support the private sector in developing appropriate fishing vessels, landing, storing and processing facilities, geared to increase the value-added of the fishery sector.

### ***Making Better Use of Incidental Catches***

Incidental catches (by-catch) of other than the target species are a problem in many fisheries, particularly in shrimp fishing where estimates are that the by-catch varies from 5 million to 16 million tons a year.<sup>48</sup> Technical and economic problems have systematically discouraged the implementation of proposals to make better use of these catches.

The magnitude of the waste has prompted a number of national and international meetings over the last few years. The results have not been very encouraging because proposed solutions have not been economically viable. There is still a long way to go before commercial use of the by-catch is profitable. Still, decreasing yields and increased competition from shrimp farms are forcing the industry to examine better uses of incidental catches.

The single most important problem in making use of incidental catches is making it profitable to bring the catch to shore. What is required are experiments and research to develop:

- selective fishing gear that will catch only target species such as shrimp;
- on-board sorting and grading equipment;
- processing methods to handle mixed species; and
- new products based on sound market research.

### ***Making better use of Industrial Catches***

The term "industrial fish" is generally applied to fish that are reduced to fish meal and oil (e.g., small pelagics such as anchovies, sardines and mackerels). Catches for these species range from 31.8 million to 46.5 million tons per year. The relationship between total catch and catch used for feed meals is shown in Figure 7. Commercial operations could be structured to add an estimated 2 million tons/year to present

catches by the turn of the century from under-exploited resources (e.g., anchoveta of the southwest Atlantic).

Thirty years ago, international agencies, universities and private corporations developed a fish protein concentrate (FPC). It was believed that FPC would help eradicate world hunger, but the product failed in both commercial and food-aid programs because of poor consumer acceptance. A simple marketing principle was overlooked: "Produce what the consumer wants to buy, instead of trying to sell what you can produce."

Because of the increasing gap between supplies and demand for food fish, industrial fish will be given increasing attention as an option for increasing food fish supplies. Product development based on sound market research about consumer preferences will be important whatever the goal may be: commercial food item, or an item in a food-aid program.

The SIFR report on research priorities indicated the importance of these issues and because of the clear advantages of the private sector in such market-driven studies, recommended that the private sector be strongly encouraged to devote more effort toward their solution.

### *Improving International Trade*

International trade in fishery commodities grew from about 4 million tons in 1960 to about 24 million tons in 1987. The value of exports increased from about US\$4 billion to US\$28 billion over the same period.

Seafood demand continues to grow in large industrialized nations such as the United States because of the health benefits seafood offers to a health-conscious population.<sup>49</sup>

Almost 50% of world trade in fish products (by value) is shared between the United States and Japan.

### *Some Constraints*

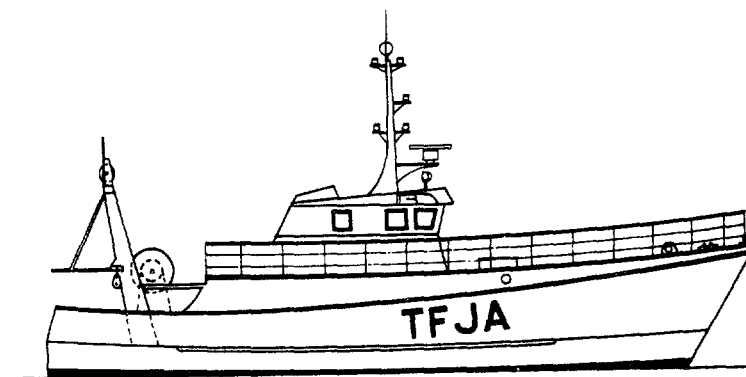
Developing countries, endowed with the majority of commercial fish resources in their EEZ's, have an opportunity to increase their share of the world fish market. However, several constraints must be addressed first:

- tariff and non-tariff barriers;
- insufficient processing, resulting in low levels of value-added product;
- quality control improvements to international standards;
- low shares in trade-related services;
- trade protection measures; and
- trade information, promotion and contracts.

With the objective of removing these constraints the Bank should:

- support actions that promote liberalization of South-North and South-South trade in fisheries commodities;
- encourage and support the participation of developing countries in international seafood and food trade fairs;

- help developing countries improve the quality of seafood products, encourage diversification, and support value-added initiatives;
- help establish fisheries inspection services and quality control departments in projects aimed at improving seafood marketing. And support projects designed to raise the standards of handling, processing and packaging of fisheries products to the levels demanded for entry in export markets;<sup>50</sup>
- provide draft legislation needed to enforce better product quality and more efficient use of resources, and help finance programs to achieve these goals; and
- help develop the concept, design and appraisal of investment proposals submitted to development finance companies.



*Stern Trawler  
North Atlantic Type  
Length 22m*

## C. IMPLICATIONS FOR BANK LENDING

"Put out into the deep and let down your nets for a catch"

Luke 5.4

### Development Prospects for the Sector

The previous chapters have made it clear we believe that:

- the fisheries sector is important and unique in the role it can play in the development of the economies of many developing countries;
- there are economic, sociological, ecological and environmental benefits in conducting fisheries development and management in better ways than are currently in practice;
- a strategy relying on a greater emphasis on sector work, interagency cooperation, research and private sector development would serve the Bank Group well in its future role in the sector; and
- the Bank is in a unique position to play a catalytic role in cooperation with other development agencies in the future development of the fisheries in developing countries.

### Bank Involvement in the Sector

Such a role would appear disproportionate to the Bank's financial contribution, the number of its fisheries technical staff, or its perceived historical involvement in the sector. But the Bank Group is ideally placed to play a strategic and highly leveraged global role in

the development of the sector because of its geographic coverage, interdisciplinary approach, contribution to development policy, role in aid coordination, strong commitment to private sector development, specialized arms (IBRD, IDA, MIGA, IFC) and diversified lending operations (project, investment, structural and sector adjustment).

An even closer working association with the FAO Fisheries Department as well as with other bi-lateral agencies, as suggested in the section on Inter-Agency Cooperation, would result in a highly efficient arrangement to promote fisheries development in the developing countries. Major steps are already being taken in this direction with encouraging results.

### Regional Investment Prospects

There are substantial regional and country differences in the level of fisheries development. But a common element in all regions is a need for sector work, required to accurately define the potential for investment or reinvestment in both capture and culture fisheries as there are many case-by-case opportunities for improving the present operations of fisheries.

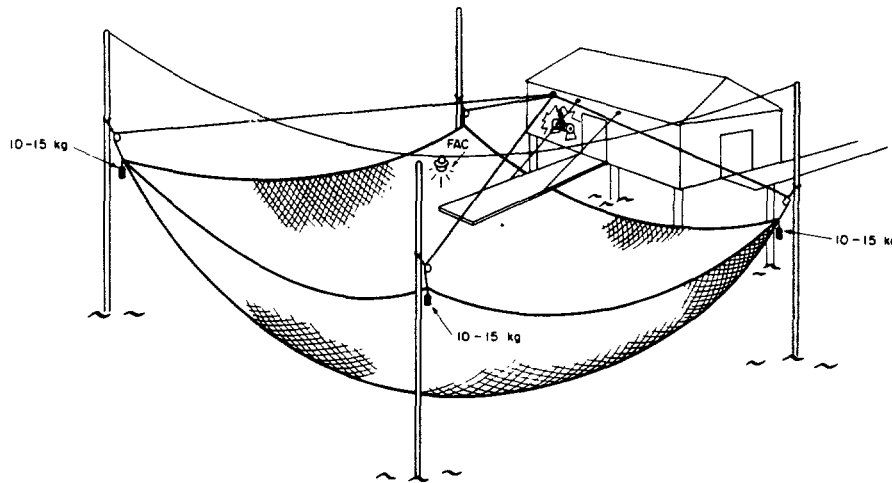
We have earlier indicated that significant opportunities for an increase of fisheries production could come from one or more of the sub-sectoral strategies outlined in previous sections without a significant increase in new

resources. Hopefully there will also be some increases from previously under-exploited stocks and major increases from aquaculture.

To the extent information is available, we have allocated countries in the regions to one or more broad categories which represent, in our view, areas in which opportunities exist for specifics of each country is clearly beyond the scope of this paper. Implied within these potential Bank Group involvement in fisheries

development. But a detailed review of the divisions are applications from one or more of the specific sub-sectoral strategies.

The broad divisions are: Resource Management; Reduction of Waste; Utilization of Industrial Fish; and Aquaculture. In some case we do not have sufficient information to make a judgement as to the potentials, which gives a final category of Lack of Current Data.



*Lift Net*  
*River/Pond/Bay Mediterranean Type*



## Regional Sub-Sectoral Opportunities

### Africa Region

Sub-Saharan Africa has a fast growing population, and fisheries development varies substantially from country to country. Fish consumption in some countries is very high and negligible in others. Paradoxically, countries with abundant resources off their coast are low consumers and vice-versa (e.g., Nigeria, poor resource base, high demand; Mauritania, large resource base, poor demand). Despite the 200-mile extended jurisdiction, most coastal states are heavily dependent on the activities of foreign fleets. Contractual arrangements (protocols) with foreign fleets are not always favorable to coastal states, as mentioned in Chapter III, Foreign Fishing Under License, and some countries lack the means for fisheries management. Aquaculture has no indigenous tradition and the level of development is very low, but is technically feasible and in the long-run promising.

The Bank should focus its involvement in providing assistance to: (i) the improvement of contractual arrangements with foreign fleets; (ii) the establishment of management programs including appropriate monitoring, control and surveillance to assure the highest revenues from the foreign fleet activity; and (iii) strengthening of national research facilities.

The Bank should explore the possibilities of regional management of the resources to gain

efficiency and effectiveness, due to the mobility of the resources across the borders of several coastal states. A report setting forth this approach has been prepared and follow-up projects proposed are under consideration by the Bank and other agencies.

Assistance should also be provided, on a case-by-case basis in the long term, to the development of shore-based fishery capabilities to progressively replace the foreign fishing effort and increase the value-added component of the sector. Local and foreign private investment should be encouraged to participate, particularly in those countries where actions are being taken to improve the investment environment for private sector development.

Financial support for aquaculture should be preceded by a thorough assessment of the potential for development on a regional or country basis, making appropriate use of the Geographic Information System (GIS) and remote sensing technologies available, complemented by field work. An analysis of the stocking of natural and man-made water bodies through the promotion of private-sector hatcheries would be a promising start. Development of mixed agriculture and aquaculture farming systems, with special emphasis on an analysis of sociological aspects, would also be a sensible approach in most of the countries within the region.

Table 5

Sub-Sectoral Potentials For Bank Operations in Africa Region

Resource Management	Reduction of Waste	Utilization of Industrial Fish	Aquaculture	Lack of Current Data
Angola Cape Verde Ghana Gambia Guinea Guinea-Bissau Liberia Mauritania Mozambique Namibia Senegal Seychelles Sierra-Leone Somalia Tanzania	Angola Cameroon Cote d'Ivoire Gabon Gambia Ghana Madagascar Mauritania Nigeria Senegal Sierra-Leone	Angola Gambia Mauritania Mozambique Namibia Senegal	Burundi Cote d'Ivoire Ghana Kenya Malawi Niger Nigeria Rwanda Uganda Zaire Zambia Zimbabwe	Central- African- Republic Botswana Burkina/ Faso Chad Comoros Congo Djibouti Ethiopia Lesotho Madagascar Mali Mauritius Sao Tome- Principe Sudan Swaziland Togo

## Asia Region

The region has a large and fast growing population, a strong fisheries and aquaculture tradition, and a high per capita consumption of fish. Both inshore and offshore marine fishing grounds are mostly over-fished, coral reefs are being threatened by environmental degradation and destructive fishing methods, and coastal areas are becoming seriously polluted. Under-exploited fishing grounds are rare but can be found in the Maldives, Indonesia, India, Papua New Guinea and parts of China .

The Bank should continue to focus its involvement on aquaculture development, favoring low-intensity rather than high-intensity high-technology activities, particularly in less developed areas where the soil conditions and price of land are not major constraints.

Intensive aquaculture should be the domain of the private sector due to the high capital requirements and the need for highly paid technical and management skills. IFC could play an important role in this type of development.

It would also be prudent to selectively diversify away from the present emphasis on high value shrimp culture to avoid a substantial fall in prices due to oversupply similar to the price drop which occurred in 1989. Other high value species of interest are abalone, scallops, sea bass, sea bream, flounder and turbot.

Culture-based fisheries for stocking natural and man-made water bodies and flood plains should be given special attention as an avenue

to increase catches and fish supplies for the domestic market. Flood plain fisheries development in the area soon to be taken up should be limited to operations of not more than 100,000 ha. There is much to be learned about this type of development and little practical experience to draw upon.

Much more attention should be given to coastal zone management and environmental enhancement, which is one of the most serious problems in many countries of the region. An integrated multi-disciplinary approach would be essential. Close working relationships with projects dealing with coastal deforestation should be sought. Research on coastal zone management, suggested by the SIFR research study, should receive much more support as there remain many important unanswered questions in this field.

Appropriate fisheries legislation to establish FMRs encompassing resources management and monitoring, control and surveillance are needed, due to the high level of over-fishing both at the artisanal and industrial level. Projects that provide alternative employment opportunities which would serve to divert pressure from artisanal fishing in coastal areas would be highly desirable. Previous to the launching of projects geared to exploit some of the untapped industrial fisheries resources, appropriately designed trial operations (chartered vessels could be used) are highly recommended (e.g., India, China).

A close working relationship between the Bank and IFC should be sought in this area, particularly when considering offshore operations requiring high capital investments and skilled management inputs.

Table 6

Sub-Sectoral Potentials For Bank Operations in Asia Region

Resource Management	Reduction of Waste <sup>1</sup>	Utilization of Industrial Fish	Aquaculture	Lack of Current Data
China Fiji India Indonesia Kiribati Korea Malaysia Papua New-Guinea Philippines Solomon Is. Sri Lanka Thailand Tonga Vanuatu Vietnam Western-Samoa		China India Korea Malaysia Philippines Sri Lanka Thailand	China Dem-Kampuchea India Indonesia Korea Malaysia Myanmar Nepal Papua New-Guinea Philippines Sri Lanka Thailand Vietnam	Bhutan Mongolia

1. Throughout this region, waste is not a major problem since almost every part of the catch is used in some way.

## Europe, Middle East and North Africa Region

This region is perhaps the most heterogeneous of all within the Bank. Meanwhile the Mediterranean resources are heavily exploited, and pollution is a serious concern. The Gulf of Aden, the Arabian Sea and the Atlantic Ocean off Morocco still have some under-exploited resources.

Eastern European countries are burdened with government parastatals and ageing and antiquated fleets whose continued existence may be doubtful as the shift to a market economy progresses.

Adjustment of the industrial fisheries in Eastern Europe should receive high priority because fisheries can be a source of needed foreign exchange, and production of fish may prove to be less demanding of physical inputs than, e.g., livestock development. Industrial fisheries in the region have been a substantial source of employment. But a keen understanding of the many existing constraints and studies of the options available on a case-by-case basis, are called for before undertaking any substantial investments.

A thorough assessment of Eastern European parastatals would be an essential task at some point before providing any assistance in the privatization process; IFC should consider coordinating efforts with the Bank in this respect. Foreign direct investment would be important in this area. Creative thinking will be needed to develop the private sector, in view of the widespread lack of experience with private property rights, and the lack of entrepreneurial skills, capital and collateral.

The Soviet Union may soon be revising its approach to fisheries under the political and economic circumstances now developing, a situation that may have a substantial impact on many development coastal states who have joint venture and other agreements with the USSR. The transition to a market economy may also result in a significant reduction in fishing fleet size. Due to the importance of the USSR fishing fleet in the world fisheries context there may be a reduction in total world catch as a consequence of these events.

Hungary is well advanced in aquaculture, and the field may also have good prospects in Poland, Turkey, Egypt and Pakistan.

Consumer demand for fish and fishery products vary widely in the region. Fish are an important source of protein for human consumption in Eastern Europe and for human consumption and livestock feed in most of the rest of the region.

The Bank should continue its support for artisanal fisheries in Yemen. Assistance may be provided to Morocco in the design and implementation of resources management programs; policy changes may also be required.

Mediterranean Africa does not appear to present marine capture possibilities, except for Tunisia. Aquaculture operated by the private sector should be selectively encouraged in Egypt, Tunisia, Turkey, Pakistan and East European land-locked countries and those lacking sufficient wild stocks to meet domestic demand.

Table 7

Sub-Sectoral Potentials For Bank Operations in Europe Middle East and North Africa Region \*

Resource Management	Reduction of Waste	Utilization of Industrial Fish	Aquaculture	Lack of Current Data
Iran Morocco Oman Portugal Poland Tunisia Turkey Yemen	Iran Morocco Pakistan Yemen	Iran Morocco Yemen	Egypt Iran Hungary Poland Romania Tunisia Yugoslavia	Afghanistan Algeria Bahrain Bulgaria Cyprus Czechoslovakia Iraq Jordan Kuwait Lebanon Libya Malta Qatar Syria

\* Note: As of September 1991

## Latin America and the Caribbean Region

The region has abundant resources off its coasts, but little consumer demand except for the English-speaking countries of the Caribbean, which paradoxically have a limited resource base. The region contributes about 20% of world catches and exports 70% of its total production. The region, despite the high level of production (Chile and Peru are among the six leading fish producers in the world), has considerable potential for expansion particularly for small pelagics, constituting the largest single source of untapped conventional resources (estimated 2.8 million tons/year) now known.

Aquaculture development in the region has focussed on high-value species whose availability from the wild has or is becoming scarce, such as shrimp, fresh water prawns, scallops, salmon. Domestic-oriented aquaculture is negligible (less than 4% of total fish production), but increasing in importance in countries like Brazil and Colombia, which are among the few net fish importers of the region.

The Bank should focus its assistance on supporting the establishment of FMRs including resources management programs, appropriate monitoring control and surveillance and judicial systems. It should also support the strengthening of marine and

inland water research institutes. Assistance should also be provided for marketing research and product development, reinforcing existing fish utilization institutes and pilot plants, geared to the development of food-fish products from the abundant small pelagic resources, currently used to produce fish meal. In coordination with IFC and MIGA, support should also be provided for the improvement and up-grading of current fish meal manufacturing to provide for the production of high-quality fish meal.

Policy reforms are required in a number of countries in the region, e.g., Peru, fisheries and labor legislation; Uruguay, fisheries-labor legislation; and Mexico, shrimp farming land policies. In connection with planned initiatives the Bank should be ready to assist in these areas.

Coordination is also called for with IFC and MIGA on the privatization of a number of parastatals and promoting the involvement of private initiative. There is scope for cooperation with the Inter-American Development Bank in co-financing fisheries projects (e.g., Argentina, Uruguay, Mexico) and with the FAO in conducting aquaculture potential assessment to establish integrated agriculture/aquaculture farming systems, with emphasis on Brazil, Colombia, Bolivia, Paraguay and Mexico.

Table 8

Sub-Sectoral Potentials For Bank Operations in Latin America  
and Caribbean Region

Resource Management	Reduction of Waste	Utilization of Industrial Fish	Aquaculture	Lack of Current Data
Argentina	Argentina	Argentina	Belize	
Bahamas	Bahamas	Chile	Brazil	
Barbados	Brazil	Ecuador	Bolivia	
Belize	Chile	Mexico	Chile	
Brazil	Colombia	Peru	Colombia	
Chile	Costa Rica	Uruguay	Dominican\	
Colombia	Dominican-		Republic	
Costa-Rica	Republic		Ecuador	
Ecuador	Ecuador		El Salvador	
Guyana	El Salvador		Guatemala	
Honduras	Guyana		Honduras	
Jamaica	Haiti		Mexico	
Mexico	Honduras		Nicaragua	
Nicaragua	Mexico		OECS-	
OECS-	Nicaragua		Members*	
Members*	Panama		Panama	
Panama	Peru		Paraguay	
Peru	Trinidad/		Peru	
Suriname	Tobago		Venezuela	
Trinidad/	Uruguay			
Tobago	Venezuela			
Uruguay				
Venezuela				

\*OECS Member States; Organization of Eastern Caribbean States, St Kitts and Nevis, St. Lucia, St Vincent.



## Appendix 1

### Fisheries Economics; A Conceptual Framework

These concepts are based on temperate latitude single species models, and are inadequate for modeling the tropical multi-species fisheries common to developing countries. Despite this fact the models serve to illustrate important concepts essential for an understanding of some of the unique difficulties encountered in fisheries development, investment analysis and management.

Fishery resources are different from most other natural resources in two important ways.

First, cultivation of fish stocks in the marine environment is possible for only a few species. For most marine species, catches cannot be increased beyond a finite limit.

Second, there is the difficulty of controlling access to the resources. This is in part due to the mobility of the stocks and the problems of establishing meaningful boundaries in the marine environment. Most marine stocks of fish have been (and continue to be) subject to free and open access. In addition, the solution to practical socio-economic and political problems of allocation have proven to be extraordinarily difficult, even if boundaries and other biologically determined factors are understood.

The consequence of these two characteristics is that there is both biologic and economic waste; i.e., depletion of stocks and wasteful uses of capital and labor. Any management plan for the resource needs to take into account these characteristics. The peculiarities of the undertaking, as well as the

effects of different management approaches, can be illustrated by reference to Figure 1.

In this diagram, the vertical axis shows the amount of catch (expressed as tons of fish, or US\$) obtained as a function of the fishing "effort." The latter is in turn a function of the number of vessels, the average catching power of each vessel, and the number of days spent fishing.

The catch increases as the fishing effort increases, but only up to a point, the Maximum Sustainable - long-run - Yield (MSY). This point is a biologically optimal point in the sense that it is the maximum catch possible without depleting the stock. Further fishing effort leads to depletion of the stock.

The graph also shows the benefits/costs of increasing the fishing effort. For simplicity's sake, costs are assumed to increase in direct proportion to the fishing effort. This assumes that each vessel has the same operating and fixed costs (including opportunity costs of capital and labor; i.e., ordinary and expected wages and profits).

Left to their own devices, fishermen will fish until it ceases to become profitable, i.e., until the total cost of the catch is equal to the total revenue that it brings. This self-regulating mechanism leads to depletion of the stock, because each individual fisherman will continue fishing until it becomes unprofitable for him--he does not take into account the effects of his fishing on the entire stock. In terms of the diagram, the fishing fleet would



## NOTES

1. The World Bank refers to the International Bank for Reconstruction and Development (IBRD), and International Development Association (IDA), and the World Bank Group refers to the World Bank plus the International Finance Corporation (IFC), and Multilateral Investment Guarantee Agency (MIGA).
2. Health effects of Polyunsaturated Fatty Acids in Seafood - Proceedings of Conference Washington, D.C., June 24-26, 1985. Academic Press 1986 - Symopoulod, Kifer, Martin.2.
3. World Bank estimate based on recent production trends. Detailed catch data are available from FAO only up until 1988, but preliminary estimates for some totals are available from: Fishery Commodities 1989 - 1990, COFI/XIX/91/Inf.6, February 1991, FAO, Rome, April 1991. Catch data cited here is based on live weight and excludes marine mammals and aquatic plants.
4. Statistics Yearbook 1988 and Yearbook of Fisheries Statistics, Vol. 67., FAO, Rome, 1988.
5. Source: Fishery Commodities 1989 - 1990, COFI/XIX/91Inf.6, FAO, Rome, February 1991.
6. Annon. Asia-wide Shrimp Agro-Industry Sector Study. World Bank, June 1989.
7. Review of the State of World Fishery Resources. COFI/91/Inf.4, FAO, Rome, March, 1991.
8. Source: Aquaculture Through the Eighties - A Decade of Progress and Change. COFI/91/Inf.5, FAO, Rome, December 1990.
9. Yearbook of Fisheries Statistics 1988, Catches and Landings, Vol.66., FAO, Rome 1990.
10. Review of the State of World Fishery Resources. COFI/91/Inf.4, FAO, Rome, March 1991.
11. Garrett Hardin, 1986.
12. Seaman, William S., Jr. and Lucian M. Sprague, Artificial Habitats for Marine and Freshwater Fisheries. Academic Press, 1991, Orlando Fla.
13. Source: Report of the Expert Consultation on Large Scale Pelagic Drift-net Fishing COFI/91/Inf. 9, FAO, Rome, February 1991.
14. Source: World Bank., Paris, October 13-15, 1986.
15. Source: World Bank Audit and Staff Reports.
16. In the long run, the key to African Development was private investment -- Sir William Ryrie, Executive Vice-President, IFC (Financial Times, June 1990).
17. ...to ensure that aid was well spent, there should also be more donor co-ordination -- Sir William Ryrie, Executive Vice-President, IFC (Financial Times, June 1990).

18. Sector studies for the following countries are in various stages of preparation by the Bank: Mauritania, Senegal, G. Bissau, Guinea, Sierra Leone, Cote d'Ivoire, Ghana, Equatorial Guinea, Sao Tome and Principe, Gabon, Angola, Malawi, Bangladesh, Indonesia, Argentina and Mexico.
19. Aid should be linked to policy reform and the development of private sector -- Sir William Ryrie, Executive Vice-President IFC (Financial Times, June 7, 1990).
20. Developing the Private Sector. A Challenge for the World Bank Group. World Bank, Washington, D.C. 1989.
21. See also the discussion of fisheries economics in Appendix 1, and the section on Fisheries Research which substantially overlaps many management issues.
22. U.S. Department of Energy, DOE/ER-0236, December, 1985.
23. El Nino, name given to the phenomenon by fishermen at a northern village of Peru, due to its appearance at Christmas time.
24. Source: Tropical Ocean and Global Atmosphere Programme (TOGA); World Climate Research Programme (WCRP).
25. The Bank co-sponsored the Fourth International Conference on Artificial Habitats for Fisheries.
26. See particularly note 8 and notes 7, and 9.
27. Feed conversion rate for rainbow trout obtained at the International Aquaculture Research Center, Hagerman, Idaho, is 1.53:1.
28. Source: World Bank.
29. World Bank Data: Indonesia.
30. Preliminary estimates, Boonchob Kanchanalak, World Bank Agriculture Hydrology specialist, 1986.
31. Most salmon production today is based on cage culture at sea in a manner similar to that practiced by the Norwegian and Scottish industry. Chile is the third largest producer of farmed salmon, see note 34.
32. Broad guidelines for these purposes are already available. Probable losses to downstream fauna can be gauged well ahead of dam construction. Committee for Inland Fisheries of Africa, Occasional Paper No. 11, FAO, Rome, 1984.
33. In Chile, a government/private organization (Fundacion Chile) conducted the salmon research work. Salmon was brought from the Northern Hemisphere in the early 1970s.
34. In Thailand, and Honduras.
35. World Food Program/Committee on Food Aid, 18/INF/7, October 1984.

36. The Overseas Development Agency (ODA), UK, has extensively supported research and field work directed toward the use of pesticides in controlling insect infestation. Their findings are being successfully applied in countries such as Malawi.
37. Workshop on Group-based Savings and Credit for the Rural Poor; Papers and Proceedings of a Workshop, November 6-10, 1983, Bogra, Bangladesh. Geneva, International Labor Organization, 1984.
38. Surprisingly this is not a serious problem since such projects usually fail at an early stage. Of course scarce manpower and financial resources are wasted.
39. The Bank was a co-sponsor of the Fourth International Conference on Artificial Reefs in Miami, Florida, Nov. 2-6, 1987.
40. ODA, Overseas Development Agency, UK; SIDA, Swedish International Development Authority.
41. State of the World Fisheries Resources. COFI/1987, FAO, Rome, 1987.
42. Current FAO projections do not forecast any significant global increase in catch potentials. Thus on a global basis increases in some fisheries are expected to be offset by declines in others. Source: Review of the State of the World Fishery Resources. COFI/91/Inf.4, FAO, Rome, April, 1991.
43. Only the Soviet Union uses large quantities of mackerel as a food fish. The frozen fish in the round that they produce would have little attraction for other markets.
44. Excludes tuna because its highly migratory nature makes it difficult to estimate.
45. MCS is most efficient when the marginal cost of providing an additional unit of MCS equals the marginal benefit it provides. Quantifying benefits will be difficult due to the uncertainty regarding the future levels of foreign fishing and the demand of local fishermen for protection from foreign fishing. Economic efficiency may not be the only criteria used for determining the level of MCS to provide. Countries may decide to increase MCS to satisfy pressures from local fishermen, or to assert national sovereignty. [Expert consultation on MCS (FAO/GCP/INT/344-NOR), FAO, Rome, 1981].
46. Strictly for fisheries operations only, completely disassociated from defense systems or military and police equipment, which the Bank would not finance.
47. Working papers are available for anyone desiring further details.
48. Fish By-Catch Bonus from the Sea. Consultation of shrimp by-catch utilization, Georgetown-Guyana, - FAO/International Development Research Centre, Canada, October 1981.
49. Fish oils, particularly Omega-3 fatty acids, apparently reduce the risk of cardiovascular diseases, the number one killer in the United States.
50. Losses due to detention and low prices because of poor quality cost hundreds of millions of US dollars a year. Detention of fishery products from developing countries by the United States Food and Drug Administration alone amounted to US\$106 million in FY 1985.

## REFERENCES

- Anon. Post-harvest Food Losses in Developing Countries. Staff Summary Report of an International Workshop, October 1977, Washington D. C., U. S. National Academy of Sciences, Washington, D. C., 1978.
- Anon. Report of the Workshop on Fisheries Credit and Marketing Development. Bangkok, Thailand, November 1989. FAO Fisheries Report No. 435.
- Anon. The Standard Specifications for the Marking and Identification of Fishing Vessels. FAO, Rome 1989. (Illustrations).
- Anon. Fisheries Credit Programmes and Revolving Loan Funds: Case Studies. FAO Fisheries Technical Paper No. 312.
- Anon. Women in Fishing Communities: A Special Target Group of Development Projects; Guidelines. FAO, Rome, 1988.
- Anon. Report on the Study of International Fisheries Research. WB/UNDP/CEC/FAO. World Bank Policy and Research Series, No. 19. (In Press) Washington D.C. 1992.
- Christy, Francis T. A Reevaluation of Approaches to Fisheries Development: The Special Characteristics of Fisheries and the Need for Management; in Agriculture Sector Symposium Papers January 8 - 9, 1987, World Bank Washington, D. C. 1987.
- Committee for Inland Fisheries in Africa. Code of Practice for Minimizing the Risks of Introduction of Fish Species. CIFA/90/7, FAO, Cairo, Egypt, February 1990.
- Committee for Inland Fisheries in Africa. Prospects and Trends of African Inland Fisheries and Aquaculture Toward the Year 2000. CIFA/90/3, FAO, Cairo, Egypt, August 1990.
- Cooper L. The Twinning of Institutions: Its Use as a Technical Assistance Delivery System. World Bank Technical Paper No. 23., 1984.
- Edwards, Peter. Aquaculture: A Component of Low Cost Sanitation Technology. UNDP/WB Joint Report. World Bank Technical Report No. 35. Washington D.C. 1986.
- Hoff, K., Joseph Stiglitz, Christopher Udry, Ammar Siamwalla and Others, Clive Bell, Ifran Aleem and Joseph Stiglitz. A Symposium Issue on Imperfect Information and Rural Credit Markets. The World Bank Economic Review, Vol. 4, Number 1, Washington D. C. September 1990.
- IUCN., Elements of the IUCN Coastal and Marine Conservation Programme. 1988 - 1990.
- Josupeit, H. A survey of External Assistance to the Fisheries Sector in Developing Countries: 1978 - 1985. FAO Fisheries Circular No. 755, Revised, Rome, April 1987.

Kaczynsky, Vladimir and Dominique Le Vieil. International Joint Ventures, in World Fisheries: Their Distribution and Development. Technical Report, WSG 80-2, University of Washington, Sea Grant College, Seattle, Washington, August 1980.

Kaczynski V. M. The Future of Distant Water Fishing Effort. Technical Report, Institute for Marine Studies, University of Washington, Seattle, Washington, May 1985.

Lloyd's Register of Shipping. Lloyd's of London, London, 1990.

McNeely, J. A., Kenton R. Miller, Walter V. Reid, Russell A. Mittermeier and Timothy B. Werner. Conserving the World's Biological Diversity. Report For: International Union for Conservation of Nature and Natural Resources, World Resources Institute, Conservation International, World Wildlife Fund of the U. S. and the World Bank, Gland, Switzerland and Washington D. C. 1990.

Meynell P.J. Success and Failure in Fishermen's Organizations: Case Studies of Fishermen's Organizations in Developing Countries. FAO Fisheries Circular No. 819, Rome, January 1990.

Munro G. R. and Antony D. Scott. The Economics of Fisheries Management. Handbook of Natural Resource and Energy Economics, vol. II, ed. Kneese A. V. and J. L. Sweeney. Elsevier Science Publishers B. V., 1985.

Saila, S. B. Importance and Assessment of Discards in Commercial Fisheries. FAO Fisheries Circular No. 765., October 1983.

Technological Issues in World Bank Lending for Agriculture, pp. 1 - 23. In Agricultural Technology in Sub-Saharan Africa: A Workshop on Research Issues. Gnaegy, Suzanne and Jock R. Anderson, Editors. World Bank Discussion Papers, No. 126. World Bank Washington, D.C., 1991.

Underwood, Peter. Expanded Maritime Jurisdiction: New Prospects for the West African Fisheries. New Directions in Ocean Law, Policy and Management Series, Dalhousie Ocean Studies Programme. Dalhousie University, Halifax, Nova Scotia, Canada, 1983.

Wijkstrom, U. F. and Hans Aase. Fish Farmers in Rural Communities: Results of a Socio-Economic Pilot Survey in Northern Province of Zambia. FAO, GCP/INT/436/SWE.5, Lusaka, Zambia, 1989.

Young, R. H. Strategy for Shrimp By-Catch Utilization. FAO Fisheries Circular No. 745, Rome, March 1982.

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