The Development and Management of Marine Fisheries in Latin America and the Caribbean

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Washington, D.C.
July 1997—No. ENV - 110

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Dr. Christy gratefully acknowledges the contribution of William Vaughan, Senior Economist and Michele Lemay, Senior Coastal Specialist at the IDB who jointly oversaw the consultancy upon which this report is based and commented on the manuscript. The author and the Environment Division are grateful to the following individuals for having furnished reviews and information: Hector Malarin and Mario Niklitschek, both of the IDB; Gardner M. Brown of the Department of Economics, University of Washington; and Lee G. Anderson of the College of Marine Studies, University of Delaware. The author is grateful to Adriana Maraviglia and Diego Rodriguez at the IDB for their assistance in data collection, and to Ms. Ruth Haas who edited the final manuscript.

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Preface

The coastal zone and resources of Latin America represent strategic assets for the member countries of the Inter-American Development Bank (IDB). Many are now looking to coastal tourism, aquaculture and maritime transportation, for example, as offering promising opportunities for the diversification and integration of their economies. There is also an increasing awareness of the need to maintain these resources while optimizing the allocation of uses within the coastal zone. This regional interest is expected to increase over the next decades—spurred by new trade opportunities, changing markets, heightened awareness of fisheries conflicts, and the entry into effect of international agreements such as the United Nations Convention on Law of the Sea (UNCLOS).

The Eighth General Increase in the Financial Resources of the Inter-American Development Bank explicitly recognizes the need for a new focus in calling for "*Support for the conservation and management of the region's maritime resources*." One of the objectives is to assist the region in establishing programs for the management of coastal and marine resources, including living marine resources, that are tailored to the social and economic priorities of coastal states.

In response to this heightened awareness of coastal issues, the Bank began developing its strategy for coastal and marine resources management in 1995. Building on the experience to date with Bank operations and emerging policy reforms throughout the region, the strategy establishes possible future directions for programming, analysis, and monitoring, which together will help maximize the intended impact of the Bank's activities in the region's coastal and marine areas. A series of studies, including this sector review of marine fisheries, are being undertaken in support of this strategy. Inquiries and comments with regard to this report and related studies can be directed to the Environment Division, Sustainable Development and Social Programs (SDS), Inter-American Development Bank, 1300 New York Avenue, N.W., Washington, D.C. 20577.

Glossary

AR	Artificial reef: Materials placed on the sea floor that serve as habitat for marine organisms.
Artisanal fishermen	Fishermen who generally use small vessels and gear, sometimes manually or wind powered or with outboard motors; fishing locally; based in communities.
Biomass	The total population of a stock of fish.
Buyout	Purchase by management agency of superfluous vessels or gear and removal from the fishery, generally destroyed.
By-catch	The catch of nontarget species in nets or with gear used for the target species. May include juveniles of other species and marine mammals or birds.
CARICOM	Caribbean Community. Members include Antigua and Barbuda, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Montserrat, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, and Trinidad and Tobago.
CFRAMP	CARICOM Fisheries Resource Assessment and Management Program.
CIDA	Canadian International Development Agency.
Common property resource	Resources over which a community or user group exercises some control. Distinct from open access resources.
CPUE	Catch per unit of effort.
Demersal	Stocks of fish associated with the sea floor.
Depletion	Fishing beyond the point of maximum sustainable yield.
DML	Dolphin mortality limit.
ECLAC	Economic Commission for Latin America and the Caribbean
Economic rent	Economic rent is a surplus return to a factor of production and is a measure of the relative value of the natural resource. In agriculture, for example, it is reflected in the price someone is willing to pay for the land.
EEZ	Exclusive economic zone. The area out to 200 nautical miles from shore within which the coastal state has jurisdiction over the use of the natural resources.
El Niño	A warming ocean current in the eastern tropical Pacific.
Ex-vessel price	The price received by the fisherman at point of landing.
FAD	Fish aggregation device; usually floating materials anchored to the sea floor that attract schools of fish.
Fishing effort	A fishing unit times the time spent fishing, sometimes called a "vessel-day."

Fishmeal	A meal made from processed fish and generally used as a feed for poultry and hogs and in aquaculture.
GRT	Gross register tons. A measure of the capacity of a vessel.
Groundfish	Fish that are caught on the bottom (demersal fish).
High seas	The area of the oceans beyond national jurisdiction.
Highly migratory species	Species of fish that swim great distances and that are generally found both within EEZs and on the high seas. These, as listed in the United Nations Convention on the Law of the Sea, include the large tunas and various species of billfish.
IDB	The Inter-American Development Bank.
IDCP	International Dolphin Conservation Program.
IIC	Inter-American Investment Corporation.
ITQ	Individual transferable quota; a management measure that provides individual fishermen with a share of the total allowable catch of a stock.
License limit	A management measure that limits the number of vessels, gear, or fishermen that can participate in a fishery.
Liveweight	A measure of weight of fish harvested. It is an estimate of the weight as landed.
m.t.	Metric tons (usually liveweight).
MNR	Maximum net economic revenue.
MSY	Maximum sustainable yield.
NGO	Nongovernmental organization.
NMFS	National Marine Fisheries Service of the United States
OEO	Operations Evaluation Office of the IDB
Open access	Situation in which access to a resource is both free and open to anyone who wishes to enter.
Overcapitalization	Investment in more capital equipment than the optimum required to achieve MNR: the result of open access.
Overfishing, growth	Growth overfishing results from the removal of the larger animals from a population so that the aggregate weight of the yield is lower than that of MSY.
Overfishing, recruitment	Recruitment overfishing results from reducing the number of mature fish so that reproduction is reduced.
Pelagic	Species of fish that are associated with the ocean surface.
Purse seine	A net that encircles schools of fish and that is drawn together (pursed) at the bottom.

Shared stocks	Stocks of fish that migrate between the EEZs of adjacent or opposite coastal states.
Shoaling pelagics	Species of relatively small pelagic fish that congregate in large schools, such as anchoveta and sardines.
Stock	An individual population of a species that may be found in different areas than other stocks of the same species.
Straddling stocks	Stocks of fish that migrate between the EEZs of coastal states and the high seas.
TAC	Total allowable catch. The amount of catch determined by a management agency that fishermen are allowed to catch.
TED	Turtle extruder device.
Trammel net	Two or three nets with different sizes of mesh attached together and usually fixed in place, trapping the fish.
Trawl net	A net towed behind a vessel or pair of vessels, usually on the bottom but sometimes in midwater.
TURF	Territorial use right in fisheries.
UNCLOS	United Nations Convention on the Law of the Sea.
Underexploited	A stock of fish whose yield is lower than the MSY.

Introduction

The marine fishery resources of Latin America and the Caribbean offer significant opportunities for the beneficial involvement of the Inter-American Development Bank (IDB). These opportunities, however, are unfamiliar and seemingly contrary to traditional Bank activities. This is because fishery resources have special characteristics that have led to large overinvestment by the countries in the development of fisheries, and to significant waste of economic resources. The Bank's opportunities lie in encouraging improved management of the fisheries industry through measures that will control overinvestment and capture the extraordinarily large resource rents that are currently being dissipated.

There is now a global and regional awareness that marine fisheries have been significantly mismanaged in all parts of the world, including the South Atlantic and South Pacific oceans. It has also become apparent that proper management of fisheries can produce large benefits for the coastal states. In countries that have taken the necessary steps, fisheries are now contributing significantly to national economic growth and welfare. It is becoming clear that although proper management of fisheries is a difficult task, it can succeed in capturing economic rents that were formerly dissipated, and in achieving sustainable use of the resources.

This is an appropriate time to review the Bank's involvement in marine fisheries and to develop a new strategy that will permit the realization of these opportunities. In the past decade, the Bank has devoted little attention to fishery resources. This is partly because earlier operations have not been successful and partly because the expertise needed to deal with the special characteristics of fisheries has not been available. The Bank, however, continues to receive requests for help in fishery matters and is currently engaged in other areas that affect fishery resources, such as tourism, transportation, and waste treatment and disposal. Furthermore, rapid urbanization in the countries of the region is also affecting fisheries since most of the large cities are located along the coast. The Bank, therefore, is often engaged indirectly in fishery matters. Even more important, it is in a singularly good position to help states achieve effective fisheries management.

In order to fulfill this function, however, the Bank needs to adopt a strategy that is based on a clear understanding of the special characteristics of fisheries and the resource situation within the Latin American and Caribbean region. This paper attempts to provide the background information necessary for the development of a new strategy and offers some suggestions for its formulation and implementation. It is aimed at Bank staff who work with the countries, both in the region and in headquarters; those who are involved in policy formulation; and those who undertake economic analyses of natural resources.

Chapter II describes the characteristics that make fisheries different from most other natural resources. The most critical element is the absence of satisfactory property rights. This leads to significant misallocation of capital and labor and results in the degradation of resources (this problem is not unlike those affecting some forest and grazing lands and environmental resources). An additional critical element is that fishery resources are not homogeneous but in fact provide an exceptionally large range of products. Fishery resources are also distinguished by the fact that they tend to migrate—in some cases thousands of miles. The chapter discusses the four major types of fisheries in the region: (1) tunas and other highly migratory species, (2) anchovetas and other small schooling fish, (3) groundfish on the continental shelves, and (4) inshore fisheries.

The national policies and institutions that govern fisheries development and management in the region, and the changes in these policies that are taking place, are also discussed. The experience of the Inter-American Development Bank, as well as of other development agencies, provides the basis for an identification of past problems and the need for changes in approach and strategy.

This background discussion sets the stage for a discussion in Chapter III of the basic issues facing the use of fishery resources and the possible approaches to resolving them. It emphasizes the critical need for improved management in order to obtain the potentially large economic rewards of the fisheries and to provide a basis for dealing with conflicts over competing uses of the sea's resources. The chapter suggests some specific steps that might be followed to implement more effective measures for fisheries management.

Two sets of steps are required. One set must be taken by governments at the political level because the adoption of effective management measures requires decisions on the distribution of wealth, decisions that generally cannot be made by administrators. Other steps are primarily the responsibility of the administrators. Although some steps are independent of each other and can be taken at any time, the fundamental changes need to be made at the political level.

Political-Level Steps

<Remove subsidies and consider means to extract rents: Under the present system of open access to the resources, subsidies maintain or actually increase wasteful fishing effort. These subsidies need to be removed. The establishment of satisfactory forms of property rights will lead to the creation of values for those rights. Governments need to consider the adoption of systems for extracting all, or a share of, the rents to cover management costs.

< *Shift attitudes from development to management:* The opportunities for further development of fishery resources are limited and additional investment will not add to total catch but may actually lead to further depletion of the stocks. Simply put, there are too many fishermen catching too few fish. The major opportunities of the future lie in improved fisheries management and the reduction of excessive and redundant capital.

< *Acquire knowledge about potential economic rents:* The reduction in wasteful overinvestment will produce very large economic rents (surplus profits) that are currently dissipated. Knowledge of the amounts of the rents will provide an incentive for the political decisions necessary for effective management.

< *Strengthen awareness of the importance of property rights:* The fundamental cause of the economic waste in fisheries is free and open access to the resources and the absence of satisfactory property rights. This lack of awareness of the importance of property rights is an impediment to the adoption of management measures.

< *Make distribution decisions:* In order to create satisfactory forms of property rights, decisions have to be made as to their allocation among and between competing uses and user groups. The information flowing from the previous steps will be essential in making these difficult political decisions.

< *Change legislation:* In most countries, present legislation is not satisfactory for implementing the necessary decisions on the creation of property rights, and needs to be changed.

Administrative-Level Steps

< *Acquire information:* Basic information is required for the adoption of improved measures for fisheries management. The most important kinds of information relate to the social and economic aspects of fisheries. These areas of information have been largely neglected in the past and there has been an overemphasis on the production of biological information.

< *Prepare fishery-specific management plans:* The information acquired in the earlier steps should be used to prepare management plans, including estimates of the benefits and costs of the management measures.

< *Create conditions and incentives for establishing property rights:* Given the right conditions, fishermen will tend to acquire exclusive rights to fishery resources. These conditions can be fostered by certain governmental actions such as requiring the use of fixed fishing gear and techniques that provide a basis for establishing boundaries, or encouraging tenure systems that allow fishermen to invest in resource enhancement, such as creating nursery areas or stocking small fish that can be captured when they are larger. Support for establishing or strengthening fishermen's groups is also important.

< *Consider the desirability of systems for governmental extraction of the economic rents and, if desired, establish such systems:* A specific part of the management plans should be proposals for systems to extract the rents created by the property rights systems.

< *Establish systems for buying out the surplus capital:* Although it is possible that superfluous fishing effort could be removed by administrative fiat, it would generally be more politically effective to buy out and remove the redundant capital equipment. Purchases of vessels could be financed through a revolving fund that would be replenished by the economic rents obtained through improved management. This form of investment in disinvestment can produce large returns and make major contributions to national economies.

< *Support the development of alternative employment opportunities:* Since management requires closing access to the resources, it will affect employment in fish capture activities. The adoption and implementation of the management systems will be more effective if provisions are made for employment in other areas, which may well include fish processing.

< *Strengthen enforcement capability:* Ultimately, the most effective enforcement will come when the fishermen have a sufficient sense of tenure in their resources that they will regulate themselves. However, as the systems are established, the government will have to play a role in ensuring compliance with the regulations. In most countries, present enforcement capability is inadequate for this task.

The final chapter of this paper (Chapter IV) provides suggestions for a strategy for the Bank's involvement in fisheries. This covers both an overall strategy and some specific elements with regard to research, technical cooperation, and investment projects.

Background

The Special Characteristics of Fisheries[1]

Fishery resources have special characteristics that distinguish them from most other natural resources and that pose particular challenges for their management and development. These include (1) the diversity of their products and means of production, (2) the natural limits to their supply, (3) the mobility of the resources, (4) the difficulties of determining potential yields and most important, (5) the general absence of satisfactory property rights.

The diversity of products and means of production

A basic element of fisheries is the enormous diversity of their products and of the means of production. Fish are not a homogeneous commodity such as corn, wheat, or beef. Instead, there is a multiplicity of products. The United Nations Food and Agriculture Organization (FAO) records catch data for 995 different species of fish. These range from low-valued species, such as anchoveta, which are caught in great quantities and used for fishmeal, to high-valued species, such as bluefin tuna, which are consumed in luxury markets. The price range is from US$ 0.10 or less per kilogram for anchoveta or "trash fish" to a record US$ 260 per kilogram for tuna (the price recently paid in Japan for a large bluefin tuna taken off New Zealand). The range and variety of fish products is shown in Table 1.

An additional complicating element is that the price of individual products is affected by a number of factors, including the time, season, and place of landing; the size and quality of individual fish; and the location of the market. Although these factors also affect other commodities, they tend to be more important for fish because of the high perishability of the products.

The means of production also have enormous variability. At one extreme, the products are harvested by hand (gathering of shellfish) or taken by individual anglers using a line and baited hook. At the other extreme, harvesting may be done by gigantic nets hauled on board vessels of over 10,000 gross register tons (GRT) which process the catch and transfer it to transport vessels for shipment to the markets. The costs of a single production unit may range from zero to many millions of dollars. These disparities in products and production mean that it is difficult to make generalizations about fishery resources and that the preparation of fishery projects requires careful and clear specification of the particular fishery and its parameters.

There are also significant disparities in markets. Generally, the luxury products go to the developed countries, but certain of these products are more highly preferred in some countries than in others.

The natural limits to supply

One of the most important characteristics of fisheries is that there is a natural limit to the supply of any individual stock of fish (a stock being defined as a particular species located in a specific area of the sea). The harvest from a specific population of fish increases with increasing amount of fishing effort. However, it does so at a declining rate until it reaches the point of maximum sustainable yield (MSY). Additional fishing effort beyond that point will lead to reduced levels of catch. This is because either the fishing is affecting the reproduction potential of the stock (recruitment overfishing) or large individuals have been removed and smaller individuals are being harvested, with a lower total tonnage (growth overfishing).

[1] A full discussion of the special characteristics of fisheries can be found in Christy (1987). See also Spliethoff et al (1990).

Table 1. Markets for fishery products

Market	Types of Species	Sources	Prices	Implications
Luxury	Salmon, shrimp, sea bream, etc.	Capture and culture	$3-4/kg. Tending to decline with increased cultivation.	Increased trade from culture states. Increased demand for fishmeal. Conflicts over space and water use.
	Flatfishes (flounders, soles, plaice, etc.)	Capture	$3-4/kg. Increasing due to depletion of stocks	Most stocks heavily overfished.
	Tunas, swordfish	Capture	$0.70-2.00/kg (>$200/kg for sashimi)	High consumption in developed states. Increased processing in, and exports from, developing states.
	Crabs and lobsters	Capture and production of substitutes from low-priced fish through surimi process.	$3-12/kg. Tending to decline with production of substitutes.	May stimulate development of underexploited species and conversion to food use of species now used for feed.
	Mollusks (oysters, clams, cockles, mussels)	Mostly culture, some capture.	$1-5/kg. May decline for cockles and mussels with increased culture.	Opportunities for increased production and consumption in developing countries.
	Cephalopods (squids, octopus and cuttlefish)	Capture	$1-4/kg. Likely increases over the long run.	Opportunities for increased capture by some developing states and for increased exports.
Standard	Most finfish species making up the bulk of the market (cods, hakes, haddocks, jacks, mackerels, groupers, croakers, etc.)	Capture	$0.50-3.00/kg. Increasing due to depletion of stocks.	Generally heavily overfished with declining total catches and decline in size of animals.
Low-income	Carps, catfish, milkfish, etc.	Culture	$0.20-1.00/kg.	Heavy production in Asia, mostly China. Very little in Africa and Latin America.
	Artisanal-caught marine and lake fish (sardines, mullets, scads, tilapias, chub, mackerels, etc.)	Capture from canoes, rafts and other small craft, generally non-powered.	$0.20-1.00/kg. Rising prices due to depletion.	Generally heavily overfished with declining total catches and decline in size of animals.
	Frozen blocks of low- quality fish of miscellaneous species	Capture by industrial vessels of former USSR.	Under $1/kg.	Sold to local African coastal states for various reasons. Not likely to continue.
	Trawler by-catch (small individuals, including juveniles of high-valued species).	Discards from shrimp trawling operations.	$0.05-0.50/kg. Prices increasing as discards sought for feed to use in aquaculture.	Locally an important source of protein for low-income consumers.
Nonfood markets	Small shoaling pelagics (anchovetas, pilchards, sardinellas, etc.) reduced to fishmeal and oil, mostly for feed.	Capture mostly by large-scale operations.	$0.10-0.40/kg. Price increases at present limited by price of substitutes for feed (e.g., soybeans).	Conversion to food use possible in future but stocks not found in Asian waters where future need greatest.

The shape of the yield curve can vary widely. Some stocks (e.g., sharks) are particularly vulnerable to overfishing because they reproduce late in their life cycle and have relatively few young. In these cases, the yield curve shows a sharp decline after reaching the maximum level. The yield curves of other species (e.g., many shrimps) may be relatively flat over a wide range of fishing effort since harvest takes place after reproduction and the stocks are fully replenished each season.

Some stocks are subject to wide annual fluctuations as a result of changes in natural conditions. Many of these stocks (such as anchoveta and pilchard) are of considerable importance in Latin American fisheries.

In a few cases these natural limits to supply can be extended. For example, salmon yields can be enhanced by improving spawning areas and producing young in nurseries. Other forms of aquaculture allow increases in the production of a number of marine species (e.g., oysters, mussels, shrimp, and seabass).[2] In total quantitative terms, however, aquaculture production of marine species is still very limited and has little effect on the yields from natural stocks.

It is typical that as a particular stock reaches its limits of production, consumers turn to other less preferred and lower-priced species. This leads to increased effort to harvest the lower-priced species and a rise in production until they too reach their maximum yield and real prices begin to increase.

During past centuries, the ability to shift development to less-preferred (and less-exploited) species has provided an escape valve that allowed a continued increase in global production of marine fish. At present, however, there are limited opportunities for continuing this pattern of exploitation. Globally, marine catch of all species appears to have reached its limit at about 80 million metric tons. This does not, of course, mean that there are no opportunities to further expand the catch of certain species in certain areas.

The major consequence of limited natural supplies is that as demand continues to grow, the real prices of particular fish products increase. Some indications of this are illustrated in Figure 1, which shows price-quantity time series relationships that have the appearance of backward-bending supply curves. For these stocks, real prices have increased while the quantities produced have declined. This is contrary to most natural resource industries, where rising real prices lead to increased supplies.

An increase in real prices has major implications for the management of fisheries, where a condition of open access exists. It provides an incentive for increased fishing effort or, at the least, it compensates fishermen for the smaller average catches they harvest. Thus, instead of the smaller catches being a brake on increased investment or an inducement to leave the fishery, the high prices stimulate increased fishing effort and further depletion of the stock.

Mobility and interrelatedness of fish stocks

Another important characteristic of fishery resources is their mobility. Some marine animals are sedentary and remain in fixed locations during most of their life cycle. Oysters and mussels, for example, remain fixed in place once they have passed their larval stage. However, other species, such as tunas, migrate over great distances.

A significant consequence of stock mobility is that management measures will affect different user groups, in some cases from different countries and in other cases from different communities wihtin a country. Furthermore, since most stocks are found within the coastal zone during part of their life cycles, they are affected by nonfishery uses of, and effects on, the coastal environment, such as land clearing, waste disposal, agriculture, and forestry. Degradation of the coastal zone can have a significant effect on the welfare of fish stocks.[3]

A complicating element is that of the various kinds of interrelationships among species. In a predator/prey relationship, high catches of the former may lead to significant population increases of the latter whereas high catches of prey species may reduce the population of predators. Conversely, the protection of some predator species, such as seals, may reduce the availability of prey species that are of value to commercial fisheries. In some cases, different species may be in competition for the same

[2] At present, about 15% of the total quantity of fish production comes from aquaculture. Most of this is freshwater culture of carps and catfish.

[3] For a separate discussion of coastal management issues in Latin America and the Caribbean, see IDB (1997).

biological niche, so that a rise in the population of one may be associated with a decline in the population of another, as in the case of anchoveta and South American pilchard.

A related problem is that of by-catch. This is the catch of nontarget species taken in the same nets or with the same lines used for the target species. In the case of bottom trawls, for example, the fishermen may be targeting shrimp but may at the same time take large quantities of other fish, marine turtles, or mammals. In some cases this by-catch is discarded at sea whereas in others it may be landed and sold at low prices as "trash fish" for low-income consumers or for conversion into fishmeal. Such by-catch may include juveniles of species which, in mature stages, may be sought by other fishermen.

These various kinds of factors and interrelationships mean that effective management of fisheries may involve numerous different groups, including fishermen from different countries or communities, fishermen using different gears or targeting different species, and groups using the coastal zone for different purposes.

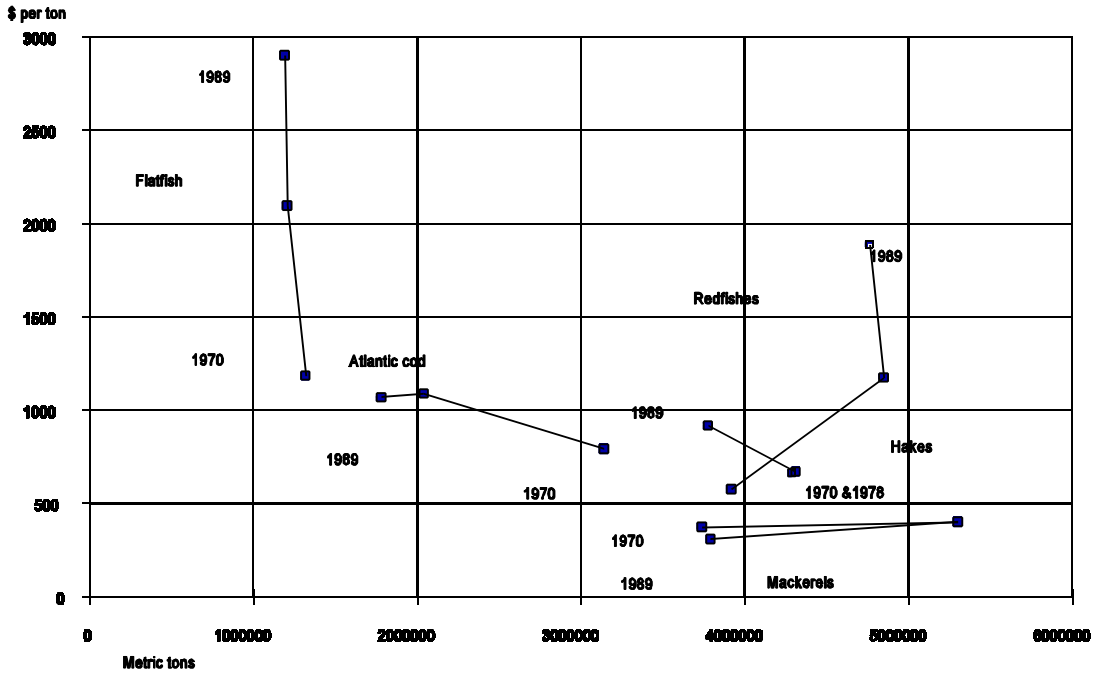

Figure 1. Relationship between catch and deflated average unit values for selected species.

Problems of resource assessment and evaluation

The problems of assessing and evaluating fishery resources are associated with their special characteristics. It is extraordinarily difficult to estimate populations and potential yields from resources that are fugitive, interrelated, and found in an opaque, fluid medium subject to significant environmental changes, such as temperature and salinity. Resource planners generally want to have firm estimates of potential yields and a solid understanding of the status of the resources. However, these are seldom available, except in the broadest terms, and it is generally necessary to make

decisions on the basis of information that is highly uncertain.

The economic characteristics of fisheries are of critical importance to resource planners and managers. Here again, however, the data are difficult to obtain. Traditionally, fishery management has been more concerned with the quantitative aspects of the resources than with the economic aspects, and the greatest proportion of fishery research budgets has been allocated (mistakenly) to their biological aspects (see section on the acquisition of information on fisheries management, p. 36). Relatively little attention has been devoted to gathering information on costs and revenues.

In part, this is due to the complexity of the task. As noted earlier, fisheries include a vast number of species with a wide range of value per unit; they may also include numerous different kinds of harvesting units (vessels, gear, etc.). In addition, there are often a large number of landing spots, particularly for small-scale fisheries along beaches, which makes it difficult to collect data.

The condition of open access

The most significant characteristic of fisheries is that they are often treated as open access resources. Where this condition exists (as it does generally throughout Latin America and Caribbean), entry into the fishery is open to all at no cost other than that of acquiring the gear and equipment. This absence of exclusive use rights is the source of both biological and economic waste and conflict. The economic theory of open access natural resources explains why an uncontrolled fishery tends to attract excessive amounts of capital and labor and why it may be fished beyond the point of maximum sustainable yield.[4]

At different levels of fishing effort (numbers of vessels or fishermen) maintained over the long term, a particular stock will produce different levels of sustainable yields. Figure 2 represents a simplified model of the consequences of open access, and is presented for illustrative purposes only. It shows a static situation, which does not take into account interest rates or the rate at which stocks adjust to changes in fishing effort (Brown, 1986). In certain situations, where interest rates are very high, it is conceivable that the optimum approach would be to mine the stock as a means for maximizing present revenues and use those revenues to produce other goods and services. Nevertheless, the static model is useful in demonstrating the results of open access to fishery resources.

As shown in the figure, the yields increase in association with greater amounts of fishing effort up to the point of MSY. For most stocks, fishing beyond that point depletes the stock so that the subsequent yields are lower than the maximum, even though fishing effort and investment have increased. For some stocks (such as shrimp), depletion may not occur so rapidly and the MSY can be achieved over a wide range of fishing effort. However, economically excessive amounts of capital and labor will still be employed.

The total catch curve can also represent total revenues on the assumption that varying amounts of catch do not affect average prices received. The total cost curve is shown as a straight line, based on the simplifying assumption that every unit of effort has identical costs. With open access, the fishery reaches equilibrium when total costs and total revenues are equal (at point E).

[4] Modern theoretical discussions of the consequences of open access to fishery resources were initiated by Gordon (1954) and Scott (1955). For more recent work, see Charles (1988), Neher et al. (1989), Townsend (1990), and Galarza and Malarin (1994).

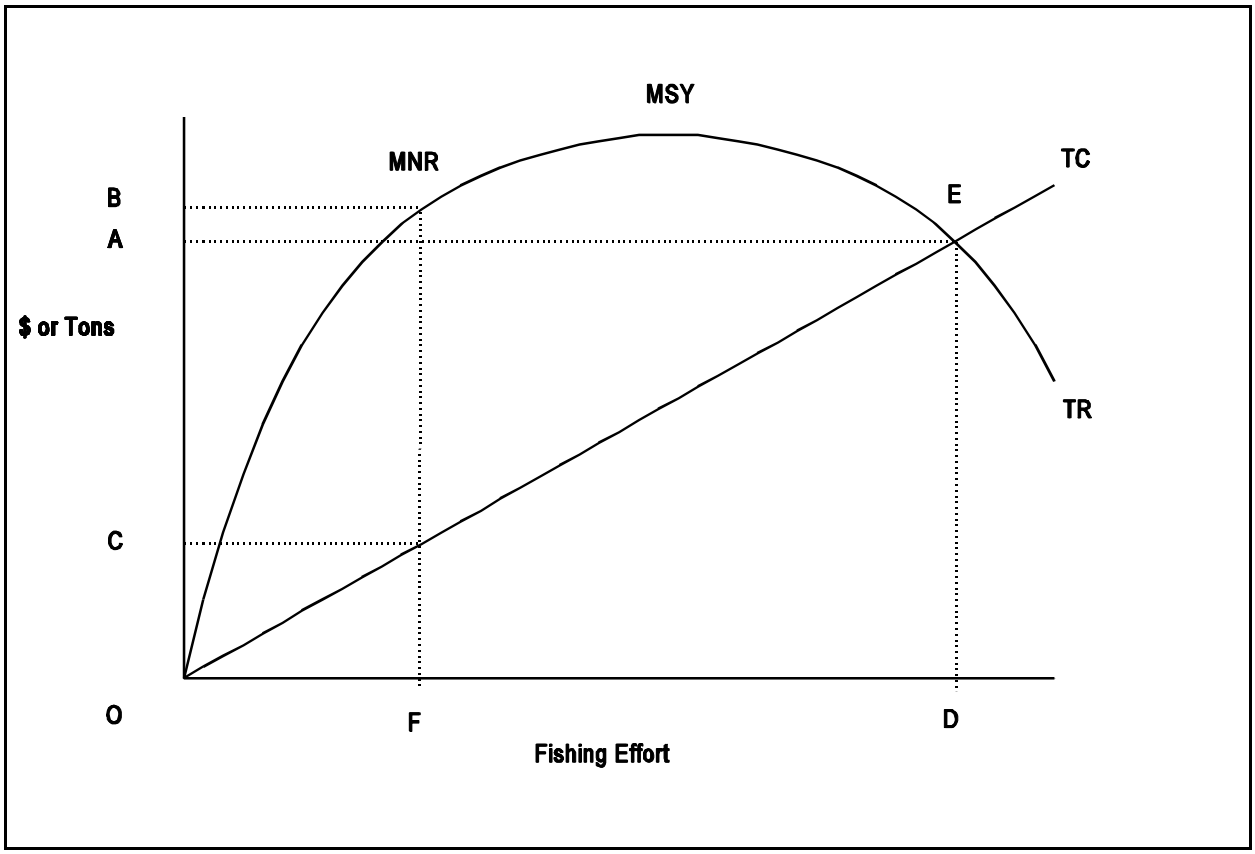

Figure 2. Consequences of open access in fisheries.

At any amount of fishing effort below that point, average revenues are greater than average costs, producing surplus profits (profits above the opportunity costs of the fishermen and expected returns to capital). These surplus profits will attract other fishermen into the fishery until the surplus profits are dissipated and equilibrium is reached.

The principle of economic efficiency suggests that the fishery should operate at the point of maximum net revenue (MNR), where the cost of the additional unit of effort is equal to the additional revenue it produces; that is, where marginal costs and revenues are equal. At this point (in the illustration), total fishing costs are equal to OC and total revenues are equal to OB. There is a surplus profit (or economic rent) of CB. If the fishery resource were subject to ownership rights (as are most natural resources), this is the point at which the owner would operate.

With the extension of national jurisdiction, most fish stocks now come under the sole ownership of a single country. That country, if it wishes, can control the amount of fishing effort and investment through various techniques (discussed in section on allocation of capital and labor in fisheries management, p. 38). Such controls can be used to increase the net economic revenues from the fishery, but they generally do so by reducing employment. In essence, the implementation of controls on fishing effort affects patterns of wealth distribution and thus becomes a political issue.

When faced with the economic distress that results from overinvestment in a fishery, policymakers often adopt palliative measures rather than dealing with the root cause, which is open access. One approach is to provide price supports or other devices that increase the revenue per unit of fishing effort and that raise the total revenue curve (as shown in Fig. 3).

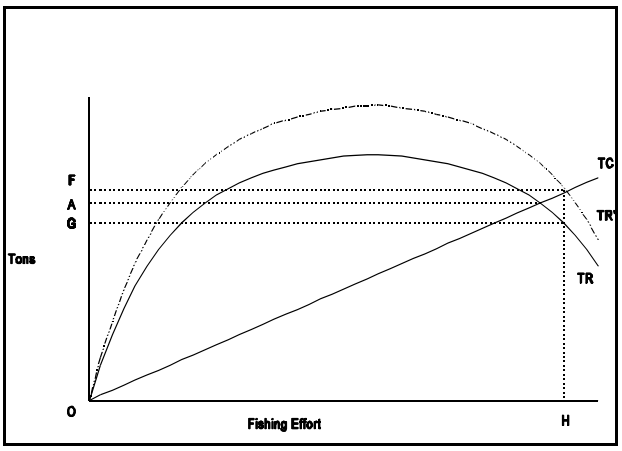

Figure 3. Effects of an increase in price.

In the short term, these measures produce additional profits for the fishermen in the fishery. However, this will attract more fishermen (to the point OH) and thereby lead to higher total costs until they once again reach total revenues at OF. At that point, average earnings per fisherman will decline to their former level. Generally, the subsidy will also lead to further depletion of the stock. In the illustration, total annual yields decline from OA to OG. It should be noted that a rise in real prices will have the same effect.

Alternatively, attempts to alleviate economic distress may lead policymakers to provide low-cost loans for new equipment, low-priced fuel, or other devices that reduce the average costs to the fishermen. As seen in Fig. 4, this has a similar perverse effect. Temporary surplus profits are produced that attract additional fishermen (to the point OJ) depressing in turn both average and total catches and revenues, from OA to OI. It should be noted that technological innovations that reduce per unit fishing costs will have the same effect.

The diagrams represent typical stylized fisheries but not, of course, all fisheries. In the case where a fishery is just developing, there may be opportunities to increase total catches and total revenues at rates greater than those of total costs and total effort. Some such opportunities occur where coastal states can replace foreign fishing effort by developing their own domestic capacity. However, even in these cases, growth in domestic fishing effort should be promoted with restraint to avoid excess investment in the domestic fleet.

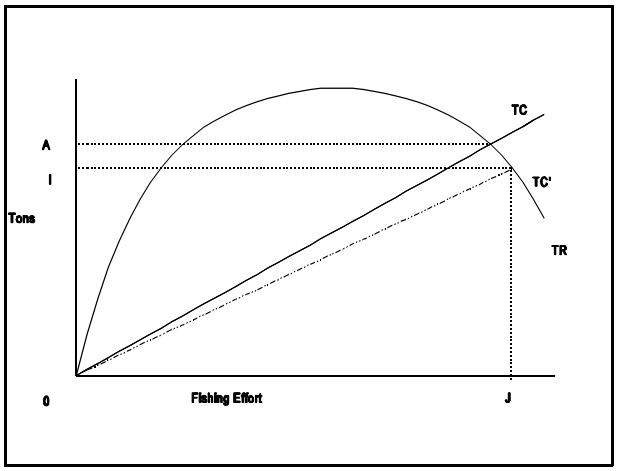

Figure 4. Effects of a decrease in costs.

The economic theory of open access fisheries has been tested in numerous empirical studies, all of which have revealed that there are large amounts of economic rents being dissipated (further discussed in next section, see pp 38 and 52). On a global basis, a rough estimate indicates that the costs of the world's fishing industry are about two times greater than they would be under a rationalized system and the rents being dissipated are on the order of $50 billion per year (FAO, 1993). Investment in disinvestment, as discussed later, can produce very high returns to national economies, although generally at the cost of reduced employment opportunities.

In addition to depletion and economic waste, open access also creates conflicts as different user groups compete for the resources. There are various kinds of conflicts. One type is between present and new users of the same fishery. Another is between users of different kinds of gear for the same stock (e.g., between longline and handline for groupers). In some cases, conflicts occur between different groups fishing different stocks in the same area (e.g., between shrimp trawlers and fishermen using fixed nets or traps). There are also conflicts between groups with different interests or values, such as recreational and commercial fishermen.

The Fisheries Situation in Latin America and the Caribbean

There are four types of fisheries in Latin America and the Caribbean. The first is fisheries for highly migratory species, particularly the tunas, which are found in all ocean regions and generally have similar sets of problems. The second is fisheries for shoaling pelagic species (species that feed on the surface and are found in large schools). These fisheries tend to be located only where there are major upwelling currents that bring nutrients to the surface from deep ocean areas. In addition to the areas off the west coast of Latin America, such fisheries are found off the northwest and southwest coasts of Africa and in the areas of the Pacific where equatorial currents produce large upwellings. The third type is fisheries for demersal stocks (those feeding on the sea bottom) found on the extended continental shelf. These shelves are generally located on the east coasts of the continents and, in addition to the Patagonian shelf, are found in the Northwest Atlantic and North Pacific. Finally, there are the inshore, coastal fisheries. These, and the problems associated with them, are found throughout the world.[5]

Highly migratory fisheries

The highly migratory species are those that migrate over vast distances of the oceans through the exclusive economic zones (EEZs) of coastal states (out to 200 nautical miles) and beyond those zones on the high seas. The major market species are albacore, and bigeye, bluefin, skipjack, and yellowfin tuna. In addition, there are important commercial and recreational fisheries for swordfish and the billfish (marlins and sailfish). These species are found off the coasts of Latin America and the Caribbean in both the Pacific and the Atlantic oceans.

The tunas and albacore are mostly processed through canning and consumed largely in developed states. Prices to fishermen are on the order of $700 per metric ton (m.t.) for skipjack and small yellowfin and about $2000 for albacore[6]. Price fluctuations have occurred in recent years in response to the increased development of stocks in other regions (west Pacific and Indian Ocean); the development of large, low-cost canning operations in Southeast Asia; and embargoes in the United States against tunas caught in conjunction with dolphins. Upward movements of prices in the early 1980s were dampened by the declining prices of chicken, which is considered competitive with canned tuna in some markets.

Some of the catch, particularly of bigeye and bluefin tuna, is aimed at the sashimi market, primarily in Japan, where prices can be extraordinarily high. This is a highly specialized market and requires extreme care in handling the animals (to avoid bruising) and either immediate dispatch to the market (by air) or immediate deep freezing.

Some of the tunas and many of the billfish are of value to recreational fishermen, particularly those from the United States. Some communities in the region receive significant economic returns from these fisheries.

The commercial fisheries for yellowfin and skipjack mostly use purse seines — large nets that surround the schools of fish. The use of pole and line gear, in conjunction with live bait, has diminished largely because of high labor costs. Longlines are generally used for bigeye tunas, the larger yellowfin, and for swordfish. Although there are a few artisanal fisheries for highly migratory species, most operations are large scale and use refined technologies. For example, some tuna purse seiners have helicopters for locating schools and most of them have freezer capacity. These vessels are capable of fishing anywhere in the world.

Tuna catches on the Pacific side of Latin America are considerably larger than those on the Atlantic side. In the eastern Pacific, total catches of yellowfin and

[5] There are several international and multilateral agreements relating to fisheries. For the most part, these do not directly affect present opportunities for fisheries development and management in the region. A list of the most pertinent ones is given in Annex 1.

[6] Note: all units of tons in this paper are metric tons.

skipjack rose from 240,000 tons in 1970 to 360,000 tons in 1993. In the latter year, these two species made up 75% of the total catch of the market tunas in the eastern Pacific. The catch of bigeye tuna, which accounts for 21% of the total, has doubled since 1970. About three-quarters of this is currently being taken by Japan.

Over the past two decades there has been a major shift among countries, with a decline in catch (with the exception of bigeye tuna) by non-Latin American states from 75% to 45% of the total. To a large extent, this change was due to the shift of the U.S. fleet from the eastern to the western Pacific. U.S. catches of skipjack and yellowfin tunas in the eastern Pacific dropped from over 200,000 tons in the early to mid-1970s to about 20,000 tons in the past few years. This occurred in part because of the difficulties of acquiring access to the EEZs of the coastal states and to the problems associated with the mortality of dolphins in the process of taking the tunas. In 1960, "U.S.-flag vessels made up the entire fleet [of tuna vessels with a carrying capacity greater than 400 short tons], but by 1980 the proportion of U.S. vessels was down to 50%, and is currently about 5%. Conversely, the Mexican and Venezuelan fleets, which in 1975 accounted for only about 10% of the total, now form about 60% of the international fleet" (Joseph, 1994, p.4).

The Latin American catch of tunas is taken almost entirely by four states: Mexico, Ecuador, Venezuela, and Colombia. Their combined catch rose from 26,000 tons in 1970 to 260,000 tons in 1993. Almost all of this increase has occurred since 1983.

Information on the status of the stocks is generally highly uncertain. There appear to be opportunities to increase catches of skipjack tuna in all ocean areas and to do so in an economically rational manner (FAO, 1994). For yellowfin tuna in the eastern Pacific, the catch may be close to its maximum biological level and is probably fully exploited in the northern part of the area (north of Colombia).[7] This suggests that further investment in the harvest of yellowfin tuna may incur additional costs that are greater than the additional revenues produced. Little is known about the status of yellowfin stocks in the western Atlantic. Bigeye tuna and albacore in both oceans are being fished close to the levels of MSY. For marlins and swordfish, there is some concern about levels of exploitation in the Atlantic. In the Pacific, there appear to be economically viable opportunities for increased catches of swordfish.

Management measures to prevent excessive investment in capital and labor are becoming imperative for most fisheries for highly migratory species on both coasts of Latin America and the Caribbean; the exceptions are swordfish in the Pacific and skipjack tunas in both oceans. Although individual states may be able to increase their catches of yellowfin and bigeye, this could affect catch rates for the stocks as a whole and reduce overall net economic benefits.

The major problem in achieving effective management measures for the highly migratory stocks is that of reaching agreements among the relevant states. The basic issue for all international or multilateral agreements on fisheries management is that of determining the distribution of benefits and costs among the participants. The prevention of economic waste requires that there be direct or indirect limits on the amount of investment. Establishing such limits requires decisions on the distribution of wealth. The difficulty of negotiating such decisions has prevented effective international fisheries management regimes from being created in all but a few cases. This is an issue that must be addressed by the countries

[7] There appears to be some disagreement on the estimates of potential yields of yellowfin tuna in the area. "According to studies made by the IATTC staff, the yellowfin stock is capable of sustaining annual catches of about 300,000 tons at optimum levels of fishing effort, providing the age structure of the population does not change. With current levels of fishing effort, the catch is below this level; abundance and catch rates remain high, and the population is not overfished" (Joseph, 1994, p. 16). However, it should be noted that the average catch of yellowfin tuna in the eastern central and southeastern Pacific was about 300,000 tons in 1991\93.

concerned. It is, however, important to understand the difficulties when considering activities affecting national investment in fisheries for highly migratory stocks.

Another problem regarding the exploitation of highly migratory species is that of conflicting values. One set of value conflicts is that between commercial and recreational use of the resources, such as marlins and some of the tunas. The other is the conflict between commercial fishing and those who are concerned about the mortality of marine mammals. The latter group has significantly depressed economic returns in the eastern Pacific by imposing embargoes on tunas landed by fishermen who set their purse seine nets on schools of dolphins. This has led to the movement of U.S. purse seiners out of the area and to economic hardship for Latin American vessels, particularly those of Mexico, Venezuela, Panama, and Colombia.

Shoaling pelagic fisheries

Shoaling pelagic species are those that feed on the surface and that are found in large schools. They are associated with up-welling currents that bring large amounts of nutrient materials from the deep ocean to the surface areas where photosynthesis can take place. For Latin America, the most important of these upwellings occurs off Chile and Peru. This was the source of the largest single species fishery in the world, the Peruvian anchoveta fishery, which reached a peak of 13.8 million tons in 1970.

This fishery collapsed in the 1970s, falling to a level of less than 1 million tons, and has since recovered to about half its peak level. Other species of shoaling pelagics (South American pilchard and Chilean jack mackerel) have become an increasingly important part of the catch (see Fig. 5). The catch of these three species together is roughly equal to that of anchoveta during the peak years.

Anchoveta and pilchard are taken almost entirely by purse seine vessels from Chile and Peru. The catch of

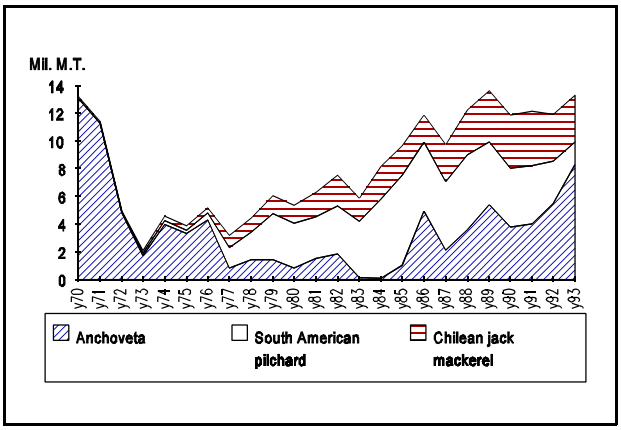

Figure 5. Changes in catch of shoaling pelagics.

jack mackerel rose gradually during the 1970s, and was taken mostly by inshore Chilean vessels. In 1979, the USSR entered the fishery, taking 500,000 tons in offshore waters, and increased its catch to over a million tons by 1990. With the breakup of the USSR, catches in 1991 were taken by some of the former Soviet republics. The total, however, dropped to about 800,000 tons and has been negligible since then. Chile, however, has continued to increase its catch, reaching 3.2 million tons in 1993 (Fig. 6).

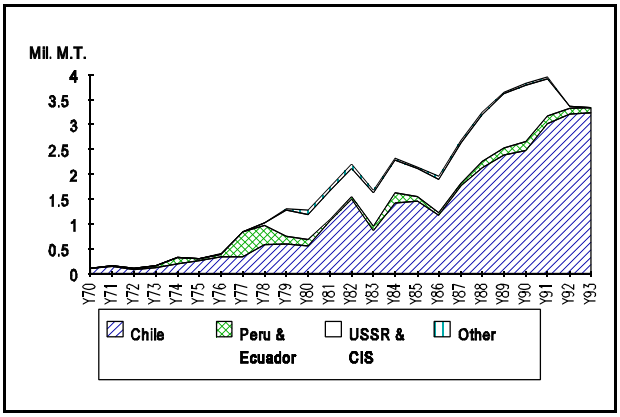

Figure 6. Catch of Chilean jack mackerel.

Almost the entire catch of these species is turned into fishmeal for export. In the past few years, average prices to the fishermen have been about $100 per ton. The price is affected by the price of substitute meals, such as soybean meal, and by the growing demand for meal for the culture of shrimp and salmon. Because of the low price, the total value of the catch in Chile and Peru is only about $1.3 billion, which is about twice

the value of the tuna catch even though the quantities of pelagics are twenty times greater than those of tuna.

The biomass of these stocks is significantly affected by ocean currents and temperature. There are some indications that declines in the biomass of one species of shoaling pelagics are associated with increases in the biomass of others. Generally, there is a major decline in the biomass of anchoveta when a strong current of warm water moves close to the coast. This current, known as El Niño, appears around Christmas every few years and has widespread global effects on weather.

The stock of Chilean jack mackerel extends beyond the 200-mile zone of Chile and is a straddling stock (i.e., one found within a nation's exclusive economic zone and on the high seas). Although currently there is no fishing for jack mackerels on the high seas, there is a potential for entry by distant-water states.

Extended-shelf species

In some areas, continental shelves extend more than 200 miles from shore. These areas tend to be fairly fertile owing to the relatively shallow waters, which allow the penetration of light and photosynthetic activity. In Latin America, the most significant area of extended shelf lies off the coasts of Argentina, Uruguay, and, to some extent, Brazil and the Antarctic. This area has rich resources of groundfish, such as Argentine hake and southern blue whiting, as well as large stocks of squids.

In 1970, total catches of groundfish in this area amounted to about 660,000 tons, of which 400,000 tons was marbled rock cod taken by the USSR. This latter catch has been negligible since 1972. Since 1978, total groundfish catch in the area has been relatively level at about 900,000 tons but there has been a major shift in catch from the noncoastal to the coastal states, particularly Argentina (see Fig. 7). In this period, catch by noncoastal states dropped from 25% to 5% of the total and Argentinean catch rose from 45% to almost 70%.

The catch of squids from the area was negligible during the early 1970s; it rose to about 200,000 tons in 1982 and then to about 700,000 tons in 1987 and has remained relatively level since. As in the case of groundfish, although to a lesser extent, there has been a shift in catch from the noncoastal states to the coastal states, particularly Argentina (see Fig. 8). In 1987, Japan, Taiwan, and Korea took 65% of the total as against 7% by the coastal states. By 1993, coastal state catch had risen to 29%.

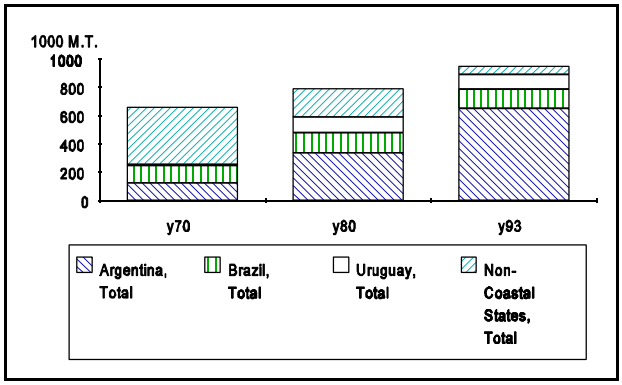

Figure 7. Catch of groundfish in southwest Atlantic by coastal and noncoastal states.

The groundfish stocks are mostly taken by trawlers and to some extent by longlines and other bottom gear. The vessels used by the noncoastal states tend to be large and highly mobile while those used by the coastal states are generally smaller, although Argentina has an expanding fleet of freezer and factory trawlers (NMFS, 1994). Squids are taken by surface gear such as jigs and drift nets, usually from moderate-sized vessels. Most of the products are aimed at the international market, since the domestic demand in the coastal states is relatively low.

There are indications that the stocks of Argentine hake and Patagonian hake (the two major species taken in the groundfish fishery) are currently fully exploited (FAO, 1994; NMFS, 1994). Although there tend to be large natural variations in the biomass of squid stocks, FAO reports that "these stocks are considered to be fully to heavily exploited in the Patagonian Shelf and Slope, and lightly exploited elsewhere, particularly in the northern coastal areas [off Brazil]". (FAO, 1994, p. 37).

These stocks of hake and squid are straddling stocks, whose management requires a multilateral or international regime. Although Argentina and Uruguay have had an effective management regime for many years and Argentina and the United Kingdom are cooperating in management measures, the availability of the stocks to foreign fleets on the high seas poses a difficult problem.

Inshore stocks

The various fisheries discussed here present problems for management. In each case, however, these problems are of concern to only a limited number of states. All countries in Latin America and the Caribbean face difficult problems with regard to the management and development of their inshore stocks which, for most, form the primary basis for their fishing industries.

Although for many countries, inshore fisheries may be of lesser value than the others, these stocks are generally critically important in social terms. They tend to employ the largest number of fishermen as well as people associated with the fishing industry as providers of materials and equipment, and as processors, marketers, and distributors.

Inshore stocks include a large number of species. For continental states, the most important, in terms of value (as well as problems) are the various kinds of shrimp. For the island as well as continental states, there are also important reef species, such as grouper and snapper; small pelagics, such as mullets, sardines, and anchovies; larger pelagics, such as mackerels and weakfish; crustaceans, such as lobsters and crabs; and others. Although most of these species are used for domestic consumption, there are important exceptions such as shrimp, lobster, groupers, and snappers, which command relatively high prices in international markets.

Fisheries for these inshore stocks use a wide variety of gear (handlines, trawls, drift nets, stake nets, purse seines, traps, longlines, trolls, etc.) and craft (pirogues, hand- or sail-powered boats, small boats with outboard motors, large vessels with inboard motors and freezer capacity, etc.). The fishermen range from those who are employed casually or seasonally to those who work full time. The activity may range from artisanal to large-scale industrial.

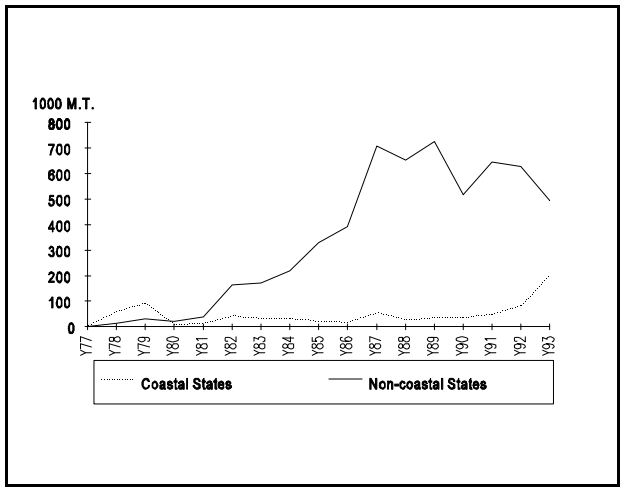

Figure 8. Catch of squids in southwest Atlantic by coastal and noncoastal states.

In some of the artisanal situations, there are traditional systems governing access to the resources. These have developed where communities are relatively isolated and heavily dependent upon the fisheries in close-by waters. Generally, the resources fall within fairly clear-cut boundaries, such as coral reefs, estuaries, and bays. The fishermen in these communities exercise a form of *de facto* tenure over the areas in the form of a Territorial Use Right in Fisheries (TURF). These systems were formerly widespread but have now diminished greatly due to a number of factors, such as impingement on the areas by large-scale vessels, a move to market systems and the development of incentives for individualistic behavior at the expense of community interests, and government opposition to community tenure. There are, however, some TURFs still operating today in certain Latin American countries (Cordell, 1989; Wylie, 1989; McGoodwin, 1989).

Inshore stocks of fish are generally being fished beyond the point of MSY. Inefficient use of inshore fisheries results from open access and is marked by both depletion of stocks and economic waste. Almost all those fisheries in the region that have existed for

several years face this problem to a greater or lesser extent. Its severity depends largely on the relationship between prices and costs. When prices decline or costs increase, the degree of overfishing diminishes. The difficulty is that in the long run relative prices tend to increase as a result of shrinking supplies and growing demand, and costs tend to decrease as a result of technological innovations. Thus, in general, the problems of depletion and economic waste are becoming increasingly severe.

In addition to waste, the inshore stocks also tend to be the focus of conflict between small- and large-scale fishermen. This is particularly true of the shrimp fisheries, where the larger-scale trawls work over the grounds used by the small-scale fishermen. Such conflicts can become severe, even violent, and are frequently the fisheries that initially attract political attention.

Where a fishery is newly developing, there are opportunities for increased levels of catch and increased net economic revenues. However, these do not obviate the need for management of the existing fisheries and will themselves require management controls as they reach full development.

There are numerous stocks of fish in the sea that are not utilized at all. In fact, most marine organisms fall into this category. Generally, however, there are very good economic reasons these stocks have not been developed. There may be no market for the species or the costs of harvest may be excessive. These species may be considered as weeds rather than as natural resources that have potential for development.

The region's inshore fisheries also face significant environmental problems, in terms of both the externalities that are inflicted on them and those that they produce for other uses and interests. They are of interest to the Bank because they are frequently affected by Bank-financed activities in tourism, transportation, waste disposal, etc.

Summary

Each of the four kinds of fisheries faces problems and difficulties, and each has certain opportunities. Some of the problems, such as open access and the essential need for improved management, are common to all types of fisheries. However, other kinds of problems and opportunities differ widely among the different types. The highly migratory species, which are of interest to a few countries, offer opportunities for development but require attention in the international arena in terms of both markets and the need for multilateral and international agreements.

The shoaling pelagic fisheries face a different set of problems in the marketplace owing to their high sensitivity to the prices of substitute products, such as other forms of feed for poultry and aquaculture. In addition, they face significant problems in terms of the need to adjust to the severe fluctuations in biomass resulting from changes in natural conditions.

For the stocks located on extended continental shelves, the opportunities and problems are generally intranational in character although in certain situations multilateral agreements need to be reached satisfactorily in order to resolve some of the problems.

While in each case the kinds of fisheries described here are of interest to only a few states, the inshore fisheries are important to all states in the region. It is generally these fisheries that should be the focus of the Bank's attention.

National Trends and Policies

Both fisheries development and fisheries policies have undergone significant changes during the past three decades. A discussion of the trends and phases in development of the region's fisheries provides a basis for reviewing the trends and phases in national policies and management practices.

Trends in the development of marine fisheries

In terms of volume of catch, the marine fisheries of the region are overwhelmingly dominated by the catches of

Peru and Chile (see Fig. 9). Together, these two countries took over 14 million tons in 1993 — or almost 80% of the total quantity of catch of Latin America and the Caribbean. Estimates of the value of catches are not readily available, but some rough indications can be provided. Virtually all of the catch by Peru and Chile is species used for fishmeal and has a low unit value of roughly $100 per ton. Thus, the total gross revenue of production of these two countries was about $1.4 billion in 1993.

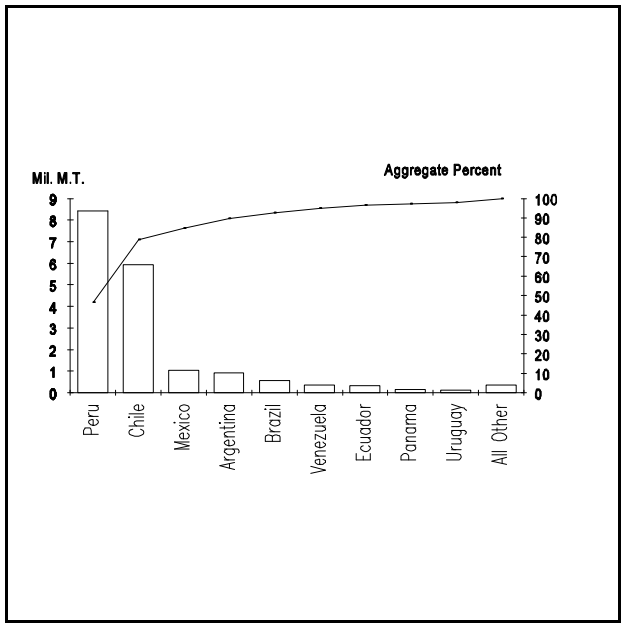

Figure 9. Catch by country in 1993.

Of the 4 million tons taken by all other states in the region in 1993, about 1 million was shoaling pelagics, producing a gross revenue of about $100 million. The balance of the catch (3 million tons) consisted of species that are roughly valued at $1000 per ton, with a total value of $3 billion. Thus total regional gross revenue from marine fisheries in 1993 was on the order of $4.5 billion, of which Chile and Peru accounted for 30%.

In 1970, Peru led the world in catch, producing over 12 million tons. As noted above, the fishery collapsed in the following years and Peru's total catch fell to less than 2 million tons in 1983. It has subsequently increased, reaching more than 8 million tons in 1993. Chile has experienced a steady and large increase in catch over the past two decades, growing from about 1 million tons in 1970-72 to 3 million tons in 1980-82 and 6 million tons in 1991-93 (see Fig. 10).

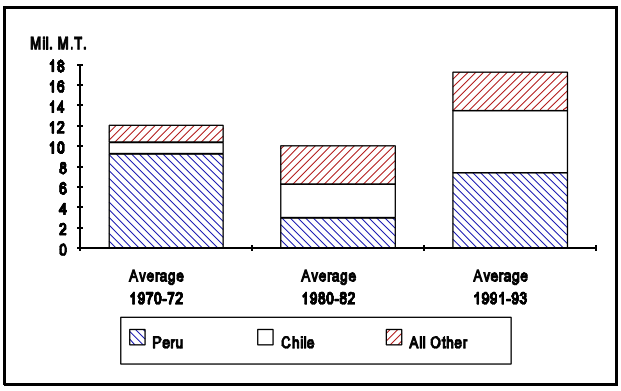

Figure 10. Change in catch by Peru, Chile, and other countries.

Most states in the region experienced greater growth during the decade of the 1970s than during the 1980s (see Fig. 11). In the 1970s, 28 states showed marine catch increases greater than 25% whereas in the 1980s there were only 18 states in this category. Also, in the 1970s the number of states showing decreased total catch was 7 compared with 17 in the 1980s.

Excluding Peru and Chile, countries of the region increased their total marine catch by 100% in the 1970s but showed virtually no change in the 1980s. This contrasts markedly with global changes in marine catch, which during the 1970s increased by only 15% and during the 1980s by 26%.

There are, however, some significant exceptions to the regional trends. Among the important fishing states, Argentina, Venezuela, and Colombia (in addition to Peru and Chile) experienced significant growth during the 1980s (see Fig. 12)—the first two having increased by about 90%, and the last by 200%.[8]

[8] A large part of the increase in Colombian catch is by foreign vessels licensed to fish in Colombian waters. In 1993 the government reported licensing 150 foreign fishing vessels. These were for Pacific operations (21 vessels), Caribbean operations (76 vessels), and tuna operations off both coasts (53 vessels) (Weidner and Hall, 1993).

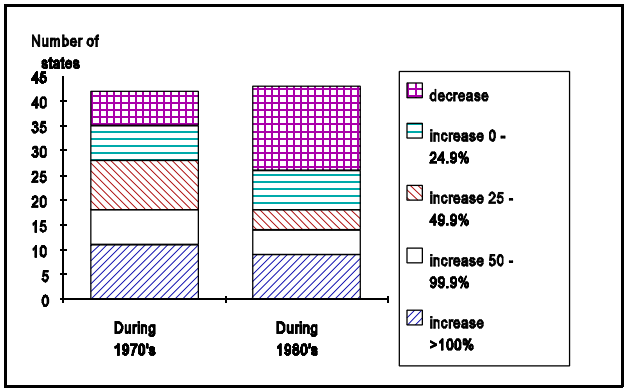

Figure 11. Relative changes in catch by states by decades.

Some of the Caribbean island states also showed significant growth in the past decade: Trinidad and Tobago (194%), Antigua and Barbuda (115%), the Bahamas (108%), and Grenada (92%).

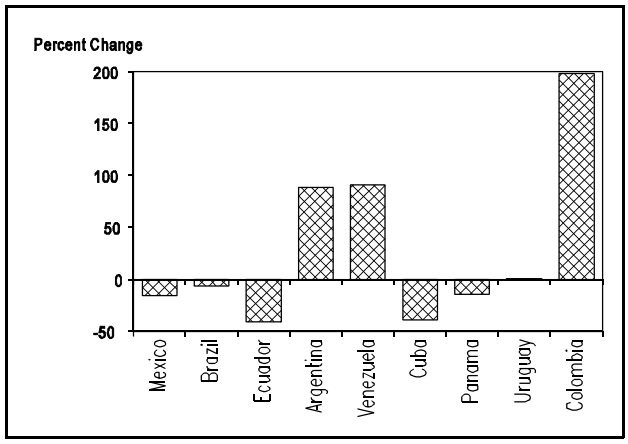

Figure 12. Percent change in catch from 1980-82 to 1991-93, by selected countries.

The difference in trends between the two decades (leaving aside the changes in Peru and Chile) can be illustrated by the changes in the kinds of species harvested. About half of the increase in the 1970s was in the catch of shoaling pelagic species. In the 1980s, however, the catch of these species declined significantly, the declines offsetting two-thirds of the gains registered in the previous decade. Most of the declines occurred in the catches by Mexico and Ecuador of California anchovy (down 330,000 tons), California pilchard (down 90,000 tons), and club mackerel (down 240,000 tons). These species, like Peruvian anchoveta and South American pilchard, are subject to wide fluctuations in abundance related to the El Niño phenomenon.

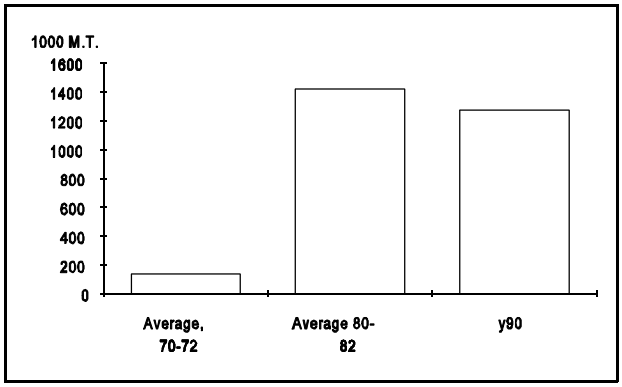

Figure 13. Regional net exports (excluding Chile and Peru).

The production of groundfish (mostly Argentine hake) increased considerably in the 1970s and continued to increase in the next decade, but by a lesser amount. In the case of the tunas, shrimps, and squid, the gains in the 1980s were greater than those in the previous decade.

In essence, although total catch for the countries of the region (excluding Chile and Peru) did not increase greatly during the past decade, there was a shift from the low-valued shoaling pelagic species to the higher-valued species used for human consumption. The low-valued shoaling pelagics dropped from 47% of total production to 25%.

The growth in volume of catch during the 1970s was due mostly to the increase in the export markets for fishmeal. In 1970-72, net exports of fishery products from countries other than Chile and Peru were negligible (see Fig. 13). By 1980-82, however, they had grown to over 1.4 million tons (in liveweight terms).

National policies and institutions[9]

In addition to the changes in trends of catch over the decades, there have also been changes in policies regarding fisheries. In general, although there are significant differences among the individual states, there are four phases: (1) neglect; (2) development attempts through large-scale, parastatal operations; (3) policies favoring the private sector and small-scale fisheries; and (4) a move toward fisheries management.

During the 1960s, most governments paid little attention to the development of fishery resources.[10] Peru's rapid growth, for example, was initiated by U.S. entrepreneurs and developed mostly without government involvement. In many countries, an infrastructure to support fisheries did not exist.

In the 1970s, fisheries gained increasing importance to many governments. There were several attempts to develop the resources through the use of large-scale parastatal enterprises, some of which were supported by the Bank. Since in some countries there was a total lack of infrastructure for fisheries, it was thought necessary to use public sector agencies to build it. It was also a prevailing concept among all development agencies at that time that public sectors provided the best path to development.

Weidner and Hall (1993) state that during the 1970s and 1980s various countries (Brazil, Colombia, Cuba, Ecuador, Mexico, Nicaragua, Panama, Peru, and Venezuela) implemented costly but marginally successful government-sponsored fisheries development programs. Several other countries (Colombia, Cuba, Ecuador, Guyana, Mexico, Nicaragua, Perú, Suriname, Trinidad, and Uruguay) established state fishing companies to promote development. Few of these companies achieved their established goals, and according to these authors, the industry is now almost entirely conducted by private companies. Most governments have sold off, or are trying to sell off, their debt-ridden state fishing companies (Hall, 1993).

In the case of Peru, the creation of public sector operations was due to the collapse of the anchoveta fishery in 1972. "Peru's left-wing military government's response to the crisis was massive state intervention in the industry, the consequences of which are still being felt by the Peruvian fishing industry. The government's intervention proved to be a financial disaster. The nationalized fishing companies turned what had been a major industry providing tax revenue into a sector requiring years of massive state subsidies. The government during the 1970s and 1980s funded hundreds of millions of dollars in losses from inefficient, overstaffed state corporations" (Weidner and Hall, 1993).

The general failure of large-scale state-run fishery operations throughout the region initiated an important change in the policies of most countries and a move toward privatization. In the case of Argentina, the move has taken place in company with a number of other reforms instituted by the administration of President Menem, who took office in 1989. These reforms included a new stable currency system, stricter tax collection, government spending cuts, and privatization of deficit-plagued fishery corporations (Weidner and Hall, 1993). The government of Mexico, in an effort to build a more modern fishing industry, instituted a major privatization program. One of the principal steps was to permit private investors to participate in the capture fishery for shrimp as well as shrimp culture. The government also sold most of the assets of state corporations (Weidner and Hall, 1993). According to these authors, many observers believed the restrictions on domestic and foreign private investment during the 1980s was one factor explaining the inability of Mexican fishermen to significantly expand their catches since 1987.

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[9] This section does not provide details of national policies and institutions because this is the subject of another study being undertaken for the IDB (see Agüero draft).

[10] Some attention was paid by several governments along the west coast because of concerns about the growing presence of large-scale U.S. tuna purse seiners. According to McDougal and Burke (1962), during the 1950s and 1960s, the primary drive for an extensive enlargement of the territorial sea came from Chile, Ecuador, and Peru, and this issue became of considerable interest and concern generally to Latin American states.

In Peru, an attempt to privatize fish harvesting activities took place in the mid-1970s. In 1978 the Bank made a loan to provide credit to cooperatives for the purchase and conversion of the state-owned anchoveta vessels to vessels used to harvest fish for human consumption. However, the government continued to control fishmeal production through the state monopoly (PESCA Peru). This, together with adverse economic and political conditions, made the move to privatization largely ineffective. With the advent of the Fujimori administration in 1990, the full privatization of industry is now taking place.

The change in national policies in the region is also marked by increasing attention to the need for fisheries management. This has occurred as the incidence of depleted stocks has grown and with the awareness that the opportunities for increased development have declined. A number of changes in the policies of several countries indicate the significance of the move toward better management (as well as of the problems associated with it). A few of these are described in Annex 3.

Chile has recently moved toward effective fisheries management. Some of the important developments are outlined in a paper prepared for a World Bank conference by Patricio Pavez, Chief of Cabinet and UnderSecretary of Fisheries of the Republic of Chile.

"Chile's fishery sector has reached maximum expansion in terms of the available resource base....The present situation - with a fully allocated resource base, and disproportionate fishing effort and processing capacity with the associated high production costs - places the country's fishing industry squarely at risk of destabilization.

"The traditional concept of fishery development in the post-World War II period - a concept that still prevails in some developing countries - is based on a view of the fishery industry as simply an extractive activity....Fishery management policies consistent with the concept have traditionally been oriented toward increasing extractive activity through one of two approaches: An increase in the number of vessels, or improvements in the gear used to fish traditionally exploited stocks, or both - a process known as *intensification of production.* An expansion of the fishing fleet's area of operation to new fishing grounds, or exploitation of underexploited stocks, or both - a process known as *extensification of production*.

"These approaches are facilitated by the inadequate definition of the ownership of fish stocks, which are treated as commonly owned resources, and the failure of the market to efficiently allocate production resources.

"What this wrongheaded and shortsighted vision of fishery development does is encourage greater mechanization of fishing vessels and a more rapid expansion of fleets, principally through free-access options and subsidized government loans. The goal is to achieve increases in fishers' incomes over the short term.

"And indeed, there is often a significant increase in earnings at first, thanks to higher unit yields resulting from technological improvement. Over the long term, however, the higher earnings are not sustainable, as a result of several effects of this fishery management approach:

- The congestion, or overcrowding, effect, which generates a significant increase in operating costs.
- The conservation effect, with stock deterioration through overfishing.
- Conflict between artisanal and industrial fishers exploiting common areas or resources.

"These effects lead to widespread economic deterioration of the fishery sector, a situation in which any management guidelines enacted by the government lack both effectiveness and support. From a macroeconomic viewpoint, this type of management approach, which has been common in fishery sectors throughout the world, results in the waste of scarce commodities, such as capital and renewable natural resources, in labor market distortions, and in increased impoverishment of the country.

"A development strategy that is intended to achieve sustainabililty in the fishery sector must meet the following criteria if it is to succeed:

- It must make provision for regulating access to fisheries.
- It must prevent overfishing, which may in the long run jeopardize conservation of fishery resources.
- It must impose regulations designed to resolve conflicts between artisanal and industrial fishers.
- It must impose regulations designed to minimize the fishing industry's polluting effects.
- It must establish flexible management that can adapt to changing social, biological, economic, and political conditions and generate political support for fishery management.
- It must define a modern administrative structure and public management system with the appropriate hierarchical levels, coordination, and financing.
- It must formulate fishery legislation that clearly defines the rules of the game and offers appropriate incentives to each participant in the fishing sector" (Pavez, 1994, pp. 60-61).

Chile is implementing a sophisticated access and quota allocation system based on both biological and economic efficiency principles, and Peru is seriously considering the adoption of a comprehensive body of regulatory measures with similar characteristics (Agüero and Zuleta, 1994). The two countries have different constitutional concepts of resource ownership (in Peru, fishery resources belong to the state; in Chile, they are considered the common property of the citizens), but both have made considerable progress toward introducing management interventions aimed at resource conservation and economic efficiency (Agüero and Zuleta, 1994).

The problems in Peru and the need for effective management are also critical. It is estimated that the present fishing fleet has the capacity to harvest between 21 and 32 million tons of fish per year (García Mesinas, 1994), which is about three to four times greater than the total catch in 1993 and two to two and two-thirds times greater than the maximum catch in the early 1970s.[11] Mr. Alfredo García Mesinas, the former Vice Minister of Fisheries of Peru, has stated that "if a country allows unlimited access to limited fish stocks, its fisheries will necessarily become inefficient and uneconomic, and fishers, processors, and everyone else associated with the industry will suffer....Some options for controlling entry to fisheries are licensing arrangements, vessel quotas, and other compensatory schemes, which recognize the value of a more or less exclusive right to exploit a common resource, with guarantees of a restricted number of competitors" (García Mesinas, 1994, p. 89).

Peru already has one fishery under effective control—the fishery for giant squid. Although the fishery is currently used only by foreign fishermen, the rules apply equally to domestic fishermen. In this case, rights to harvest shares of the total allowable catch (TAC) are allocated through an auction mechanism. Weidner and Hall (1993) state that the administration has reported considerable success in license sales to two Asian countries (Japan and Korea). Very substantial allocations are involved (up to 200,000–250,000 tons annually) and this has become an important source of income. The fees earned from the sale of licenses have increased sharply; from $1.5 million in 1990-91, to $20 million in 1992, and $23 million through June 1993.

In the fishery for anchoveta and sardine, according to Weidner and Hall (1993), new vessels for the fishmeal fishery will only be approved as replacements for older vessels that are being withdrawn from the fishery. This limitation is part of the administration's increasing focus on "responsible" fishing, which is reflected in the 1992 General Fisheries Law.

In the Caribbean, according to the FAO, few resources are administered through a management plan with a regular mandate for stock assessments. As a consequence, knowledge of the status of fishery stocks is limited. However, experts in the region agree that a

[11] Another source indicates that fleet capacity may be as much as eight times greater than recent catch levels. See Galarza and Malarin (1994).

number of the resources are fished at their maximum sustainable yield and many are overfished (FAO, 1994).

In general, there are few opportunities in the region for projects aimed at increasing fishery production. There are some opportunities for improvements in handling, processing, and distribution which could increase value and reduce the level of imports. The most significant opportunities, however, are in the area of fisheries management, where improved measures could lead to important increases in the contribution of fisheries to national economies.

These opportunities are currently being explored by a regional program supported by the Canadian International Development Agency (CIDA). This program, the CARICOM Fisheries Resource Assessment and Management Program (CFRAMP), is aimed at improving management and conservation of the fishery resources of the CARICOM (Caribbean community) countries to allow sustainable exploitation of these resources by providing the region with the information and institutional capacity to manage and develop its fisheries resources (CARICOM Fisheries Unit, 1995).[12]

The program has three major objectives. One is to improve the national systems for the collection of data on catch and effort and for the licensing and registration of fishing activities. A second is to improve the assessment of stocks. Three resource assessment units have been set up in different countries to cover pelagic and reef species, shrimp and groundfish, and lobster and conch. The third objective is focused on strengthening national and regional fisheries management, providing training, and supporting the involvement of fishermen and communities in management programs.

Activities to achieve the first two objectives appear to have proceeded much further than the last and to have received thus far the greatest emphasis. Resource assessment remains one of the primary focuses of the project (CARICOM Fisheries Unit, 1995).

Trinidad and Tobago, has undertaken a number of studies and moves related to effective management. With the help of an FAO/United Nations Development Programme (UNDP) project, it has produced several studies of specific fisheries, including economic analyses and management proposals. More specifically, under the FAO Technical Cooperation Program, it has produced Draft Policy Directions for Marine Fisheries of Trinidad and Tobago in the 1990s (Trinidad and Tobago Fisheries Division, 1994). This document, prepared for discussion purposes, provides detailed suggestions for fisheries management and identifies the most pressing priority in the fisheries sector as the introduction of sound management practices.

"In the formulation of this management policy, the Government's objectives for management are as shown below. Not all of them will be equally applicable to particular fisheries situations. In practice, it can be expected that the management strategies that are ultimately put into place, will reflect a compromise of some or all of these objectives:

a) Implement efficient and cost-effective fisheries management;
b) Ensure through proper conservation and management, that the fisheries are not endangered by over-fishing;
c) Ensure that the exploitation of the fisheries resources and the conduct of related activities, are consistent with ecological sustainability (e.g., for target species, non-target species, and marine environment);
d) Maximize economic efficiency of particular (commercial) fisheries;
e) Ensure accountability of the fishing industry and the community at large for fisheries management;
f) Achieve appropriate cost-sharing arrangements between all the beneficiaries of sound fisheries

[12] The participants in the CFRAMP program include Antigua, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Montserrat, St. Kitts, St. Lucia, St. Vincent, and Trinidad and Tobago.

management" (Trinidad and Tobago Fisheries Division, 1994, pp. 4,5).

These and other recent developments in the move toward fisheries management indicate that there is within the region a high degree of receptivity to the concept of closing access in fisheries and providing the kinds of exclusive use rights necessary to produce the significant benefits that are available from good management. At present, the move to fisheries management is more by intention than by practice, but this is to be expected. The implementation of effective management measures is a difficult task, as is evident in the experience of those countries which have adopted management mechanisms, and requires persistent attention.

IDB Experience in Fisheries Development Projects

History

During the 1950s and 1960s, fish catches by the countries of the region increased considerably. This resulted from several developments, including the transfer of such technologies as mechanization, trawl and purse seine nets, and modern netting material. The rapid growth was also aided by growing demand and access to international markets as well as the availability of unexploited resources. To a large extent, this growth came from the private sector, without external aid. Indeed, during this period, development assistance to fishery resources was negligible.

The Bank's first fishery projects began in the early 1970s. In 1982, the Bank completed an evaluation report on loans to the fishery sector. This contained a chronological outline of key developments that is worth summarizing here.[13] As of October 1968, the Inter-American Development Bank had done relatively little in the fishery sector. However, by the end of 1981, it had seven full-time professional positions allocated directly to fishery activities. It had financed 38 technical cooperation (T.C.) projects (mostly for project preparation), and extended close to $300 million in loans for 15 projects, with a combined total of about $720 million. Briefly, the major developments during these 12 years were as follows:

1968	Bank hires an expert, on detachment from FAO, to study and recommend possible strategy for operations in the fishery sector.
1969	Board of Executive Directors approves a set of policy guidelines for the sector; first T.C. project in the sector is approved.
1970	Bank puts a fishery specialist on its regular payroll, in the Agriculture Division in the Project Analysis Department (PRA).
1971	First mission to a member country to evaluate a possible project; a Bank document is published in collaboration with FAO on commercialization of Latin America's fishery products.
1973	First IDB loan for a cooperative project in the fishery sector.
1974	Bank issues a paper on Latin America's overall fishery potential.
1975	Bank assigns first sector specialist to supervise operations in the field.
1978	Paper on aquaculture in Latin America published in cooperation with FAO.
1980	Seminar held in IDB headquarters on nontraditional fish products for human consumption; fishery section in PRA Industry Division merged with forestry in the Agriculture Division.

[13] The following enumeration of investment and technical cooperation projects contains some that were for aquaculture and some for inland fisheries, which are not included in this analysis.

1981 Two and one-half fulltime PRA professionals on board in headquarters (section chief devotes half time to forestry activities); five sector specialists on board in the field offices.

Following this evaluation, there were two more loan projects for marine fisheries (one in September 1982 and one in September 1983) and 17 technical cooperation projects. As of 1997, there is one coastal resources specialist but no fishery specialists on the Bank staff.

The changes in investment and technical cooperation projects from 1971 to the present are shown in Figs. 14–16 (see Annex 2 for tables). The Bank's investment projects, in both number and amounts, were moderate in the early 1970s, increased considerably in the late 1970s, and dropped off in the 1980s, reaching zero after 1983.[14] Technical cooperation projects show a slightly different trend since there were significant amounts and numbers in the early 1980s and also in the most recent period.[15]

Policies

The set of policy guidelines adopted by the Board of Executive Directors in 1969 was based on a comprehensive and detailed analysis of the fisheries situation in the region (IDB, 1969). The guidelines subsequently were adopted as an operational policy that is still in effect (see *Operational Policies Manual*, OP-724, Oct. 31, 1975).

These state that the fundamental objective for fisheries development in Latin America and the Caribbean is to obtain the maximum sustainable yield from the regional fisheries resources in order to intensify the production of low-cost protein food to reduce the growing protein deficit in the region, and to improve the trade balance of Latin American countries through increased exportation and import substitution.

As a general policy, priority is to be given to projects for artisanal fishing cooperatives that are designed to increase productivity, and to regional training centers. Emphasis is also given to support for science and technology centers. The guidelines state that industrial promotion projects should be given preference when they form part of overall fishery development programs.[16] Generally, priority is to be given to projects with a broad multiplier effect that have no real possibility of attracting private capital.

The operational policy sets out five areas of activity:

- Production development, including port infrastructure, fishing fleets, and industrial plants.
- Marketing infrastructure, such as fishing terminals and cold-storage plants, transportation and distribution units, organization of fishing cooperatives.
- Training of seagoing personnel, processing experts, and scientific personnel.
- Preinvestment, including scientific and technological studies and technical assistance, that

[14] Projects for inland fisheries and aquaculture are not included. In addition, the Bank has made a few global sector credit loans with fisheries components, which are not included. The most important of these were to Chile, approved in 1982, and to Argentina, approved in 1990. Under the Chile project, loans of $32.9 million were made to the industrial fisheries and $13.5 million to the artisanal fisheries. The Argentina project includes $16.25 million for fisheries development, a portion of which would be provided by the IDB.

[15] Beginning in 1990, the Inter-American Investment Corporation (IIC) made seven loans and investments in fishery projects. Three of these were for aquaculture projects. Two provided support for construction and operation of fishmeal plants (one in Chile and one in Peru). A project in Brazil provides for the purchase and operation of 12 new 24-meter shrimp trawlers. A project in Peru provides for the purchase and renovation of four vessels and implementation of a plant to process shark meat, fin, and skins. The IIC is part of the Inter-American Development Bank Group. It is legally autonomous, and its resources and management are separate from those of the Inter-American Development Bank.

[16] In the original 1969 document, it is stated that "industrial promotion projects should only be given preference when they form part of overall fishery development programs" (IDB, 1969, p. 35).

can be used to prepare sectoral plans or specific projects[17].

< Research programs aimed at improving the identification and exploitation of fish resources and technology for catching and processing operations.

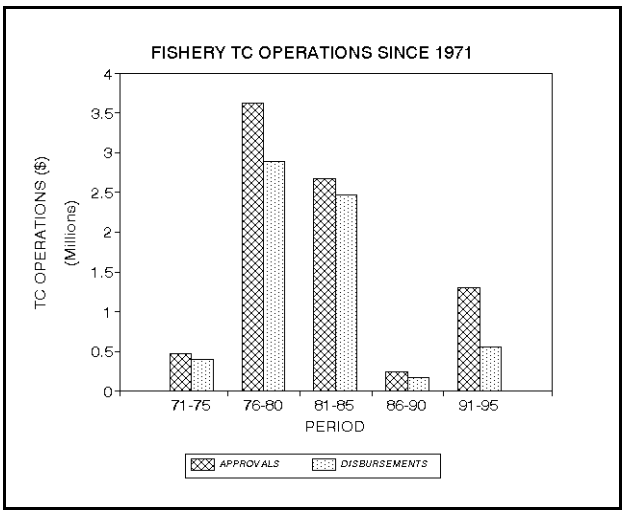

Figure 14. U.S. dollar amount of fishery technical cooperation lending and disbursements since 1971.

Evaluation criteria are also spelled out in the operational policies. Projects should:

< Be consistent with national or regional development plans or policies.

< They should not have a negative effect on the conservation of natural resources.

< They should contribute to the expansion of production and/or improvement of productivity and facilitate the improved utilization of food resources.

< Projects should take account of effective utilization of manpower resources and suitable remuneration policy consistent with feasibility of the project.

< They should be designed to diversify catches aimed at reducing the natural uncertainty of fisheries, while at the same time promoting the expansion of complementary industries; integrated projects would receive high priority.

< Finally, projects should consider modern technical elements and the dynamic, effective administrative structure required to guarantee a successful operation.

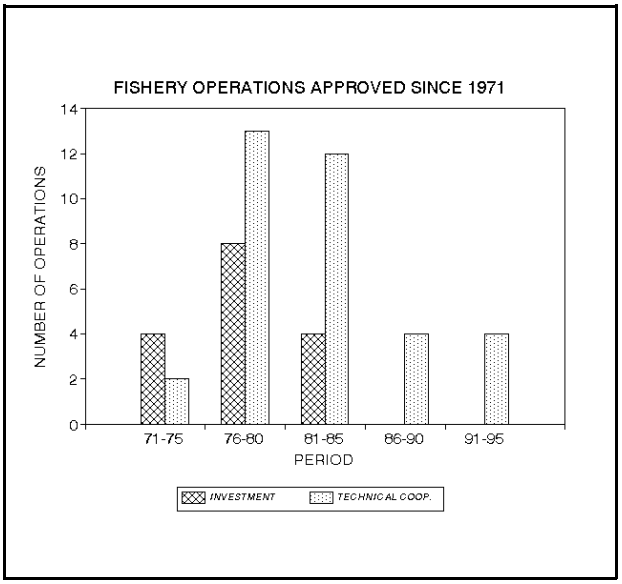

Figure 15. Fishery operations approved since 1971.

These policy guidelines are noteworthy in several respects. In 1969, the World Bank, the Asian Development Bank, the African Development Bank, the United Nations Development Programme, and FAO were still largely focusing their efforts on investment projects for large-scale fisheries and were still supporting parastatal organizations. Support for large-scale commercial fisheries by several of these agencies persisted into the early 1980s. In Southeast Asia, policymakers in international and national agencies gave priority to the development of capital-intensive commercial fisheries. Between 1978 and 1984, the governments of Thailand, Indonesia, Malaysia, and the Philippines received more than $599 million in fisheries aid, 88% of which was for capital investment (Bailey et al., 1986). The Asian

[17] The original 1969 statement also explicitly included reference to socioeconomic studies.

Development Bank, the World Bank, and Japan accounted for 76% of this aid. The IDB operational policy, however, stressed small-scale fisheries and private enterprise.

One of the reasons for this was given by the Chief of the Fishery Projects of the Bank in 1974, who stated that the exploitation of vast coastal resources of species of table fish and shellfish, which can normally be sold directly to the consumer, offers considerable prospects for expansion of small-scale fisheries (Luna, 1974). He further noted that the most appropriate form of organization (of small-scale fisheries) was the production and marketing cooperative. Although enshrouded in myths that usually give rise to fears and doubts, the truth is that lack of experience with fishery organizations of this type has identified them with poorly conceived, badly organized and worse-managed consumer cooperatives whose results have been negative. Luna emphasized that a fishery cooperative must be a modern organization for catching, processing, and marketing. It must also be appropriately financed and efficiently managed, which requires substantial technical assistance in its initial stages.

The policy statement makes several additional important points that were not always widely understood by other development agencies at that time. For example, instead of stating a goal of maximizing employment opportunities (a common policy objective in the 1960-70s), it refers to achieving effective utilization of manpower with suitable remuneration. It suggests the need for diversification of catches in order to deal with the problems of natural variability in fish populations. It also suggests the need for projects that do not have a negative effect on conservation.

These elements of the operational policy are as valid today as they were when they were first promulgated. There are, however, other elements that may have been appropriate in 1969 but which today are a source of mischief. One is the concept that the objective should be to achieve the maximum sustainable yield. This, as noted earlier, is an inappropriate objective in that it ignores the economic factors involved. The concept of MSY as a management goal has long since been abandoned by development agencies and fisheries administrations. As discussed earlier, the primary objective is to achieve economic efficiency, which means controlling fishing effort and costs at the point where marginal revenues and costs are equal. A secondary objective, depending upon the situation, may be to enhance employment opportunities.

The emphasis on capital investment in fishing vessels and port infrastructure was not inappropriate at the time, given the fact that there were development opportunities. As Luna (1972) pointed out, the principal factor adversely affecting the development of fisheries in Latin America at that time did not stem from the resources or the potential consumption, but from the absence of marketing channels or their inefficiency, and the absence of an appropriate technology for processing products that was in line with the purchasing power and geographical distribution of the bulk of the population. The physical infrastructure of the sector (i.e., fishing ports, fleets, terminals, cold stores, industrial plants, and marketing and transportation facilities) was also notoriously inadequate (Luna, 1974). In 1989, it was reported that Bank projects financed the building of 4900 new fishing vessels (Luna, 1989). Today, without effective management measures, capital investments leading to increased fishing effort will produce damaging consequences in all but a few situations.

One of the sources of the problems with the fisheries development policies of the 1970s and 1980s was the unrealistic assumptions about the potential for development. The original 1969 guidelines included an analysis of presumed opportunities for fisheries development in the region. As noted, Latin American fishery resources were largely undeveloped at the time, with the notable exception of the anchoveta fishery of Peru. The opportunities for development, however, were greatly exaggerated in the Bank's background document, as well as in several subsequent statements on regional development. For example, it was assumed that development projects could lead to an additional production for human consumption of 4 million tons

per year within a 5-year period.[18] In fact, production for food rose by a little over 2 million tons between 1971 and 1981—a doubling of catch and a significant increase, but not of the order anticipated.

Investment projects

Most of the 16 investment projects undertaken by the Bank had multiple purposes, including the construction of vessels and port infrastructure, and provision for marketing and processing facilities. All but two of them provided support for constructing or rehabilitating vessels. One was solely for support of a research center. About half of them provided lines of credit while the other half provided funds to executing agencies for capital investments. Two were aimed primarily at the large-scale sector and most of the rest at the artisanal sector. In the latter case, emphasis was given to establishing or supporting fishermen's cooperatives.

Only two or three of the investment projects attempted to provide information on the potential yields of the resources targeted by the projects, although they all had general statements to the effect that the resources were plentiful. The concept of MSY appeared to dominate the analyses. No reference was made to the objective of achieving maximum net economic revenues from the fisheries. Furthermore, there were no references to the possibility that the increase in vessels would lead to decreased catches per unit of effort, or decreased productivity. There were no references to the possibility that increased catches by the beneficiaries would be likely to have negative effects on other fishermen fishing for the same or related stocks.

It must be recognized, however, that estimates of potential yields are always laden with uncertainty because of the difficulties of comprehending all the significant variables affecting the biomass of a marine stock. Nevertheless, rough estimates can usually be made with sufficient certainty to provide a basis for anticipating total and per capita yields.

Another significant deficiency in all but two or three of the projects was the absence of information on markets and prices for the products, although several were aimed at the production of food for low-income consumers. Three of the most costly projects sought to increase the food use of fish caught for fishmeal through improved handling and processing and marketing promotion. These occurred in the period when much attention was being given in the United States and other countries to the idea of developing a fish protein concentrate as a means for alleviating protein malnutrition. This objective, although worthy, has not yet been achieved. The costs of producing a concentrate of the quality suitable for human consumption exceed the prices that needy consumers are willing to pay. This is in part because of the high transport costs from the producing areas in Latin America to the presumed market of consumers in Asia and Africa. However, it should be noted that there have been recent technological improvements in increasing the quality of the product in order to meet the burgeoning market for feed for shrimp and salmon cultivation. This may eventually lead to an effective market.

Half of the projects involved the development and support of fishermen's cooperatives, mostly as a means for receiving credit for constructing vessels and for marketing and processing operations. Although the chief of the Bank's Fisheries Division clearly recognized the problems associated with the creation of fishermen's associations (see earlier discussion), the project documents make no reference to these difficulties, nor to the problems that small-scale fishermen have in making standard loan repayments (owing to seasonal disparities in earnings and uncertainties in catches) or to the importance of fishermen's involvement in organizing themselves.[19]

[18] In 1974 Luna stated that it was a reasonable assumption that fish could provide at least 25% of the regional protein deficit in a period of not more than 10 years. Achieving such a target would entail an increase in the catches for human consumption of about 5 million tons (Luna, 1974).

[19] A noteworthy exception was a technical cooperation project (the most recent one) for a community action program. This was based on requests for support from the fisheries communities themselves and involved the fishermen in the preparation of the proposal.

Two projects (one of which was a loan for modernization of agricultural services and not specifically a fisheries project) focused on strengthening fisheries research capabilities. Both of these were based on the assumption that increased information on the biological aspects of fisheries would lead to increased production and to improved management. In one case, the project was justified through means of a "profitability ratio" that was derived by relating the value of exports of the major species to the costs of the research investments. Neither of the project documents explained how increased biological information would lead to increased levels of catch.

Evaluation

Attempts to relate increased fish production to investment in fish harvesting capacity are fraught with pitfalls for a variety of reasons. Such projects may not lead to increased harvesting capacity because of failures in implementation of the project. If the stocks are already fully utilized, increased harvesting capacity may actually lead to decreased total catches. The increased numbers of vessels may target different species than those intended. Increased catches may be due to other factors than the investment projects. Catch levels may also be influenced by changes in factor and product prices due to developments unrelated to the projects; they may be significantly influenced by changes in the natural environment. There is thus no necessary correlation between projects that invest in fish harvesting capacity and increased catches of fish. Nevertheless, in spite of the pitfalls, the changes in catch levels of target species between date of project initiation and date of last disbursement (for the eleven projects supporting vessel construction) can provide a rough indicator of their effects. As shown in Fig.17, three countries experienced significant increases in catches during the period of the projects. For three other countries, the catch increases were negligible, and for five projects catches actually declined.

It is difficult to measure the real effects of the projects on the economic and social welfare of the countries. The project completion reports and the standard ex post evaluations focus essentially on the implementation of the projects and the problems that may have been associated with implementation.[20] Baseline data by which to measure changes in fishermen's incomes, increases in net economic revenues, increased consumption by low-income consumers, etc. are virtually nonexistent, and no attempts have been made to assess these benefits, much less the possible relationship between such changes and the projects' activities. The six criteria for evaluation of fisheries projects contained in the operational policy (see earlier discussion) do not appear to have been applied to any of the projects.

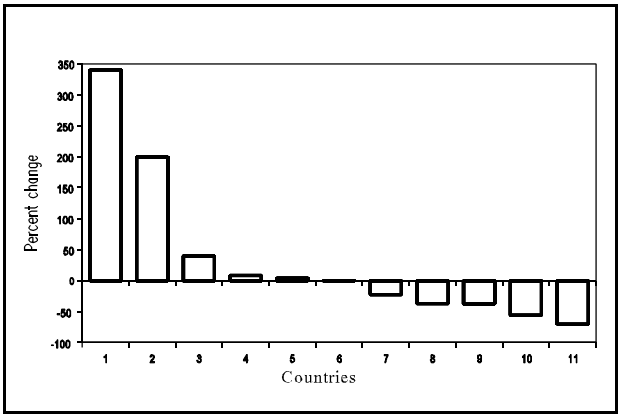

Figure 16. Percent change in catches of target species between beginning of project and date of last disbursement, for projects with investments in vessels.

In the late 1980s, the Operations Evaluation Office of the Bank undertook in-depth evaluations of four fisheries projects (one of which was a global sector credit loan not included in the projects listed here). Three of these evaluations are available and two of them provide important lessons for the Bank's future activities in fisheries.

One of the projects evaluated was a Multisectoral Global Credit Program for Chile that had a significant fishery sector component (OEO, 1989). This project

[20] In an evaluation of experience in fisheries projects done for the European Commission it was noted that "a further major problem with some evaluations and the syntheses of them is that they may fail to take a long-term view of project impact, confining themselves to questions of efficiency of the implementation of projects" (Spliethoff et al., 1990, p.6)

provided subloans amounting to $32.9 million for 81 industrial fishing operations and $13.5 million for 1776 artisanal fishing operations. Two major aspects were addressed in the evaluation, one relating to the problems of overfishing and the other to the difficulties of providing credit to artisanal fishermen.

With regard to the first aspect, the OEO report noted that there was some evidence that some artisanal loans were granted for the extraction of species already under excess fishing pressure (OEO, 1989). A critical conclusion was that credit operations in fisheries should only be considered when there is an effective program of fisheries management in place. Further comments included the following:

"An active fisheries management and regulatory body must exist to act on the results of ongoing fisheries research, monitor sector developments, and regulate harvesting activities to brake the tendency towards species overexploitation (OEO, 1989, p.4).

"In the process of developing a potential fisheries credit operation, sectoral studies should be a pre-requisite. The studies should be available before the loan contract is approved, and their results explicitly considered in the design of the operation. Such studies should identify stressed species for which additional fishing effort is not warranted (OEO, 1989, p.8).

"The executor must review (the) analysis as the sub-loan proposals are presented as part of the approval process. This requires sectoral acumen on the part of the executor's staff to be certain market forecasts, catch projections, and the input requirements in the sub-loan proposals are reasonable. This is particularly important in fisheries because species abundance fluctuations and price variations determine project viability" (OEO, 1989, p.3).

The evaluation, however, does not specify the kinds of management measures that would be appropriate, although it does note in a footnote that the open access nature of fisheries is the source of the difficulty.

With regard to the aspect of providing credit to artisanal fishermen, the evaluation specifies a number of the problems adumbrated by the chief of the Fisheries Division in 1974. These problems contributed to the fact that a serious debt in arrears problem had developed in the artisanal portfolio. Further comments included the following:

"The financial institution acting as executor must have sufficient knowledge of the peculiarities of the sector to be able to design sub-loan contracts which account for earnings volatility and periodicity, especially for small fishermen (OEO, 1989, p.5).

"The integrity of the sub-borrower project analysis must be subjected to close scrutiny to avoid approving projects with unrealistic market expectations in terms of catch and revenue (OEO, 1989, p.5).

"Artisanal fishermen may lack familiarity with credit instruments, being more accustomed to repayment in kind arrangements with middlemen or processing plants, who can exact repayment automatically every time a fisherman sells his catch simply by taking a percentage (OEO, 1989, p.6).

"Credit operations involving artisanal fisheries should explicitly anticipate and plan for debt collection procedures to avoid arrears problems. Loan proposals should discuss the feasibility of innovative artisanal credit arrangements, including repayment schedules tied to fishing seasons, correspondent relations with other financial intermediaries to accept repayments, delegation of collection responsibility to community leaders, perhaps even including a partial interest repayment rebate incentive for good community repayment performance" (OEO, 1989, p.10).

These arguments are well supported in the literature on small-scale fisheries, which stresses the vital importance of working within the social and economic context of the communities (see, for example, Smith, 1979; Panayotou, 1982; and Emmerson, 1980).

Similar points are made in the evaluation of the investment project to Guyana (OEO, 1987). This project provided a loan of $14 million in 1981 to the government of Guyana for execution by Guyana Fisheries Ltd. (GFL). The general purposes of the

project were to increase national production and export of shrimp, increase production of fish for human consumption, and increase employment in the fisheries sector. The project consisted of the purchase of 20 new shrimp trawlers, the adaptation of 10 old shrimp trawlers for use as demersal fishing vessels, improvements in the processing plant, and the purchase of four refrigerated trucks.

In terms of results, the evaluation noted that the project estimated that catch rates would be 28.4 metric tons per vessel per year. In fact, in 1984 and 1985, the GFL fleet landed an average of 11.9 m.t. per vessels respectively, while the national average was 16 m.t. and 13.6 m.t. Total GFL landings had been projected to be 653 m.t. in 1985 but were in fact only 214 m.t. (OEO, 1987). Also by 1984 net sales were one third of those projected and there was a net loss of US$ 4.1 million rather than a projected profit of over US$ 1.2 million. These projections appear to have been grossly overoptimistic (OEO, 1987).

The project was apparently plagued by a number of problems, many of which related to a justification based on incomplete and inadequate information. Particular deficiencies included an inadequate analysis of product demand and prices, underestimation of the costs of processing and cold storage, overestimation of shrimp product yields, failure to consider the net losses on the several varieties of processed fish, and the formulation of a plan to recondition vessels without careful investigation of the viability of doing so (OEO, 1987). The report concluded that there could be no case for increasing the size of GFL's shrimp fleet, for two main reasons. The first was because fishing effort was being reduced owing to indications of overexploitation of the shrimp resource and the second was the persistent inefficiency of GFL's management and the continued increase in its losses (OEO, 1987).

In an annex discussing important issues in the evaluation of fisheries projects, the OEO report made the following comments:

"Many projects use cooperatives as a means of forwarding loans to small-scale fishermen. An assumption made at project preparation stage is that cooperatives will instantly become acceptable to fishermen as a reasonable way of improving themselves. This shows a naive understanding of the peasant fisherman's socioeconomic institutional environment and his status within it (OEO, 1987, 115).

"The introduction of cooperative marketing...may have to face severe competition from private fish traders who are generally well entrenched in the fishing community, sometimes as providers of capital and credit (OEO, 1987, p.115).

"In many countries in an effort to assist the small-scale fisherman, it is difficult to find adequate supervision for the use of the loan or subloan except under the auspices of a cooperative institution which forms part of a government organization or Ministry. This is not often the Department of Fisheries, since in many cases such departments are based in the biological sciences and do not have the training, manpower or extension services to supervise loans to small-scale fishermen....If loans are to be channelled through cooperatives, it is necessary for the Executing Agency to employ Supervisors who know something about fisheries (OEO, 1987, p.116).

"Loans given to existing fisheries...may effectively subsidize fishing activities at a level below real costs. This may have two effects. First it may divert fisheries effort away from other fishing activities into the particular below-cost activity, thus affecting the other fisheries. Second, it may lead to over investment in the activity so subsidized, which, in the long run, apart from its commercial effects, may damage the fisheries stock" (OEO, 1987, p.118).

Summary

In the past decade, the Bank has funded no investment projects in fisheries and relatively few technical cooperation projects, although some of the recently approved coastal zone management projects have had fisheries components. It is not clear why the Bank has largely ceased its fisheries activities. In part, it could be because of a lack of interest on the part of the member states which have come to realize that there

are limited opportunities for further investments in fisheries but have only recently gained an appreciation of the benefits and large economic gains that could be achieved through effective fisheries management. In part, it could also be due to the apparent lack of significant success in the Bank's past efforts, as well as the current absence of fisheries expertise on the staff.

The question of degree of success, or failure, in the Bank's fisheries projects is difficult to answer because of the absence of critical information on the economic effects of the projects. It appears that the basic policies originally adopted for fisheries projects were not entirely inappropriate at the time of their adoption. It is also possible that some of the early projects providing for capital investment in fish harvesting and processing were beneficial to the recipient states. However, the fact that catches declined or rose only slightly in eight out of the eleven projects that involved investments in fish harvesting capacity indicates that the record of failure may outweigh that of success.

From the in-depth evaluations, as well as from the project documents, it seems clear that little account was taken of the special characteristics of fisheries. In particular, the problems associated with open access received scant attention during project preparation. It is not inconceivable that the declines in the catches of some of the recipient countries could have been partly due to depletion resulting from excess capacity supported by the projects.

Another aspect that may have been important was the reliance on FAO fisheries expertise during the 1970s. In this period, FAO was still largely dominated by the thrust for expansion of fisheries catch through capital investment and it was still development oriented. There has, however, been a significant shift in FAO's direction in the past decade, with considerably more attention being given to the economics of fisheries and the requirements for management.

This change in direction is equally appropriate for the Bank. With renewed attention to fisheries and a focus on fisheries management, the Bank would be able to take advantage of the significant opportunities for supporting projects that can produce large economic returns.

Experiences of Other Development Agencies

When fishery investment projects were undertaken by other development agencies, beginning in the 1970s, they initially followed the general mode for all development projects during that period. They generally focused on the transfer of technologies to large-scale enterprises, frequently within the public sector.[21] Typical projects included support for construction or purchase of large-scale vessels, construction of harbors and port facilities, and provision of processing plants.

The success record of such projects was not good, as pointed out in evaluations of fishery projects undertaken in the 1980s. The World Bank, for example, noted that overall, the performance of its fisheries portfolio continued to be poor: 50% of 16 completed fisheries projects were judged at audit to have failed in their major objectives, or to offer uncertain or marginal outcomes (World Bank, 1986). It might be noted that two of those deemed to have met their objectives did so only because of unanticipated increases in fish prices (resulting from increased scarcity of supplies). The Asian Development Bank (1986) came to a similar conclusion: that only two of eight completed projects achieved economic internal rates of return of at least 10%.

These and other evaluations give several reasons for the lack of success. In the case of the World Bank, only one of the thirteen reasons given relates to the special characteristics of fisheries; the rest are applicable to all development projects. The only reference to the open access condition is found in a footnote. In some of the projects, funds for constructing vessels would be provided only if the governments established a limit on fishing effort or

[21] "For example, of $295 million in loans provided by the World Bank for 27 fishery projects between 1964 and 1981, 60 per cent were utilized for large-scale fishery development" (UNDP, 1986, p. 27).

there was an assumption that attrition would lead to the removal of the older vessels. However, the governments failed to provide limits and the assumption that natural attrition would reduce effort is at best naive. Basically, the evaluation shows very little understanding of the problem of open access and of the needs for effective management measures.

The UNDP also listed several reasons for failure, one of which was insufficient attention paid to the limits of resources or to economic constraints (UNDP, 1986). It further stated that "there is an urgent need to find improved techniques for controlling fishing effort in order to prevent over-fishing of stocks and to achieve socially and economically rational use of limited resources" (UNDP, 1986, p. 37).

An evaluation by the Asian Development Bank laid primary emphasis on open access as the cause of failure, saying that a starting point would be an understanding of the common property nature of the resource and the market failure that leads to overinvestment in fisheries capture and to depletion of fisheries resources (Asian Development Bank, 1986).

With regard to small-scale fisheries, the various evaluations indicated that many of these were damaged by misplaced emphasis on large-scale operations. The UNDP evaluation stated that technological improvements applied to limited resources have led in some cases to an uneven acquisition of the technology, benefitting a few to the detriment of the many. This was also a source of conflicts between different users of the same stock or area (UNDP, 1986).

An early examination of fisheries projects by the World Bank recommended a new strategy for fisheries lending (Sfeir-Younis and Donaldson, 1982). It suggested that emphasis be given to improving small-scale fishing efficiency and productivity and that there was an important need for research on social and economic aspects. A recent review prepared for the European Commission specifies the overall problems in detail that is worth quoting:

"Failure in fisheries projects is primarily a result of creating interventions, in the form of assistance projects which do not take the special characteristics of capture fisheries and aquaculture into account (Spliethoff et al., 1990, p. 1).

"These special characteristics—*uncertainty, limited yield, shared resources, multiplicity of products and obscurity of production techniques and social systems,* clearly affect the way in which interventions in fisheries should be planned. Projects will obviously be put at risk if these characteristics are not fully taken into account (Spliethoff et al., 1990, p. 19).

"Strengthening of the institutional framework to develop and manage (a country's) fisheries production systems is a prerequisite for sustained impact of investments (Spliethoff et al., 1990, p. 1).

"The realization that stocks of fish have limits has meant that assistance has had to be directed more towards the management of the stocks than towards their increased exploitation (Spliethoff et al., 1990, p. 4).

"Agencies might have to consider investment in the reduction of production capacity as the more appropriate course of action than investment into expansion (Spliethoff et al., 1990, p. 18).

"More attention should be given to the active participation of beneficiaries in projects, flexibility in the way they are implemented, comprehensive information gathering, long-term commitment, phased development of projects, emphasis on the development of human resources, good quality field management, adequate incentives and appropriate strategies for the development of sub-sectors" (Spliethoff et al., 1990, p. 32).

Some bilateral development agencies (notably in Denmark, Norway, Sweden, and Germany) are currently providing support for small-scale fishery projects with attention to the customs, culture, and motivations of the communities. In addition, the Asian Development Bank has recently funded projects designed to support community-based fisheries management and development.

However, for the most part, the major development agencies have responded to these evaluations by ignoring fishery investment projects.[22] It appears that these agencies are now giving low priority to fisheries investment projects due, perhaps, to the low rate of success in the past, the apparent high risks of investment, and to the transaction costs of acquiring information on the special characteristics of fisheries and formulating appropriate projects. It is anomalous that this attitude of neglect is occurring simultaneously with the widespread public attention being given to fisheries and with the development of increasingly effective measures for fisheries management.

[22] Technical assistance and cooperation projects continue to be undertaken by some agencies, particularly by UNDP and FAO.

Issues and Approaches to Solutions

Fisheries Development

One of the difficulties in dealing with fisheries is the tendency to treat them as a single resource and in terms of volume of catch rather than value. In this sense, it is not possible to state that there are no opportunities for increases in the quantity of total fish catch. Such opportunities do exist since there are large quantities of marine organisms that are not harvested at present. However, such statements are irrelevant since they say nothing about whether the increased catch will be economically desirable and contribute to economic growth.

Opportunities for development must therefore be dealt with in terms of costs and revenues, which means that they must refer to individual stocks of fish rather than fish as a whole. In essence, the issue is whether increased net contributions to the economy will result from increased investment (development) or decreased investment (management).

There are a few fish stocks in Latin America and the Caribbean that are currently being utilized at levels below their potential maximum net economic yield and for which increased investment could produce increased marginal net returns. However, these are the exceptions rather than the rule. Most fish stocks at present suffer from economic overfishing, if not from biological overfishing. That is, a reduction in levels of fishing effort (and in total fishing costs) could lead to increased net economic revenues and in some cases to increased total catch (see Fig. 2). Thus, for most fish stocks of the region, where open access exists, development activities and investments that lead directly or indirectly to increased fishing effort will be damaging.

Incentives to increase fishing effort can come from activities and policies that reduce fishing costs or increase prices and revenues. Examples of the former include not only grants or low-cost loans for constructing vessels and acquiring gear but also improvements in landing facilities, fuel subsidies, tax abatements for imported inputs, provision of more technologically efficient gear and even training in ship handling and gear utilization. Activities and policies that lead to increased prices to the fishermen include price supports, reduction of export or stamp taxes, provision of low-cost ice or methods that improve fish quality (such as chilled seawater tanks), collection systems, and improvements in processing facilities. Some of these kinds of activities may be beneficial for other reasons, such as improvements in quality of products for consumers or for export markets, but their effect on fisheries that are already fully utilized will be detrimental since they will attract additional fishing effort to a resource already marked by overcapitalization.

National governments (and international aid programs) have tended to think in terms of development opportunities rather than management measures for several reasons. Among them is the long history of the treatment of fisheries as physical rather than economic resources, resulting primarily from the dominance of the biological sciences in fisheries analysis. This has produced numerous biological assessments of stocks and has supported a variety of research vessels whose task is to locate so-called underutilized stocks.[23] This

[23] An evaluation of one of the world's largest research vessels has determined that the information it has produced on underutilized stocks has never resulted in the development of a new fishery. "In the case of the (research vessel) *Dr. Fridtjof Nansen*, no new major fisheries have yet been opened up as a result of survey data, although the vast meso-pelagic resources discovered by the vessel in the Arabian Sea may prove to be an exception. The programme evaluation team indeed concluded that the most significant use of the survey results has been where an expansion of the offshore fishing fleet was restricted because of the evidence made available by the survey vessel, thus avoiding over-expansion of the industry and consequent waste of capital" (UNDP, 1986, p. 25). Two comments might be made about this statement. First, in spite of many efforts, the meso-

approach has tended to seduce administrators into thinking that the seas are an abundant source of raw materials that can be converted into natural resources by investment in development programs.

This view is reinforced by the reward systems for fishery administrators and development agents. The former are rewarded more for increased investments in capital equipment and increased total physical production (visible products) than they are for increased net economic revenues (which are not readily apparent and are difficult to measure). The latter are often rewarded more for increased amounts of loans or increased physical infrastructure than for improved contributions to national economic growth.

In addition, when overfishing leads to reduced average catches, which are not balanced by increased prices, fishermen experience hardships and put pressure on their governments for some form of aid. If governments respond by providing aid, such as subsidized fuel or price supports, this may alleviate the hardships in the short run but will exacerbate the problems in the long run because they keep the inefficient producers in the industry and may even attract more investment.

Another approach often adopted by governments, sometimes with the support of development agencies, is to encourage development of offshore stocks to reduce pressure on inshore stocks in the belief that there are underutilized resources in deeper waters. Support is provided to larger-scale vessels through loan programs, fuel subsidies, and other means. However, it is often the case that the inshore stocks produce higher economic returns than the offshore stocks, with the result that the new investment adds to the local pressure rather than alleviating it. Governments may impose regulations against the use of new vessels in the inshore areas but these are generally ineffectively enforced. This not only adds to the economic and biological waste in the inshore fisheries but also works to the disadvantage of the artisanal fishermen, who depend upon the inshore stocks and have low mobility.

Where an open access condition exists, efforts to encourage development of fisheries often have perverse effects. However, in those situations where access is closed and the fisheries are effectively managed, development projects may be beneficial, as discussed more fully in the next section.

Fisheries Management

Essentially, the management of fisheries is identical to the management of any other natural resource except that in the case of open access fisheries, the functions of management are fulfilled by governments, whereas in the case of other natural resources, the functions are fulfilled by the resource owners.

Resource management has basically four functions: (1) determining the objectives to be sought from the use of the resources; (2) acquiring information related to yield functions of the stocks and the costs, revenues, and processes of development; (3) determining and controlling the kind and amount of capital and labor to be allocated to production; and (4) ensuring and maintaining exclusivity in the use of the resources.

In the case of privately owned resources, the owner chooses how they are to be used; for example, whether to use land for buildings or for farming and, if the latter, what products should be produced. In this process, the owner acquires information on alternative uses and production functions. The owner also determines how much capital and labor should be invested in production. Finally, the owner seeks ways to ensure the integrity of his exclusive use rights—by erecting fencing, for example. These rights are generally protected by property law. Of course, governments may impose some constraints on these functions, such as prohibiting uses that create external damage. Generally, however, the management decisions are made by the resource owner.

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pelagics of the Arabian Sea have not yet been developed and there are some reports that the estimates of potential yields were in error. Second, although the information on overfishing is useful, the author is not aware of any actions taken by governments as a result of the information that have successfully prevented continued waste of capital.

For open access resources, such as most fisheries, there are important limits to the degree to which individual users can fulfill these functions. A fisherman can choose a certain kind of gear for a particular stock of fish and will acquire information to make this decision, but he has no control over the amount he can produce since this will be affected by the amount taken by others. As long as open access exists, the management functions must be largely fulfilled by some agent of government (national, provincial, or local).

The choice of objectives

Governments may consider various kinds of objectives for the management of fisheries. These include maximizing sustainable yields of stocks, increasing employment opportunities, increasing fishermen's incomes, improving supplies of low-cost protein for domestic consumers, reducing dependence on imported food, obtaining greater export earnings, or increasing contributions to economic growth. These objectives, however, are not entirely compatible, and choosing among them often presents difficult decisions for governments, particularly because the choice tends to affect income distribution, which means that the decisions must be made at political rather than simply administrative levels. As a result of these difficulties, very few countries have statements of goals that are clear-cut, meaningful as guides for management decisions, and internally consistent.

The goal of achieving maximum sustainable yields may be clear-cut but it is not economically appropriate. In recognition of this, some countries substitute the word "optimum" for "maximum," but this is not a useful guide for decisions. The desirability of increasing food supplies or export earnings depends upon the costs involved.

It is common for statements of objectives to refer to increases in employment opportunities. However, while this may be desirable in certain special circumstances, it cannot be achieved without sacrificing contributions to economic growth since the latter often requires reductions in the amount of fishing effort. Increased average earnings for fishermen can be achieved only if the opportunity costs of fisheries labor increase.

The objective that best meets the criteria of clarity and meaningfulness is that of maximizing net contributions to the economy, although, as noted, this can only be achieved by controlling entry into the fishery, which reduces opportunities for employment. In most situations, this is the basic dilemma facing fishery administrators. It should be emphasized, however, that this dilemma is the consequence of treating fishery resources as open access resources. It is not a dilemma facing the owners of private property and would not be a dilemma in fisheries if they were subject to satisfactory property rights.

Furthermore, using fishery resources as an unemployment insurance scheme serves only to perpetuate the economic waste of the resources and to divert scarce capital into redundant enterprises. If unemployment is a significant issue, it should be addressed directly rather than be a reason for distorting the use of a natural resource. It is important, however, to be fully aware of the employment consequences of management strategies and to take steps to alleviate hardships through such means as the development of alternative employment opportunities. Such development would decrease the pressures to enter a closed fishery or to violate the regulations.[24]

The acquisition of information

For fisheries, the acquisition of information is split between governments and the fishermen. However, as long as there is open access to the resources, most of the information must be acquired by government. For the biological aspects of management, this includes information on the status of the stocks, yield functions, effects of regulations, and amount and kind of by-catch. For economic and social aspects, governments should (but seldom do) collect information on

[24] For small-scale fishing communities, the provision of a territorial use right in fisheries (TURF) will give them the opportunity to determine their objectives, as discussed on page 42.

employment and on the factors affecting costs and revenues.

Where there are controls over access, there is an incentive for fishermen to participate in the collection of information. For example, in the northern Australian prawn fishery, there is a limited entry program that has provided the fishermen with a sense of tenure in the resources. They have found that it is in their own interest to buy the research that tells them when they should move from one stock to another in order to maximize the size of the prawns they harvest and therefore the prices.

Similarly, quota holders in the New Zealand fishery for orange roughy have created an organization, The Exploratory Fishing Company (ORH3B) Limited, one of whose primary functions is to carry out exploration for new grounds and stocks, quantify existing knowledge, and carry out specific biological research (Stevens, 1993). To support this work, the individual quota holders donate a share of their quotas.

Even though the implementation of effective controls over access can shift some of the information-collection tasks away from the government, the government will still have a role to play. The degree of involvement will depend in part upon the views of society with regard to the ownership of the resources and in part upon the degree of external effects associated with the fishery. Where society views the resources as belonging to it rather than to the fishermen, the government will want to monitor the operations to be sure that society's interests are protected. It will also do so when a particular fishery affects other fisheries or other values of interest to society.

The costs of obtaining biological information on fish stocks are very high and the results are generally marked by considerable uncertainty. The resources live in a three-dimensional, opaque, and fluid medium subject to wide environmental influences (e.g., salinity and temperature) that can originate in distant areas. There are complex predator/prey and competitive relationships among the stocks. In addition, there are often major deficiencies in the data on catch and effort that are fundamental elements in the estimates of yield functions. Understanding the basic characteristics of the sea's living resources is far more difficult than doing the same for land resources.

The importance and value of biological information, however, is sometimes overstressed. For example, in fisheries such as the those of the Northeast Atlantic, for which there has long been abundant biological information, the information has not prevented the continued waste of economic resources (nor, in fact, the depletion of the stocks). Where the stocks are managed under conditions of open access, the value of such information in preventing economic waste is zero.

On the other hand, deficiencies in biological information do not preclude the adoption of effective management measures. Although the biological information may not be sufficient to determine the optimum level of the controls, there is generally adequate evidence of waste to indicate that controls on access would be desirable and would produce economic benefits. There are various indicators that can be used, such as low catches per unit of effort, low returns to capital and labor, and conflict between different user groups. These indicators are often readily apparent. This is not to say that biological information is not important in making management decisions, but rather that the costs of improving the quality and amount of the information may be greater than the benefits.

Often there tend to be more significant deficiencies in economic information than biologic information. It can be difficult and costly to acquire economic information. For example, the development of price information on a comprehensive basis requires dealing with a large number of species with disparate markets. For any one species, prices may vary with the size of the individual fish, the time and place of harvest, the season, and the quality of the fish. It is also difficult to obtain comprehensive information on costs because of the wide variety of vessels and gear in use, the share system for payment of labor, disparities in maintenance and repair, and differences in time and distance spent in search of stocks.

However, the costs and earnings in any particular fishery can generally be analyzed at a relatively low cost. As in the case of biologic information, there may be imperfections in the information but these are not likely to be so great that they would preclude useful decisions.

Bioeconomic models have been developed for analyzing particular fisheries and as a means for providing information on the need for management measures and the likely benefits that would result. One important example is BEAM 4, developed by FAO. This is a deterministic bioeconomic simulation model that can handle several target and by-catch species, and several fleets operating sequentially or simultaneously across several areas and landing at several processing plants. The model also accounts for migration and seasonal recruitment (Sparre and Willmann, 1992).[25]

Allocation of capital and labor

The most important function of management is that of allocating capital and labor. For owners of natural resources, the task is fairly simple. They determine the appropriate mix of the factor inputs and allocate those inputs at the point where they maximize their profits. However, in open access conditions, the market mechanism is unable to make the appropriate allocations with regard to the resources, and the resources attract redundant units of capital and labor. In this situation, governments must determine and allocate the appropriate amount of capital and labor to be applied to the exploitation of the resources.

There are various direct and indirect methods for fulfilling this function. However, since all such methods have distributional effects, governments generally seek other means to deal with the waste associated with excess capital and labor. The conventional approach is to deal with the most obvious symptom, which is the depletion of the stock. There are three general methods for doing this: (1) restrictions on the kinds of vessels or gear that can be used; (2) controls on the age of first capture, including limits on area and harvest period; and (3) a limit on the total allowable catch.

The first approach assumes that certain kinds of fishing gear or vessels are damaging to the stocks. In some cases, such as prohibitions against the use of dynamite or poison, the assumption is amply justified. In other cases, however, the "damage" may be due primarily to the technological efficiency of the device and its capability for taking larger quantities of the stock than existing technologies. For example, the state of Maryland has prohibited the use of mechanical power on vessels dredging for oysters and requires the vessels to use sail power. Less draconian measures include prohibitions against the use of stake nets, prohibitions against pair trawls, banning the use of longlines, etc. These kinds of measures do not necessarily prevent excessive applications of capital and labor nor do they necessarily conserve stocks since they do not prevent overuse of gear that is not prohibited. In addition, by preventing the adoption of technological innovations, they tend to perpetuate inefficiency and place the fishing industry at a disadvantage with regard to other industries. These kinds of controls are common and are generally adopted because the users of the conventional gear anticipate that the users of the innovative gear will take greater shares of the stocks.

The second conventional approach seeks to control age of first capture by limiting the size of individuals that can be landed, limiting the size of the mesh in trawl codends or drift nets, and closing seasons or areas where small individuals are available. These techniques may well be of value in enhancing the productivity of the resources, but without additional controls they do not prevent overinvestment. To the extent that they are effective in increasing the yield of the stocks, they will only serve to attract additional capital and labor.

[25] This model has been used to study several tropical shrimp fisheries, including those of Madagascar, Tanzania, the northeast coast of India, the west coast of Malaysia, and the Gulf of Guacanayabo, Cuba. A dynamic single-species model has been developed in Excel 5 and used to analyze the lobster fishery of the Gulf of Batabano, Cuba. This multiyear model accounts for stock adjustments over time and discounting of costs and revenues (Sparre and Willmann, 1992).

Although limits on total allowable catches are the most direct method for maintaining or enhancing stock yields, they are particularly damaging to the economic welfare of the fisheries. Under this approach, the fishermen have the incentive to increase their individual catch in order to get the greatest share for themselves before the TAC is reached and the season closes. For example, in the case of the U.S. Pacific halibut fishery, the imposition of a TAC led to a shortening of the season from 9 months to a few days. This was not only extraordinarily wasteful of capital but also led to degradation of the product because the processors could not handle the catch in such a short space of time, and to decreases in prices due to the glut on the market.

There are two additional damaging consequences. One is the likelihood of damage to the stocks because of excessive use of gear during the short open season. In the halibut fishery, the fishermen often laid out an extra number of longlines, which would be left on the bottom if they did not have time to haul them in. The other is loss of life. When the season opens, the fishermen will incur high risks to engage in fishing, even during periods of storm, because of the lack of other opportunities to fish.

While the conventional approaches to fisheries management may be of value in certain situations, they do nothing to prevent the dissipation of economic rents. This requires other techniques that directly or indirectly encourage a more efficient allocation of capital and labor. There are basically three approaches that can be taken: (1) a direct limit on the amount of fishing effort (a license limit scheme); (2) assigning the fishermen individual transferable quotas (ITQs) that give them an incentive to limit their investment (Christy, 1973); and (3) the use of economic disincentives, such as taxes or fees, to dissuade excessive investment. These methods can be employed by governments (national or regional) or at the local level by user or community groups. The transfer of management authority to a local group requires the creation of a territorial use right in fisheries (TURF) and although it is not a specific management technique, it provides a management approach that may be particularly useful in artisanal fisheries.

License Limits: Conceptually, the simplest method is to directly limit the amount of fishing effort by limiting the number of vessels or amount of gear in the fishery. Generally the initial step in this process is to place a moratorium on the entry of any new vessels in the fishery. This is followed by providing licenses to all those at present in the fishery (i.e., "grandfathering" them in) and subsequently by measures designed to reduce the amount of effort to the point where it produces the greatest difference between total costs and total revenues. There are, however, three major problems associated with the implementation of a license limit scheme: allocating the licenses, determining the appropriate amount of fishing effort, and achieving that amount.

Although it sounds relatively easy to place a moratorium on new entries and allocate licenses to all those at present fishing, the task can be difficult. One problem is that of defining "those at present fishing." In part, this depends upon how the "present" is defined—whether it should refer to a particular day, month, year, or number of years. Another problem is that of determining who is a fisherman. This is particularly difficult if there has been no registration or overall licensing system in effect and no data identifying fishermen in a particular fishery. Even where there are data, for various reasons some fishermen may not have been involved in the fishery during the period chosen, although they may have historically participated and ought to receive a license. Or they may have just made an investment in a vessel with the intention to participate.

Another aspect is that some fishermen may have been involved only part-time in the particular fishery during the base period, and there may be objections to including them in the allocation. It is not uncommon to find that the initial allocation is associated with individual appeals and litigation. The process may also be associated with attempts to acquire licenses through illegal means such as false claims or bribery.

A second problem is that "effort" is difficult to define since it includes several elements: the fishing unit, its catching power, and the time spent fishing. The definition of a fishing unit is also complex since it

includes the vessel, the engine power, kind of gear, and amount of labor. Furthermore, in most fisheries, there is a high degree of substitutability among these elements so that a limit on one induces fishermen to employ more of others. For example, a limit on the number of vessels leads fishermen to increase the size of their vessels or to increase the time spent fishing. A limit on size leads to increases in engine power or to nets with a larger capacity. Experience in the use of this technique has shown that fishermen will often find a means for getting around the intent of the regulation and increasing their individual catching power. This may result in a continuation of excessive investments and overfishing of the stocks. To prevent this the management agency will need to employ increasingly restrictive measures until all elements of the fishing effort are circumscribed and there are no possibilities for technological innovation.

Alternatively, the management agency could allow the innovations to take place but proportionately reduce the number of units involved so that total costs and effort are limited at the appropriate level. Reduction of fishing effort would generally be desirable in any case, since the initial allocation of licenses probably would have grandfathered in all of the (excessive numbers of) fishermen. This raises the third problem—that of reducing fishing effort. It is theoretically possible to achieve this by fiat, removing licensees without compensation, or by prohibiting transfer of licenses and allowing attrition to reduce the number to the appropriate level. The former approach is unlikely to be politically feasible and the latter approach is unworkable and undesirable, as discussed below ("Issues of Transferability and Distribution of Wealth" p 43).

A reduction of effort can be achieved by a buyout program under which compensation is provided to fishermen who are willing to relinquish their licensed fishing units. The fishing units purchased through this system would be retired from the fishery and generally should be destroyed to prevent their transfer to other fisheries that may also be subject to excessive effort. Although funds for this purpose might come from the general treasury, they could be derived from the fishermen who remain in the fishery and who will benefit from the reduced effort. The economic rents produced by the system could be extracted through taxes or user fees (discussed further below, on pp 43, 52).

One of the difficulties associated with a buyback system is that there is often wide disparity among fishermen in their rates of catch. There are generally some fishermen, known as "highliners," who take a large portion of the catch. Their average catches may be two to three times those of most fishermen and several times greater than those at the bottom of the scale. Thus, if the buyback program retires the fishermen with the lowest levels of average catch, it may require that large numbers be retired before there is a significant effect on the total amount of effective fishing effort.

Although there are several kinds of problems associated with the license limit approach, this does not necessarily mean that the system should be rejected. There are some fisheries where the problems may be relatively easy to deal with. For example, the problem of substitutability among inputs is not significant in fisheries that use traps, such as lobster trap fisheries. A limit placed on the number of traps, perhaps of a certain size, may be effective in controlling total effort since increased size of vessel or horsepower would have little effect on total catch. In this situation, a buyback system would purchase trap privileges rather than vessels.

Furthermore, the various imperfections in a license limit scheme do not necessarily preclude the system from producing economic rents. Thus it appears that freezing entry, even with limited controls on capital (e.g., in Alaska, licenses apply to individuals), and even at levels close to open access conditions, will be sufficient to preserve some rents (Wilen, 1989).[26] In all cases, the system is likely to be more beneficial to national economies than maintaining open access. It may also be more effective than an ITQ system in

[26] For estimates of economic rents produced in license limit schemes, see section entitled "Allocation of Factor Inputs", p 52).

fisheries where the costs of monitoring individual catch are very high or where there are significant problems of by-catch.

ITQs: An ITQ system requires the management agency to first estimate the total allowable catch in the fishery. This is then divided into shares that are distributed to the fishermen, usually on the basis of their past history of catch. The shares are usually expressed as a proportion of the TAC rather than as fixed quantities. The shareholders are then free to take their quotas whenever they want during the season and with whatever gear they want (short of environmentally damaging gear). Since their catch is determined at the opening of the season, so is their total revenue. Their incentive, therefore, is to take their catch at the lowest cost.

With freely transferable shares, there will be a tendency for the fishermen to buy or sell amounts in accordance with their skills, knowledge, and capital investment. Those with shares that are too small to make effective use of their investments will either buy additional shares or sell their shares and get out of the fishery. The market mechanism will operate to rationalize fishing capital and lead to a reduction of total fishing investment and effort. Thus, unlike the license limit system, there will generally be no need for the government to invest in the reduction of fishing effort.

There will, in addition, be an improvement in the distribution of fishing effort throughout the season. After the ITQ system was introduced into the U.S. Pacific halibut fishery, the season lengthened from a few days to several months; the fishermen were able to negotiate better prices from the processors; and the processors were able to receive higher prices by shifting from the frozen to the fresh market and by producing higher quality frozen fish. A not insignificant outcome has been the decline in numbers of vessels lost and fishermen drowned.

There are, however, certain difficulties with this approach. One is simply the problem of estimating the total allowable catch, which is a problem associated with other measures as well. This generally requires satisfactory information on status of the stocks and the potential yield. Although such information is available in many fisheries, there are others where stock assessments may be necessary. Government investment in such research may be required. However, the estimates do not need to be absolutely precise. If the estimate is too high, adjustments can be made in the following season. If it is too low, the shares can be increased during the season.

Furthermore there is a possibility that governments can rely on economic indicators to determine the appropriate level of TAC. Arnason (1994) has suggested that the information needed to determine the optimal total catch for a fishery already exists in an ITQ fishery. The fishermen have the most complete information about their harvesting economics and catch prices, and have detailed knowledge about the state of the fish stocks. Given an efficient quota market, all information about the future course of the fishery, the state of fish stocks, the market price for landed fish, harvesting costs, and so on, would be embodied in the market value of the quotas, which would be roughly equal to their expected return in use. The total value of outstanding quotas is thus a good measure of the total expected rents in a fishery. It follows that to determine the optimal total quota, the fishing authority has only to adjust the total allowable catch until the value of the outstanding quotas is maximized (Arnason, 1994).

A much more critical problem with the ITQ system is the cost of enforcement since it is necessary to monitor the catch of each fisherman. Where there are numerous markets and landing sites, or where transshipment of catch at sea is possible, it can be difficult to overcome the problems of monitoring individual catches.

Economic Disincentives: In the third technique, the management agency appropriates enough of the economic rent in the fishery to make it uneconomical for the redundant fishermen to participate. This can be done by levying taxes or royalties on catch, by charging user fees, or by auctioning either licenses or ITQs. In some cases, taxes on exports or imports (such as fuel and nets) serve as indirect methods for discouraging entrants into a fishery. For example,

80% of the catch in the Bahamas is crawfish and almost all of it is exported. There is an export tax of $0.25 per pound which, together with a stamp tax of 2% of the value, yielded $2.3 million in government revenues in 1993. This is roughly 4% of the gross revenue from all fisheries. Although this amount is undoubtedly well below the potential economic rent, it may deter some entry into the fishery.

The direct use of economic disincentives has several benefits, the most important of which is that it can produce significant revenues for the government, as well as reduce economic waste. The chief difficulty is that it is politically unrealistic to attempt to impose taxes or user fees on long-standing fisheries that are already overcapitalized, and where average earnings are low.

However, it is critically important to note that taxes or user fees can be imposed in conjunction with other management techniques as a means for extracting the economic rents that will be produced. This raises the issue of the distribution of wealth, which is discussed in a later section.

TURFs: The systems for allocating fishing effort discussed earlier relate primarily to medium- to large-scale fisheries and can be imposed at national levels. Such systems, however, would generally be inappropriate for artisanal fisheries. Artisanal fisheries often use a variety of small craft and gear, including pirogues or canoes powered by hand, boats powered by sail or outboard motors, beach seines hauled by hand, stake nets, etc. It would be impossible for national or regional governments to effectively limit the amount of these kinds of vessels or gear. Also, most artisanal fishermen take a wide variety of species, which they may land in a large number of places (not only in ports but also along beaches) and which may be used for their own consumption, bartered for other goods, or sold in informal as well as formal markets. In these cases, an ITQ system would not be appropriate since national or regional governments would find it difficult if not impossible to estimate TACs for the different stocks and to monitor the catches of the individual fishermen. Economic disincentives are also likely to be ineffective.

Nevertheless, management of fisheries at artisanal levels is just as necessary as it is for medium- and large-scale operations. However, since this function cannot be fulfilled by national, regional, or state governments, the only option is to devolve management authority to the local level, which may be the fishing community or a group of fishermen. In order to do this, the government must provide the community or group with a territorial use right in fisheries under which the community has exclusive rights to the use of the resources within a certain area (Christy, 1982). The community may then fulfill the management functions itself.

In times past, systems of community-based fisheries management were relatively common throughout the region (Cordell, 1989; National Academy of Sciences, 1986). Indeed, it was customary for small fishing communities to have a sense of tenure over the near-by resources and to exclude or at least control use by outsiders. Such systems were particularly strong where the borders of the assumed rights were clearly demarcated, as in the case of coral reefs and estuaries and bays. It was also common for these systems to have some kind of control over use of the resources. Such controls tended to prevent excessive use of the resources, even though they may not have been intended to achieve that result.

Some of these systems of customary community tenure still exist but many have disappeared or become seriously weakened. One of the major causes of their disappearance was the intrusion into the grounds of large-scale fishing operations, particularly shrimp trawlers. Another cause was the move from subsistence to monetary economies, which increased the incentives for individuals to seek to maximize their individual gains rather than cooperate in achieving community gains. Governments and aid agencies also participated in the destruction of the systems, owing to a lack of awareness of the management benefits of the systems and to pressure to increase fisheries investment. Nevertheless, although many of these traditional TURFs have disappeared, there frequently remains a sense that the local community has a preferential right over the fishery resources that are adjacent to it.

This sense of ownership may serve as a basis for establishing or recreating community TURFs. As in other cases, however, there are certain difficulties associated with this approach. The most important of these is the decision to provide the community with an exclusive right. Frequently, this means that other groups of fishermen will lose access to the area and the stocks within the area. These may be trawler fishermen fishing for shrimp in the area, or they may be artisanal fishermen from a neighboring community. In either case, it is difficult to make such decisions. In addition, where the important stocks migrate along coasts, an exclusive territorial right held by an individual community may not permit effective control over the stock. Problems also exist in defining the community and determining the degree of authority that should be allocated to it. Although it may be difficult to overcome these problems, the impracticalities of using other management measures in dispersed small-scale fisheries suggest that TURFs may be the only appropriate approach to management.

Issues of Transferability and Distribution of Wealth: Each management technique that closes access to the fisheries will lead to the creation of economic rents. The amount of these will depend on the effectiveness of the system and the economic characteristics of the fishery. The rents will appear as surplus profits to those who initially acquire the rights. In the Alaska system of license limits in the salmon fishery (which has a large number of imperfections), the purchase price of the privilege to fish has reached $300,000. That is the price that commercial fishermen must pay for a license to enter the fishery.

This raises two important questions: (1) whether the rights should be transferable and (2) how the rents produced should be dealt with. In some fisheries, governments have attempted to prevent fishermen from selling or leasing fishing licenses for two reasons. One is the belief that the total number of licenses will diminish as vessels age and as fishermen retire. The other is that preventing transfers will prevent licenses from being accumulated by a few fishermen or by "big business."

Economic forces, however, almost always undermine attempts to prevent transfers. If there is a decline in the number of licensees, and the total value of catch remains the same or increases, those remaining in the fishery will receive larger shares of the revenues. If, for example, a fisherman receives a surplus profit of $6000 per year, it means that the license is worth $100,000 to him (at an interest rate of 6%). If he cannot sell the license or transfer it to his son or another relative, he will be unwilling to relinquish it and will be tempted to continue to fish. If the license is attached to his vessel, he will do everything he can to maintain the vessel in the fishery even though the vessel's age would normally dictate replacement. Generally, where attempts are made to prevent transferability, the fishermen will either find a means for violating the rule or they will demand that it be repealed. Furthermore, the prevention of transferability is economically unsound since it precludes the entry of more efficient fishermen and does not allow rationalization of the fishery.

There is a possibility that individual fishermen or companies could acquire a sufficient number of privileges to affect market prices in a monopolistic or oligopolistic manner. This, however, can be fairly easily prevented by limiting the number of licenses or shares that can be owned by any individual or company.

The argument that privileges may be acquired by large business corporations is valid. Whether this is considered to be damaging to overall national interests is a matter of the degree to which it occurs (naturally or subject to controls) and the perceptions of the society with regard to competition between "big business" and individual fishermen with little access to capital. The environmental group Greenpeace has taken the view that ITQ systems will lead to "the big business takeover of US fisheries" and that this will produce "negative social impacts" due to loss of fishery access by individual fishermen and to the presumed ability of large corporations to control wages for labor (Greer, 1995; see also Eythórsson, 1996). Although these apprehensions are not entirely groundless, such social costs, to the extent they occur, must be balanced against the infeasibility and

economic costs of preventing transferability and the benefits of achieving an economically efficient industry.

Moreover, some of the problems mentioned can be alleviated by systems that permit the government to extract a portion of the economic rents that are created. Without systems for extracting the rents, this value accrues as a windfall gain to the first generation of fishermen who acquire the privileges (if the privileges are allocated through a grandfathering scheme, as is usually the case).[27]

Governments, however, can use taxes or royalties to extract the whole rent or a portion of it. The question of government extraction of the rents is to a large extent a matter of distribution of wealth and is a decision to be made by the individual states.[28] In part, the issue depends upon society's views with regard to the ownership of the resources. Where the fishery resources are viewed as belonging to society, governments may wish to extract all, or a large share, of the rents as a return to society for the use of its resources. Where this view does not prevail, then governments may be willing to allow the fishermen to appropriate the rents.

However, questions of efficiency are also important. A case can well be made that governments should extract sufficient rents to cover at least some of the costs of management (research, administration, and enforcement). For privately owned resources, the costs of fulfilling these management functions are largely borne by the resource owners. The owners have the opportunity to allocate their expenditures efficiently and the incentive to invest only as much as is necessary to maximize their returns. Where governments bear all the costs, the funds are allocated in an arbitrary fashion that is usually based on political pressures, and there are no market mechanisms for determining the appropriate amount of the expenditures. For example, the enforcement of ITQ systems can be costly. If the fishermen do not share in these costs, society may be unwilling to invest sufficient funds to ensure that the enforcement is effective (Johnson, 1995).

In addition, there is value in extracting some revenues to ensure effective control. There will almost always be imperfections in whatever system is adopted. There will also always be changes in basic conditions in the fishery, such as prices, costs, and yields. It is likely that these changes will require continued adjustments in fishing effort, sometimes downward. In order to make these adjustments, governments may have to impose additional measures. Under a license limit scheme, it may be necessary to reduce the number of fishing units. Under an ITQ system, a major decrease in the total allowable catch, and in the individual shares, may create undue hardships for the fishermen. In both cases, some flexibility can be achieved by buying out some of the fishing privileges (which could be sold back to the fishermen when conditions improve). The extraction of some of the rents could provide a form of "revolving fund" to be used for such adjustments.

If no system for extracting the rents has been adopted and the entire rents have accrued to the fishermen, then the costs of buying back the privileges or shares will be exorbitant and unlikely to be acceptable to society. However, if the government has a system for extracting some of the rents, then there will be two advantages. First, the sale price of the privileges will be lower. Second, the government will have funds available for buying out the surplus effort or purchasing back some of the shares.

There are other aspects to the issue of extracting the rents. One is that the fishermen already in a particular fishery may be more likely to accept an ITQ or license

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[27] Rights can also be distributed through an auction mechanism, as is being done currently in Peru for the squid fisheries. This approach could be used to avoid the problems of windfall gains. It would depend, however, upon the terms of the auction and the tenure of the rights that are auctioned off.

[28] A draft policy statement for the fisheries of Trinidad and Tobago provides a statement of management objectives that includes "maximization of economic efficiency" and "collection of an appropriate charge from individual fishermen and firms exploiting for gain a resource which belongs to society as a whole" (Fisheries Division, Trinidad and Tobago, 1994, p. 61).

limit system if they anticipate receiving fishing rights that will produce windfall gains. As Hannesson (in press) points out, support is likely to be forthcoming only if the constituents expect to get a capital gain from the ITQ system. It is probably unavoidable that some of the fishing rents must become capitalized into a market value of ITQs. To the extent that the government, which represents the ultimate owner of the resources (the public), is regarded as the rightful rent collector, this is a price that in all probability must be paid for putting an ITQ system in place. The obverse of this is that those fishermen who are unlikely to receive shares will be opposed to an ITQ system.

Another aspect is that the extraction of rents by governments reduces the sale price of the privilege. If the rents are extracted through annual payments of fees or royalties (rather than through a lump sum payment such as a transfer tax), the reduced sale price of the privilege will make it easier for newcomers to enter the fishery. That is, the price they pay up front for the privilege will be relatively low and the rents taken from the taxes or user fees. This would permit the less well-capitalized individual fishermen to compete for access with the large corporations. Government acquisition of a portion of the rents would do much to allay the fears of a "big business" takeover and the concern that the imposition of closed access systems represents a "giveaway" of the public's resources.

In essence the question is not so much whether rents should be extracted, but the amount that should be collected. The response to that question will depend upon several factors: the characteristics of the fishery; the interests of the different groups of fishermen, which may be disparate; the interests of society; and the views of society with regard to ownership of the resources. It should be noted, however, that in cases where more advanced forms of property rights have been acquired by the fishermen, the fishermen tend to assume some of the functions and responsibilities of management and are willing to incur some of the costs.

There are various systems for extracting rents from the fishermen.[29] Whatever system is used, however, should be based on the value of the fishing privilege. That is, it should fluctuate in direct proportion to the price of a license or a quota (i.e., to the property right). When a system is initiated, it is likely that average incomes of fishermen will be very low and that the fishermen will be unable to pay very much for the privilege. As the system takes effect, however, the price of the privilege will rise, generally at a very rapid rate. If there is a flat tax or user fee based solely on what fishermen can pay when the system is established, it will fail to extract significant amounts of rent as the system develops. However, if the tax or fee is proportionate to the value of the privilege, it will not affect the earnings of the fishermen at the beginning of the system and will be able to capture significant rents as these appear in the fishery.

Enforcement

The final function of management is ensuring the integrity of the management system, which can be complex and costly.[30] There are several elements to this function: (1) monitoring the system, (2) arrest of offenders, (3) trial, (4) punishment, and (5) reporting the results. Where resources are privately owned, the first element can generally be fulfilled by the owner while the others are usually the responsibility of government. For open access fisheries, the users may have a limited role to play in monitoring use of the resources and no role with regard to the other elements.

The major difference, however, is in the degree to which government is involved in enforcement. For private property holders, the institution of property rights strongly protects the owner and monitoring is

[29] There has been little research on the alternative techniques for extracting rents from the fisheries. Various possibilities include a set fee for the license or quota, a fee based on estimated profits, a transfer tax, a property tax, and others.

[30] This discussion focuses on enforcement in domestic fisheries. There may also be significant enforcement functions with regard to foreign fisheries, which are discussed in the section on conflict resolution.

generally a simple matter. However, for fisheries, the function of monitoring use of the resource can be very complex and costly. The degree of complexity depends upon the fishery and the management measures that are in effect, and the degree of cost depends upon the distributional effects of the measures.

Such measures as closed seasons and closed areas are relatively easy to monitor (although they may still require significant investments in monitoring capacity). Measures involving controls on kinds of gear or quantities of catch can be very difficult. Where the measures significantly redistribute wealth from one user group to another without compensation, enforcement costs are likely to be very high.

Enforcement costs are lowest when the fishermen perceive that compliance with the rules is clearly in their own interests. The most desirable arrangements, therefore, are those under which all participants who can influence the outcome feel that they are better off by abiding by the rules than by breaking them. A critical element of this is the degree to which they have tenure in the resource and a right to the products of management. This, in turn, depends upon the degree to which outsiders are effectively excluded.

Conflicts

It is primarily the absence of a market for the natural resources and therefore the absence of an automatic mechanism for allocating the resources among competing users that is the source of conflict over fisheries resources. There are two dimensions to the conflicts: international and intranational.

International conflicts

There are several kinds of international conflicts. These include problems in the delimitation of boundaries, the prevention of illegal foreign fishing within boundaries, the need to reach agreements on the use of shared stocks (those migrating within the EEZs of neighboring states), straddling stocks and stocks on the high seas, and the use of trade barriers by importing states that impose rules on fisheries that may have possible by-catch of marine mammals and sea turtles.

Questions of boundary delimitation relate primarily to controversies over borders between neighboring and opposite states and secondarily to the rights of coastal states over resources beyond 200 nautical miles. The former set of controversies can only be resolved by negotiations among the contending parties. The issue of coastal states' rights beyond 200 nautical miles needs to be resolved through international convention.

Poaching by foreign vessels in the EEZs of the coastal states is a persistent problem throughout Latin America and the Caribbean. Two recent UN agreements developed through FAO provide some help in dealing with this issue. The agreement on the marking of fishing vessels facilitates surveillance by requiring the vessels to have their call signs prominently displayed in standardized form. The UN agreement on flags of convenience (Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas) shifts some of the burden of enforcement to the flag states.

Although these measures are useful, they do not relieve the coastal states of responsibility for monitoring their own waters. This may require aerial surveillance as well as patrol vessels, and can be quite costly. In most cases, the costs are likely to be excessive. If, however, there is significant foreign poaching, there may be considerable benefits in the form of increased domestic catch as well as in the fines levied on the violators, including the possibility of confiscation of the offending vessels. The relationship between benefits and costs depends upon the quantity and characteristics of the resources within the EEZs.

A related issue is obtaining the assurance that foreign fishermen who are fishing under an agreement with the coastal state are in compliance with the terms of the agreement. The severity of the problems associated with this issue depends upon the nature of the agreement. Arrangements that are based on quantities of catch of a particular stock tend to be more beneficial to coastal states than arrangements based on

quantity of fishing effort. However, monitoring levels and kind of catch may require the use of nationals of the coastal state as on-board observers, which is often ineffective and can be costly. Arrangements that allow for a certain number of vessels may be easier to monitor but less effective in protecting the interests of the coastal states.

Conflicts over shared, straddling, and high seas stocks become significant when the stocks are fully utilized. In the absence of agreement among the sharing states, the fishermen of the different states will have a competitive race to maximize their catches. Fisheries that are shared by nations constitute one of the few enterprises, other than war, in which nations are in direct confrontation with each other over a natural resource. A recent agreement that will facilitate the resolution of these kinds of conflicts is the UN Convention on Straddling Fish Stocks and Highly Migratory Fish Stocks, signed in 1995.[31]

In the past decade, a new form of international conflict has become significant, with negative effects on many states in the region. These conflicts are over differences in the values sought from marine resources. In certain fisheries, porpoises, seals, birds, and sea turtles are taken incidentally by gear that is targeting commercial species. In particular, some purse seiners seeking yellowfin tuna in the eastern Pacific set their nets on schools of porpoise because the schools are readily visible and are often associated with schools of larger tuna. Shrimp trawls may take sea turtles during certain parts of the year. Longlines used on the high seas sometimes take birds and seals.

There are strong interests in the protection of porpoises and sea turtles in the United States and some European countries. These interests have led to regulations prohibiting imports of yellowfin tuna and shrimp from states whose fishing operations do not meet the specified requirements. In the case of yellowfin tuna, the mortality of porpoises has declined from about 350,000 animals in the 1960s to about 15,000 in 1992 and 4000 currently, due to the use of techniques that facilitate the escape of porpoises from the nets (Joseph, 1994). Currently, the mortality of porpoises is well below the numbers at which the survival of the species would be threatened. Nevertheless, bans on imports continue. These affect countries whose fishing operations do not meet the protection requirements as well as countries that buy tuna from them. In the former category, embargoes on imports from Mexico, Colombia, Panama, and Venezuela were set in 1990.[32] In the latter category, there are embargoes on imports from Costa Rica as well as Japan and Italy. As a result of the loss of the U.S. market, the price for yellowfin tuna dropped by almost 50% between 1990 and 1991. In addition, the U.S. tuna industry has suffered significant losses and has almost entirely left the eastern Pacific for the western area, where the tunas are not caught in association with porpoises.

[31] There are several recent developments in Latin America which seek to deal with the issue of jurisdiction beyond 200 nautical miles. These are discussed in a special issue of the journal *Ocean Development and International Law*, Vol. 26, No. 2 (1995). See separately F. Orrego Vicuña, F. Paolillo, F. Armas Pfirter, and M. Infante in that issue. A special situation exists on the Patagonian Shelf. For a discussion of this, see Bisbal (1993).

[32] Weidner and Hall (1993) state that the closure of export markets is affecting fleet operations. Mexican tuna catches have been relatively stable, totalling 125,000 to 136,000 tons between 1988 and 1992. Unconfirmed reports suggest, however, that in 1993 vessel owners reduced their effort by as much as a third because of increasing marketing difficulties. Unless export markets can be reopened, they say, it is unlikely that the current fleet can be supported without government subsidies. Catch of yellowfin tuna declined by 13% in 1993. In Colombia, it has been reported that the tuna fishery is unlikely to expand in the near future because it faces severe marketing problems. Colombian fishermen rely on dolphins to locate the tuna and some are killed when the fish are harvested. Weidner and Hall (1993) state that international efforts to protect dolphins are adversely affecting the market for tuna that is not dolphin safe. Colombia is currently unable to export to the United States and has also encountered difficulties in important European markets. Colombian officials note that their fishermen have sharply reduced dolphin mortalities in the eastern tropical Pacific and are hopeful that the fleet now meets U.S. dolphin protection standards. This could result in the removal of the U.S. embargoes, but marketing problems may persist because of new U.S. legislation.

The pressures for the embargoes were initially based on appropriate concerns about the sustainability of the porpoises but this is no longer an issue. The incidental mortality of all stocks of dolphins in the Eastern Pacific in 1992 was less than 1% of the estimated populations of those stocks (Joseph, 1994). Currently, the pressures come from those groups that oppose any mortality of porpoises. According to Joseph (1994), several of these organizations (U.S. environmental groups) have made it clear that they not only consider any dolphin mortality in the fishery unacceptable, but their pursuit and encirclement as well, even if none are killed.

Sea turtles are listed in Appendix 1 (the most critical category) in the Convention on International Trade in Endangered Species (CITES). The major threat to their survival lies in the disruption of the beaches in which they lay their eggs. This is due not only to the harvest of the eggs by humans but also to pollution of the beaches and to the increasing penetration of human activity on beaches that were formerly wild. In addition, sea turtles are taken in the trawl nets used to harvest shrimp, as well as in other kinds of gear.

In the United States, the mortality of sea turtles in shrimp trawls has led to legislation requiring the fishermen to use turtle extruder devices (TEDs) in their nets. The legislation also prohibits imports of shrimp from countries that have not implemented controls similar to those in effect in the United States. It is reported that current U.S. law will embargo shrimp from French Guiana, Surinam, and Trinidad and Tobago because these nations have failed to implement turtle conservation programs comparable to the U.S. program *(Shrimp News International*, 1995). To some extent, these countries have alternative markets but there is still a loss incurred by the requirements.

Under present conditions, there is no reimbursement for the losses that exporting states incur because their products are embargoed, and no costs are borne by those whose special interests are being met. This form of transfer payment from the users to the nonusers gives the users little incentive to abide by the regulations. Enforcement thus becomes difficult and users will seek alternative routes to market their products. To the extent that they are successful in this, the interests of the nonusers will be defeated.

Intranational conflicts

Within countries, there are several kinds of conflicts related to fisheries development and management. One conflict that is not readily apparent but that is of considerable significance is between present and future users. In an open access situation, the present users place low value on future returns. Excessive present use can diminish the resource base greatly, reducing the wealth available to future generations. In certain situations, fishermen that have no alternative sources of income or sustenance have no incentive to engage in conservation practices in the interest of future returns. Governments can and do prohibit such "fish mining" operations but unless they can provide other sources of income, they will have difficulty enforcing the prohibitions. It is conceivable that there may be other situations where mining of fish stocks may be in the national interest; i.e., where the net revenues gained by doing so can be used effectively to produce other goods and services. These situations, however, do not exist unless access to the stocks is controlled since net revenues are dissipated under conditions of open access. Although the effect can be large, there tends to be little perception among present and potential fishermen of the future losses. The conflict therefore is muted.

The conflicts between and among different user groups are more apparent. Users of different kinds of gear may be in competition for the same stocks or for stocks that are interrelated. In addition to direct competition, by-catch may also be a problem. Trawl nets are particularly damaging in this regard. In some situations, the catch in a shrimp trawl may contain only 20% shrimp and 80% by-catch, which may include juveniles of species that are of value to other fisheries. There may also be competition for space, such as between mobile and fixed gear. Increasingly, there are conflicts between commercial and recreational fishermen.

The conflicts between large- and small-scale fishermen are of particular concern and are pervasive throughout

the region. These generally occur when the mobile vessels of the large-scale fleets intrude on the areas traditionally used by artisanal fishermen, who have less mobility and less opportunity to move to other grounds.

Shrimp fisheries most fully reflect the problems discussed earlier. High prices have attracted excess fishing effort in all countries. Recent production from culture is dampening the increase in prices, but they are still high. Shrimp culture is also creating its own set of environmental difficulties as mangrove swamps are converted to shrimp ponds.

The nursery areas for shrimp are in marshes and estuaries that are harvested by artisanal fishermen in the near shore areas. The larger (and generally higher priced) individual shrimp are found in deeper waters, where they are taken by the trawlers of the larger-scale fishermen.

One of the difficulties is that, as competition among the trawlers increases, there is an incentive for the large-scale fishermen to move closer to shore to intercept the shrimp earlier in their life cycles and take them at younger ages and smaller sizes. This has two consequences. First, it means that lower prices are being received, and second, that conflict with the inshore artisanal fishermen increases. Although many countries have regulations against large-scale vessels operating in the inshore areas (within a few miles of the coast or within waters less than a certain depth), these regulations are difficult to enforce and are frequently violated.

The large-scale operations tend to dominate the conflicts because of their mobility and economic and political power. However, in some situations a case can be made that the artisanal fishermen make a larger contribution to the national economic and social welfare than the large-scale fishermen. Small-scale fisheries have lower consumption of fuel, tend to be less dependent upon imported materials, are labor rather than capital intensive, often use more selective gear, are based in rural areas, and produce food for domestic consumption rather than export. The capital is often owned locally and often by the fishermen themselves. They usually have more concern for the status of the stocks because of their limited mobility and high dependence on nearby resources; thus there tends to be a greater self-interest in fisheries management.

Alternative uses of the coastal zone are also a source of conflict. The coastal zone in which most inshore fisheries are found is the final depository for effluents from land, which can be highly detrimental to the health of the fish stocks. The coastal zone is also subject to direct and damaging environmental changes, such as the destruction of mangroves, mining of coral reefs, and reclamation of marshes. Artisanal fishermen, who are most dependent upon the stocks and who have less opportunity to avoid the consequences of such activity by moving to other areas, tend to incur more damage from environmental degradation than large-scale fishermen.

Approaches to Resolution of Issues

Basically, the issues described here are the result of the absence of satisfactory property rights and the consequent lack of a market mechanism for allocating the factor inputs of resources, capital, and labor. While a market mechanism would not resolve all of the issues by any means, it would put the fisheries industries on a par with most other natural resource industries and provide a basis for improvements in the decision-making process. This section discusses some examples of the kinds of benefits associated with a move to a market mechanism and some of the approaches that might be taken to implement such a system.

Benefits of a market mechanism for fishery resources

Three sets of benefits that would be produced by a satisfactory market mechanism for fishery resources are worth particular notice: (1) the nonarbitrary allocation of the resources (or resource rights) among competing and conflicting uses, (2) the efficient allocation of factor inputs within the fisheries, and (3) improvements in products.

Allocation of Fishery Resources: The first set of benefits has both international and intranational dimensions. At present, conflicts over shared,

straddling, and high seas fishery stocks are dealt with largely through international negotiations. These issues are the subject of several international and bilateral agreements, including the 1982 UN Convention on the Law of the Sea, the recently completed UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks, the UN resolutions recommending a moratorium on the use of large-scale pelagic drift nets in the high seas, the UN Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (dealing with the issue of reflagging of vessels in order to escape multilateral agreements), regional commissions for Atlantic and Pacific tunas as well as for specific areas, and such bilateral agreements as the one between Argentina and Uruguay (Treaty of the River Plate and its Seaboard, 19/11/73) (V. Orrego Vicuña, 1995; F. Paolillo, 1995; F. Armas Pfirter, 1995).

These and other agreements provide a framework for dealing with the issues, but significant problems still exist. At least some of these problems can be resolved by the move to a market mechanism for allocating the resources. A noteworthy example of this was the first international fisheries agreement signed in modern times. This was the Convention for the Preservation and Protection of Fur Seals, adopted in 1911. It was signed by Russia, Japan, the United States and the United Kingdom (acting on behalf of Canada) in response to a significant decline in the population of fur seals in the North Pacific. The agreement prohibited the harvest of seals on the high seas, restricting harvest to the islands on which the seals gathered for breeding. This reduced the costs of harvest to a fraction of what they were previously and simultaneously increased the quality of the product and its price. Japan and Canada, which gave up their right to take the seals on the high seas, were reimbursed for this by receiving a share of the skins harvested by Russia and the United States.

The agreement initially collapsed in 1941 when the Japanese withdrew, alleging that direct and indirect damage had been inflicted on their fishing industry by the increase in fur seals (Whiteman, 1965). The number of fur seals reportedly increased from 125,000 in 1911 to approximately 2.3 million in 1941. When a new agreement was reached in 1957, it contained a provision that the determination of the total yield should take into account the effect of fur seal predation on the productivity of other living marine resources.[33] The fur seal convention was terminated in 1984 when there was a generalized extension of national jurisdiction.

This arrangement essentially established a market for rights to marine resources. The resources were managed so as to achieve the maximum difference between the costs of harvest and the proceeds (to maximize the economic rents). The economic rents, in turn, were used to buy out the rights (surplus effort) of some of the participants, leaving all parties better off. The arrangement provides the principles and a model for the management of shared, straddling, and high seas stocks [see FAO (1993) for a full description of such a system and Burke and Christy (1990) for a proposal to use such a system to manage Indian Ocean tuna).

The establishment of a market for *in situ* resources would also help resolve some of the problems associated with nonconforming uses of resources. At present, allocation is determined largely by political interests in an arbitrary fashion. Those who wish to prevent the harvest of marine mammals and sea turtles or who wish to maintain or enhance recreational opportunities use their influence to impose restrictions on fishermen without providing any recompense. If there were a market mechanism for the resources, they could purchase fishing rights in order to achieve their goals and provide the fishermen with an incentive to relinquish their rights.

[33] A recent study has indicated that seals in Canadian Atlantic/Arctic waters are feeding on 6.9 million metric tons of fish and other prey a year—about double what the population consumed in 1981 (*Fishing News International*, 1995). It was estimated that the population of harp seals is now about 4.8 million and that they eat more than a million tons each of Arctic cod and capelin in Canadian waters. With an average unit value of Arctic cod of over $1000 per ton, the total value consumed by the seals in this area would be over $1 billion.

Two examples of such an approach can be mentioned. One is the case of the North Atlantic salmon where there is a strong recreational interest in reducing commercial harvest. The Convention for the Conservation of Salmon in the North Atlantic came into effect in 1983. It prohibited all salmon fishing beyond 12 nautical miles (except in the Faroese and West Greenland areas) and set national quotas (Vigfússon and Ingolfsson, 1992). However, the numbers of salmon returning to their spawning streams continued to decline, which led to the creation of a Committee for the Purchase of Open Sea Salmon Quotas. Their purpose was to buy out the quotas allocated to the Faroese and West Greenland fishermen. In April 1991, the committee purchased the Faroese quotas for $688,500 per year for the first 3 years (a price estimated to be about 27% of the landed value of the quota). The costs were shared by the states benefitting from recreational fishing (Norway, the UK, Ireland, and Iceland).

With regard to the tuna/porpoise controversy, there is currently an arrangement in effect that, with certain modifications, could permit the development of a market mechanism. In 1992, ten nations involved in the tuna fishery in the Eastern Pacific agreed to the establishment of the International Dolphin Conservation Program (IDCP). Under this agreement, the member nations adopted the objective of progressively reducing dolphin mortality to levels that approached zero by setting annual limits (Joseph, 1994). They agreed that the annual limits of dolphin mortality would be divided equally among the vessels intending to fish for tunas associated with dolphins, so that each vessel would have a dolphin mortality limit (DML). With implementation of the IDCP in 1993, a DML of 19,500 animals was divided among 106 vessels, giving each vessel a limit of 183 animals.

The actual mortality in 1993 was only 3605 animals; it rose slightly to 4095 in 1994. Currently, the total quota is 9300; there are 81 vessels, each of which has a DML of 114.

If the dolphin mortality limits for individual vessels could be transferred (which they cannot under the present arrangements), those who wished to achieve zero dolphin mortality would have the option of buying the shares. This would achieve their objective and at the same time provide the fishermen with an incentive to restrain their fishing.[34]

In both the examples cited, threats to the sustainability of the resources are not at issue. There have been (and are) situations where overfishing is considerable and where arbitrary measures limiting catch may be justified. However, in most situations of competing or nonconforming interests in international fisheries, the use of a market mechanism for resolving conflicts would be much more preferable than the present system, which is based on political strength and which carries high enforcement costs.

Allocation of Factor Inputs: With the removal of open access, the development of a market for fishery resources is inevitable. At present, because no value is placed on the resources, there is significant misallocation of factor inputs.

The economic theory has been tested in numerous empirical studies. In the fishery for squids and other cephalopods (octopus and cuttlefish) off Morocco, the stocks were so heavily overfished in the 1980s that by 1989 it was estimated that controls on fishing effort would have produced higher total catches and total revenues with considerably fewer vessels. The potential savings or economic rents were estimated to amount to US$ 250 million per year (Bertignac et al., 1989). In the United States, the National Marine Fisheries Service has estimated that the current gross revenue from New England groundfish is about US$ 170 million. With proper management controlling the capital invested in the fishery, the gross revenue would be US$ 200 million; the total costs of fishing would be US$ 70 million; and the net revenue, which is currently dissipated, would be about US$ 130 million per year, or 65% of the gross revenue.

[34] In 1992, the U.S. Congress adopted the International Dolphin Conservation Act, which calls for a 5-year moratorium on encircling dolphins with purse seine nets. This was to go into effect in March 1994 if one other major tuna fishing country agreed to comply with it. Countries that do not agree to the moratorium will face an embargo on all imports of yellowfin tuna and yellowfin tuna products as well as on other fish products (up to 40% of the aggregate value of the products). Thus far, no other country has agreed to the moratorium.

At a more local level, a study of a Malaysian shrimp fishery estimated that a very high economic return would be produced through investment in disinvestment (Christy et al. 1988). In this fishery, conducted along 40 km of coastline, it was estimated that the cost of buying out the illegal push nets and the small trawlers, together with the provision of a year's income to the displaced fishermen, would amount to about US$ 3.1 million. This investment would produce a net economic revenue of US$ 2.3 million per year -- roughly a 75% return on investment. A survey of over thirty access control systems in existence in 1990 is provided in Townsend (1990).

Table 2 shows the results of some of these, in terms of the creation of economic rents directly and as reflected in the sale prices of licenses.

In another review (Wilen, 1989), it was noted that rents are being generated in limited-entry fisheries; in some cases they are substantial. British Columbia seine licenses for salmon have ranged from early values of $500 per ton to $7000 per ton recently.

As of 1989, British Columbia roe herring licenses leased at over $500,000 for seine licenses and $80,000 for gillnet licenses. Norwegian purse seiner licenses were unofficially quoted at costing about 6 million kroner (about $700,000) for a 6000-hectoliter vessel. In Alaska, prices for permits to use various types of gear in different regions are often high: $175,000 for a salmon drift gillnet in the Aleutian Peninsula, $250,000 to use a purse seine in the same area, $325,000 for a Bristol Bay drift gillnet, etc. Wilen remarks that freezing entry, even with limited controls on capital, and even at levels close to open-access conditions, appears to be sufficient to preserve some rents (Wilen, 1989).[35]

As might be expected, the present systems are less than perfect. In some, particularly the license limit systems, overcapitalization continues to be a problem as fishermen substitute other inputs for those that are limited. Enforcement is also costly in some systems, particularly those using ITQs and those which are complex (such as multispecies and multigear fisheries). None of the systems existing today is extracting a satisfactory portion of the rents produced. In some cases, the systems fail to prevent continued depletion of the stocks. Nevertheless, most of them have led to the production of economic rents and though they are imperfect, they generally represent significant improvements over the previous open access condition.

Product Improvements: With the development of a market for fishery resources, there will be significant improvements in products and prices. Market systems provide an opportunity for fishermen to target their effort on high-valued species and individuals, instead of engaging in a race to fish smaller animals and less-preferred species further down the food chain. Several examples can be cited. In the case of the Australian fishery for southern bluefin tuna, the ITQ system allowed the fishermen to concentrate on the larger-sized animals for the Japanese sushi market rather than the smaller-sized tunas used for canning. As a result, in 1989 the value of each metric ton of fish taken was averaging four or five times the premanagement price level (Wesney, 1989).

The brief season in the Pacific halibut fishery (which was under open access in 1989) led to extreme waste in terms of quality: besides having to freeze the whole year's supply, processors reported that 50% of the fish they received had never been on ice and 30% had not even been gutted. Similar stories from other fisheries differed only in terms of the magnitude and nature of the waste (Wilen, 1989). Since the adoption of the ITQ system for halibut, the fish now enter the fresh market at considerably higher prices.

[35] It is not clear to what extent these values are the result of eliminating long-run stock externalities or the effect of reducing short-run externalities. In some cases, the values have appeared even though the stocks continue to be fished beyond MSY, and may be the result of increased real prices.

Table 2. Examples of access control systems.[a]

System	Results
Alaska salmon license limit	Sale price of licenses in 1979: $5000 to $175,000.
W. Australia shrimp license limit	Sale price of licenses: $165,000 to $220,000. Returns to capital >25%.
S. Australia shrimp license limit	Sale price of licenses: $98,000 to $196,000. Annual rents/vessel: $20,000 in Spencer Gulf; $58,000-70,000 in Gulf St. Vincent.
W. Australia lobster pot limit	Sale price: $2200/pot.
Australia southern bluefin tuna ITQ	Sale price: $1900/ton of quota.
Iceland demersal fishery ITQ	Economic rents in 1984: $15 million to $30 million.
California herring roe license limit	Economic rents in 1979: $5.6 million (subsequently dissipated).
Maine lobster TURF	Incomes/fishermen 39% greater than in open access areas.

[a] Based on Townsend (1990).

Approaches to implementation

There are several steps that governments need to take in formulating and implementing improved fisheries management systems. These include (1) decisions on the objectives to be sought from the use of the resources, (2) decisions on the distribution of wealth, (3) the choice of systems to adopt, and (4) the creation of conditions and incentives that will facilitate implementation.

Objectives: As noted earlier, there are various objectives for fisheries management. There is conflict among these objectives, the most serious of which is the conflict between use of the resources to maintain employment opportunities and increasing their contribution to national economic growth. The severity of this conflict depends upon the characteristics of the particular fishery as well as upon national or local employment situations. Generally, with regard to large-scale fisheries, the most valid objective is that of achieving economic benefits. For some small-scale fisheries, however, social goals may also be important. In these cases, improved economic efficiency might be tempered with provisions to protect employment.

In making these decisions, there is an urgent need in all countries of the region for greater information on the economic and social characteristics of the particular fisheries. Most countries have undertaken studies assessing the status of their stocks, but this information is of little value without information on the economic status of the fisheries.

At present, there are serious deficiencies in the availability of such information. Only a few countries have licensing systems in effect that could provide data on fisheries employment. Data on fishing effort, which are crucial for monitoring the economic health of the fisheries, are scarce. There have been very few studies of costs and earnings in particular fisheries[36].
In spite of these deficiencies, however, there is clear evidence that many of the region's fisheries are economically distressed. Enough is known about declines in average and total catches, and increases in conflicts, to determine that fisheries management needs

[36] There are some exceptions. Trinidad and Tobago has produced economic analyses of its gillnet, flying fish, and shrimp trawl fisheries with the help of an FAO Technical Cooperation Project.

to be improved and that the kinds of measures that need to be adopted are clear, even though the knowledge available may not be sufficient to design the optimum measures.

Decisions to Redistribute Wealth: Countries wishing to improve the economic well-being of their fisheries, will need to provide some form of exclusive use rights and remove open access. These decisions directly affect the distribution of wealth and generally require the involvement of politicians.

Countries that allow foreign fishing have a national exclusive right that allows them to restrict foreign fishing and extract user fees. In this case, the extension of jurisdiction constitutes an acquisition of the wealth by the coastal state, and there is a clear opportunity to control access by foreigners and extract economic rents.

For domestic fisheries, decisions on the allocation of exclusive use rights are much more difficult. Although the problem could be largely resolved by the use of a bidding mechanism, it would be politically difficult in most situations involving domestic fishermen. Instead, governments must make deliberate decisions to create exclusive rights and allocate them among user groups. These include (1) present and potential users, (2) different users of the same or related resources, and (3) users and society.

In cases where a particular fishery is overfished by a single set of users, effort can be limited initially by prohibiting new entrants to the fishery. All those currently fishing may be allowed to continue to do so, either with a licensed vessel or a share in the total quota of allowable catch. This avoids having to exclude any of the present users (although it is often difficult to define a present user). There are, however, two sets of problems with this approach. One is that there may be strong opposition to the system from those who want to maintain the freedom to enter the fishery at a future date. The other is that, under a license limit system, the number of fishermen allowed to participate is likely to be excessive and the amount of effort will have to be reduced.

Some countries have attempted to do this for license limit measures by making the privileges nontransferable, with the expectation that effort will be reduced through attrition (loss of vessel, retirement or death of quota holder). Such attempts generally fail and, in any case, are not desirable. With transferability, effort can be reduced only by forcing out or buying out some of the fishermen. The first approach is politically difficult to carry out. The second is preferable but depends upon the availability of funds.

Where decisions need to be made between competing groups, and a market for rights has not been established, the task may be difficult. Governments generally attempt to make decisions that minimize distributional effects, such as prohibiting large-scale operations within a certain distance from shore, imposing restrictions on the use of certain gear during certain seasons, preventing the adoption of new technologies, or by providing subsidies to large-scale vessels in the hope that they will move further offshore to develop fish stocks. These measures do not usually provide long-term solutions to the conflicts, even when they can be effectively enforced.

Measures with more direct distributive effects may be necessary, such as the creation of a territorial use right for a community or absolute prohibitions against certain kinds of gear.[37] The difficulty of making such decisions may be alleviated by the use of compensatory mechanisms, including the outright purchase of the nonconforming operations. Even though this is costly, the net returns in terms of increased revenues and reduction of conflict may justify such an approach, particularly if the costs can be recovered by the extraction of the rents. The third set of decisions relates to the extraction of rents and the distribution of wealth between fishermen and society, which was discussed earlier.

[37] In Indonesia, the eruption of severe conflicts between shrimp trawlers and small-scale fishermen attracted a high degree of political attention and led to the complete banning of trawler operations in the eastern part of the country. This major distributive decision was facilitated by the fact that there were ethnic differences between the trawler owners and the small-scale fishermen (Sardjono, 1980).

The usual approach to making these various decisions is to wait until there is a crisis. Although it would be preferable to make them before a crisis occurs, political reality suggests that this seldom happens. When conflict reaches a certain stage or when resource yields decline dramatically, it attracts the attention of politicians. They will then make decisions on the redistribution of wealth if the cost to them of not doing so is excessive; i.e., if they will lose elections by not responding to the protesting constituents. They may also make the decisions when the benefits of doing so are perceived to outweigh the political costs.

The bases for the decisions are knowledge and information, both of which need to be improved. Knowledge about the special characteristics of fisheries, particularly the consequences of open access, should be available at the highest governmental levels, including politicians and ministries of finance and planning, as well as within international and bilateral development and aid agencies. These groups should also have information about the social and economic costs of not managing the fisheries, as well as the social and economic benefits of managing them well. In particular, information on the amount of economic rents potentially available from better management is important in facilitating the decision process.

The kinds of decisions discussed here are primarily the responsibility of governments. However, it is critically important to note that, as effective management measures are put into effect, there will be a dramatic change in the role of government. The creation of forms of property rights through license limits, ITQs, or TURFs, will tend to shift many management functions away from government. Markets for fishery resources will help to resolve conflicts among competing users and will diminish the involvement of government in allocating capital and labor. Nevertheless because of the imperfections in applying property rights to marine fisheries, governments will always have to play some role in ensuring the sustainability of the resources and in protecting national interests. However, there will be significant changes in the level of involvement, and this will have important effects on administrative structures and staffing.

The choice of management system

There are several factors that need to be taken into account in choosing techniques for controlling access. These have to do with the characteristics of the resources and of the fishermen, the relative effectiveness of the systems in achieving desired goals, and the costs of implementation.

As a practical matter, the major choice for management of large-scale fisheries is between license limits and ITQs. In certain situations, the use of economic disincentives by themselves might be considered, although this would generally be politically impractical. Nevertheless, with either license limits or ITQs, taxes or user fees should be considered. For small-scale fisheries, TURFs are generally the most useful approach.

Differences between license limits and ITQs are important in terms of their effectiveness, costs of implementation, and acceptability. For fisheries that use numerous landing sites, license limits may be the best method since it is easier to monitor fishing units than the catch of individual vessels. Conversely, where all catches are landed in a single port or are exported through a single channel, ITQs may be appropriate.

ITQs tend to be more effective in preventing depletion of the target stock (but not necessarily of by-catch species, as noted later), since the total allowable catch can be fixed, whereas with license limits the total amount of catch depends on the ability to control fishing effort. ITQs are also more effective in rationalizing the fishery since the incentive for reducing costs lies in the hands of the fishermen. In license limit schemes, fishermen have an incentive to maximize their catches and will often find substitutes for the input that is limited, thus increasing their costs as well as total fishing effort. In some fisheries, however, the limit can be placed on an element of effort for which there are no substitutes and it thus can be effective in achieving rationalization. For example, limits on the number of lobster pots can effectively control fishing effort.

With regard to the problems of by-catch, ITQs tend to have a perverse effect relative to unmanaged fisheries or to license limits. Where there is a price differential between sizes of the target species, fishermen will discard the lesser valued sizes (usually smaller fish) in order to maximize the value of their quota. If there is a mixed fishery and there are quotas for the by-catch for which the fishermen do not have permission, they will discard the by-catch to avoid detection. If there is no quota scheme for the by-catch species, they will discard them if they are of lower value in order to preserve room in their holds for the target species.[38]

License limits tend to be more acceptable to fishermen (and politicians) because they appear to be simpler and more directly related to the problems of excess capacity. If there are too many fishing vessels catching too few fish, it seems clear that the answer is to reduce the number of fishing vessels. Also, the tendency is to think in terms of the immediate situation rather than the implications for the long run. Thus, a common approach is simply to establish a moratorium on the introduction of new vessels and hope that attrition will reduce their number. The damaging consequences of this approach are not always understood. Furthermore, fishermen often maintain the view that their individual skills (or luck) will produce high catches and they do not wish to be restricted in the amounts of their harvests. It is more difficult for them to comprehend the concept that an ITQ will provide an incentive to reduce costs and lead to improved efficiency in the long run.

Neither system is particularly able to deal with the problems of severe natural fluctuations in fish populations. If licensed fishing effort is set at the capacity required to take peak year yields, returns to the fishermen will be low in other years. If the limits are set below that capacity, the average catches will be high in some years and low in others. For ITQs, it will be necessary to adjust the TACs and the individual shares each year, based on anticipated population levels.

One approach would be for the government to set the TAC at a relatively low level and hold a certain share of it in reserve. In peak years, the reserve could be sold or auctioned to the domestic fishermen or sold to foreign fishermen if the domestic industry is unable to take up the slack.

This approach, if it were followed on an international scale, might benefit all parties. The shoaling pelagic species, such as anchoveta and pilchard, tend to have the greatest stock fluctuations and are also the species that can be taken in great quantities by highly mobile fleets. As noted earlier, anchovy populations tend to be out of phase with sardine (pilchard) populations in the major upwelling areas of the Pacific (the Humboldt and California currents and the northwest Pacific). Fluctuations in sardines in the Pacific tend to be out of phase with sardines in the Benguela current off southwestern Africa. This provides opportunities for a global fleet to fish the different stocks, moving from one area to another during the peak years. Coastal states could adjust their fishing capacity to a level below that required to take all fish during peak years and avoid the problems of excess capacity during off-peak years. During the peak years, they could allow the global fleet to harvest the surplus yields by paying the appropriate fees.

Fluctuations in stock size also occur within seasons and in some cases can be severe. For example, some stocks congregate during spawning season and are dispersed the rest of the year. In these situations, ITQs would not be particularly effective since there would still be pressure to take the quotas during periods of congregation, when costs are lower. However, this is also likely to be the period when the stocks are more vulnerable to overfishing. In these cases, license limits may be a more useful approach.

In all of these cases, there may be variations in the application of the different techniques to account for the comparative disadvantages of each, but such variations can be very complicated and add to the

[38] An innovative suggestion for dealing with this difficulty is to establish value quotas under which fishermen receive a share of the estimated gross revenue. Since a low-valued species or size would have little effect on the completion of their quota, they would have less incentive to discard it (R. Willmann, personal communication).

costs of research and enforcement. In short, the choice of management measure must take account of the particular characteristics of each fishery and the attributes and requirements of each technique. The major advantages and disadvantages of the different systems are summarized in Table 3.[39]

Economic measures that indirectly restrain the tendency for overinvestment might be of value in certain kinds of situations. In most countries at present, an essential first task is the removal of subsidies that encourage wasteful effort. As stated in the Draft Policy Directions for Marine Fisheries of Trinidad and Tobago, "the continuation of the assistance has contributed substantially to the present excessive investment and fishing effort within the country's fisheries. It encouraged participation in fishing, beyond what would otherwise have been financially feasible. The operations of some fishermen would not be viable in the absence of the Government's assistance package. The assistance has now assumed the same context as social welfare payments" (Trinidad and Tobago, 1994, p. 86).

In addition to removing subsidy programs, it may be desirable to impose (or increase) taxes and fees that affect fishing investment. Taxes on imported fishing vessels, materials, and fuel could reduce trade deficits, increase the comparative advantages of artisanal fishermen, and help to deter excessive investment. License fees could be increased to help cover the costs of management, including research and enforcement. Export taxes, as in the case of the Bahamas, could also produce significant revenues.

The imposition of such measures (and the removal of present subsidies) would create hardships for industries already suffering from excess capacity and generally would not be acceptable to the fishermen. However, there are some situations (e.g., in newly developing fisheries) where such actions could be taken now and in other cases could be imposed gradually. For small-scale fisheries, the imposition of ITQs and license limits at the national level will be difficult and in some cases impractical. In these fisheries, the devolution of management authority to the local level may be the only viable approach. There are certain conditions that facilitate the assumption of management responsibilities by groups or communities of fishermen and others that constrain it.

Favorable conditions include stocks that are sedentary or that have limited mobility; areas with clearly defined natural boundaries (e.g., coral reefs); communities that are close knit, with fishermen using the same or similar gear; fishing techniques that are easily observed and that allow group monitoring; one or a few clearly recognized landing spots; and others. Where the opposite of these conditions holds, there are constraints on the establishment of community TURFs and it may be necessary to deal with the constraints, insofar as possible, before transferring management authority to the user group.

Changing conditions and creating incentives for management

There are several ways in which governments can change or alleviate some of the constraints and create conditions and incentives favorable to improved management measures. There is also a role for international agencies in facilitating such changes.

The beneficial conditions and incentives can be identified by examining those situations where fishermen's groups have adopted management measures on their own. In general, there are four different kinds of situations that have induced self-management. These include situations where territories are easily defined; there are opportunities for stock enhancement and for direct or indirect extraction of economic rents; and there is a desire for equitable distribution of benefits.

[39] A similar table is found in Galarza and Malarin (1994).

Table 3. Comparison of different fisheries management techniques.

System	Prevention of depletion	Production of economic rents	Costs of enforcement
Conservation measures	Total quota, if enforced, will be effective (but at great economic waste). Closed seasons, closed areas may be effective. Gear prohibitions unlikely to be effective.	Total quota will tend to exacerbate economic waste. Other measures do not prevent economic waste.	Closed seasons, areas, relatively low cost. Total quota more costly. Gear controls may be very costly.
License limits	Not particularly effective due to substitutability among inputs.	Can produce some economic rents, though tendency to increase capital investment.	Costs depend upon what is limited. Low if limit is for vessels. High if limit is for particular kind of gear.
ITQs	Effective for target species if enforced. But difficult for by-catch species due to high grading.	Can produce economic rents effectively.	Relatively high costs due to need to measure individual catches.
Economic disincentives	Possibly, in conjunction with other techniques.	High	Relatively high

Traditional TURFs have emerged in cases where the boundaries of a fishery are relatively clear, such as coral reefs and estuaries. However, the ability to define the boundaries of a fishery are not restricted to natural conditions. TURFs have also emerged where the fishermen use fixed gear, such as stake nets, and more recently through the use of artificial reefs (ARs) and fish aggregation devices (FADs).

The implantation of artificial reefs on the sea floor can lead to increased concentration of fish stocks and perhaps (though this is not yet proven) to enhancement of the biomass, mostly of demersal species. FADs have similar effects. These devices are made up of floating materials anchored to the bottom. Schools of pelagic fish tend to congregate under and around the floating materials.

Both artificial reefs and FADs require investments, which are not likely to be made unless they can produce satisfactory returns. In some cases, governments invest in artificial reefs on the assumption that the improved catches justify the expenditures. In some of these cases access to the reefs is left open while in other cases a local community receives an exclusive right.

There are other situations where the fishermen themselves make investments in the reefs or FADs and assert an exclusive right to the territories. In the Philippines, for example, tuna fishermen have planted FADs and monitor their use to preserve their exclusive fishing right. They often allow local fishermen to fish for stocks other than tunas around the devices as a means of obtaining their acceptance of the systems. The tuna fishermen have agreed among themselves on the placement of the FADs so as to avoid congestion and also as a means for reducing opposition to their assumption of exclusive rights to fishing areas.

Governments do not generally recognize the claims of private investors to exclusive rights in artificial reefs and FADs but they frequently do not prohibit them. It would be desirable, however, to encourage and facilitate private or community investment in these techniques, as well as in the use of fixed gear. These techniques reduce search and harvesting costs. They also provide a basis for controlling access to the resources. If FADs are placed without establishing access controls, they can lead to increased overfishing and overcapitalization because they reduce fishing costs.

The difficulty is that the use of such techniques requires explicit decisions to allocate exclusive use rights to individual fishermen or user groups. It is possible, however, to meet this difficulty at least partially by auctioning or selling territorial rights to the fishermen and using the revenues to compensate those who are excluded.

Opportunities for stock enhancement and aquaculture also may be used to encourage the establishment of exclusive use rights. Since the days of the Romans, TURFs have been widely available to fishermen for the cultivation of sedentary resources, such as oysters, clams, and mussels. Cultivation is also increasing rapidly for some other fishery resources, such as salmon and shrimp. As in the case of artificial reefs and FADs, these operations require some investments that will not be made unless the investor can receive a satisfactory return, and this generally requires an exclusive use right.

Stock enhancement is an extensive form of aquaculture in which human intervention is restricted largely to seeding the stocks, which then use natural supplies of food. Such systems include not only the sedentary species, such as oysters, but also migratory species such as salmon. In the latter case, the stocks may travel great distances before returning to their home waters for spawning. Although governments often invest in stock enhancement programs, there are some situations where groups of fishermen have made such investments. Even though the stocks may be intercepted by other fishermen, the investment may still be worthwhile if enough of the fish are taken by the investors to cover their costs and provide satisfactory returns. In the example cited earlier of the work of the Committee for the Purchase of Open Sea Salmon Quotas, there have been sufficient benefits for the owners of salmon fishing sites to invest in stock enhancement.

Although at present stock enhancement is restricted largely to bivalves, seaweeds, and salmon, there are opportunities for enhancing the stocks of other species of fish and marine organisms. The provision of exclusive use rights would encourage the development of these opportunities.

Opportunities to extract economic rents from a fishery have provided fishermen with an incentive to cooperate in asserting exclusive rights to a stock when the costs (economic and political) have not been too great. This has occurred in situations where there is an opportunity to control the market and maintain high price levels. In Japan, for example, a group of fishermen harvest a special form of shellfish for which there is a high but restricted demand in Tokyo (Shiba Branch, 1993). They found that, in the absence of cooperation, the market was quickly saturated and the price declined. In order to maintain high price levels, they have agreed to restrain their catches (and effort) at appropriate levels. In essence, they have acquired an exclusive use right to the resources.

It has been reported that a similar situation has existed in a fishery for groundfish in Mar del Plata, Argentina (A. Gumy, personal communication). The fishery is operated by about 200 families who have cooperated to set the prices for the fresh fish market in Buenos Aires. In order to maintain prices, they have controlled total catch through controls on their own fishing effort.

The ultimate result of the latter situation would also be high costs to the consumer as scarcity from overfishing replaces manipulated scarcity.[40] It may be a toss-up as to which of these problems is more damaging to national interests.

Although such systems are associated with problems in monopoly pricing, they avoid the problems of overcapitalization. In the former case, the consumers bear the costs whereas in the latter case the costs are borne by society as a whole in terms of misallocation of capital and labor and, generally, degradation of the resources.

It would not ordinarily be in the national interest to permit fishermen to acquire monopoly rents, but such

[40] Another anomaly of the open access condition is that price controls that reduce fishermen's revenues restrain the forces that lead to overcapitalization and produce economic rents in the form of consumer surplus. When price controls are abandoned, as they were in China in the late 1980s, the result is large increases in fishing effort, overcapitalization, and depletion of stocks.

an approach may be beneficial if it stimulates fishermen to control access to the resources and prevents the dissipation of resource rents. In addition, controls may be established to minimize the opportunity for extracting monopoly rents. The major point, however, is that given the right incentives and conditions, fishermen will often find it in their interest to adopt efficient management measures.

In traditional systems, another motivation for self-regulation has been the need to preserve the community structure. Where individual behavior does not conform with community interests, the existence of the community is threatened. In order to avoid this, communities have often responded by adopting measures that achieve some degree of equity in the distribution of benefits. In Japan and in India, there are systems of TURFs which are maintained to prevent the dissolution of the community. In these cases, the pattern of distribution of benefits (whether these are in terms of access to the resources or shares of the proceeds) is such that all those who have a significant influence on the system feel that they are better off by compliance than by violation of the rules. Peer pressure reinforces these systems.

The importance of this incentive in modern fisheries is that there are likely to be situations where a user group has a strong common interest in achieving equitable or acceptable patterns of distribution; this may support the group's interest in limiting access to the resources. Fostering this sense of common interest within a user group will be of considerable value in stimulating a move to cooperative management and in reinforcing the use of peer pressure as a means for reducing management costs. This suggests that governments should seek to strengthen fishermen's groups and involve them in examining the need for, and the benefits of, improved management and in the formulation of management measures.

These examples indicate that open access is not necessarily an intrinsic condition of fishery resources. There is a tendency among fishermen to acquire exclusive use rights and they will do so when the benefits of having such rights exceed the costs (social, political, and economic) of acquiring and maintaining them. For inshore fisheries used by small communities, the benefits of exclusive rights are often more apparent and the costs of acquiring them are lower than for fisheries further offshore. On the high seas, the situation is more complicated.

In the 1600s when Hugo Grotius advanced the principle of the freedom of the seas, he stated that the benefits of exclusivity were low because of the vast abundance of fishery resources, and that the costs of maintaining exclusivity were high because of the limited range and capability of weapon systems. By the mid-1970s, however, these arguments could no longer be maintained and coastal states responded by extending national jurisdiction over fishery resources. As scarcity increased, so did the benefits of exclusive rights. As more and more nations claimed more extended rights, the costs of contravening international law were reduced.

Similar forces exist at local levels. There have always been benefits to acquiring exclusive rights over a fish stock or area when stocks have been scarce. However, the costs of such rights have also tended to be high. There are political and social costs when such claims diminish the wealth of competing users and when the claims are contrary to national legislation and to national perceptions that open access is necessary for development. There are also economic costs in enforcing the claims, particularly over extensive areas. However, where these costs have been low, fishermen have tended to assert and maintain *de facto* claims to exclusive rights.

Summary and Conclusions

The fundamental issue in marine capture fisheries is that of moving from open to closed access regimes. Associated issues are the need for decisions on the distribution of wealth, the formulation and implementation of appropriate management measures, the transfer of primary management responsibility to fishermen's groups, and enforcement of the new systems.

Although certain steps can be taken independently at the political and administrative levels, there are

fundamental requirements that must be met at the political level to ensure effective implementation of the new regime. These steps affect the distribution of wealth and are matters of policy that cannot generally be resolved by administrators, although administrators have an important role to play in informing the politicians.

Political-level steps

Remove Subsidies and Extract Rents. One of the first tasks of governments is to reduce or remove the support programs. Where this results in undue hardship for the fishermen, governments should consider other means for providing support that do not lead to increased effort or that may actually lead to exit of labor from the fishery.

In addition to removing subsidies, governments will wish to consider taxes and fees to extract the economic rents when exclusive use rights are put into effect. The use of indirect methods for extracting rents, such as taxes on exports and imports, might also be considered.

Shift Attitudes from Development to Management. The shift of view from development to management, as well as some of the other steps mentioned later, will require some form of education program aimed at ministerial levels, particularly the ministries of finance and planning. Effective controls over access will significantly change the conditions of the fishery industries. Once this change has taken place, there will be major opportunities for development activities in the sense that increased investments of certain kinds, such as the development of ports and infrastructure, may produce large contributions to national economies. There are thus two phases to the management process. The first phase must concentrate on establishing satisfactory property rights and eschew development activities that lead to unrestrained increases in fishing effort. Once this phase is completed, it will provide the basis for opportunities to invest in development.

Acquire Knowledge about Potential Economic Rents. Estimates of potential rents prepared by fishery administrations, together with an explanation of the consequences of open access, should be provided to high-level decisionmakers and to the public as a whole. These analyses do not need to be highly sophisticated since their basic purpose is to indicate in gross measure the benefits of effective management. When it comes to the actual preparation of specific proposals, a more refined approach is desirable. Models for estimating economic rents are available and can be used to obtain satisfactory information at reasonable cost.

Strengthen Awareness of Importance of Property Rights. As many Latin American and Caribbean countries adopt measures for privatization in the use of other natural resources, efforts need to be made to ensure that this shift in approach specifically includes fishery resources; indeed, this is vital for the management of these resources.

Make Distribution Decisions. The critical task at the political level is to redistribute the wealth in fisheries by closing access and creating property rights. The incentives for these decisions, which are usually made only in response to crisis, will be reinforced by the gains in knowledge and information provided in the foregoing steps.

Although the decisions on redistribution of wealth should be made on a case-by-case basis, it is necessary to consider the effects that closing access to one fishery will have on the other fisheries. Just as development aid for one fishery can have negative effects on others, so can the imposition of management controls.

Change Legislation. In many countries, fisheries legislation does not deal effectively with the need for systems of property rights and for the extraction of economic rents. In some cases, there may actually be provisions that preclude or impede the adoption of effective management measures.[41] There is a need to review legislation and to revise it where necessary.

[41] This was the case in the United States where legislation specifically limited the amount of fees for licenses or use rights to the cost of issuing the licenses. This has been changed in a current bill.

Administrative-level steps

Acquire Information. The acquisition of information on the economic and social aspects of fisheries requires, first, the establishment of licensing systems (where these do not exist) to determine the amount and kind of fishing capital and labor. Fishing effort and catch per unit of effort must be measured to evaluate the status of the fisheries. This should be followed by studies of the costs and earnings in the different fisheries and especially estimates of the potential economic rents that will be available with closed access.

Prepare Fishery-Specific Management Plans. Although primary responsibility for the formulation of fisheries management plans should lie with the fishermen's groups, governments need to prepare proposals for specific fisheries for their consideration.

Establish Systems for Extracting Rents. If governments decide to extract the economic rents, it is critically important that the means include exclusive rights systems. Experience has shown that the sale and purchase of fishing privileges begins as soon as the controls are put into effect (and sometimes even before, among speculators).[42] It has also shown that the price of the privileges escalates very rapidly. Where the government delays in implementing a system for extracting all (or a proportion of) the rents, the rents accrue to the fishermen and will be collected when they sell the privileges. Once this occurs, the new entrants have a vested interest in the privileges they have purchased and it becomes very difficult to impose appropriate fees and costly to buy them out. Furthermore, the amount of rents extracted should be proportionate to the value of the fishing privileges, so that they will rise (or fall) as the rents increase (or decline).

Establish Buyout Programs. Most fisheries in the region are already marked by excessive numbers of vessels. If ITQ systems are used, there will be an incentive for the fishermen themselves to reduce the excess effort (and excess costs), but if license limit schemes are adopted, it will generally be necessary to reduce the amount of overcapacity. The purchase and removal of vessels from fleets can produce extremely high returns in terms of increased catches per vessel and the production of economic rents. As indicated in the example of a small Malaysian fishery, the economic returns from a buyout program can be extraordinarily large. Although buyouts should not take place until entry controls are in effect, the concepts and processes should be established as early as possible so that they can be put into effect as essential elements of the management regimes.

Shift to the Use of Fixed Gear and Techniques. Certain fish stocks can be effectively harvested through the use of fixed devices such as FADs and artificial reefs, and fixed gear, such as fish pots and stake nets. These techniques need to be encouraged and supported wherever they are be feasible. The auction of exclusive use rights to appropriate sites for the use of these kinds of gear and techniques is one way to encourage private investment while at the same time producing revenues that can be used to compensate those who are excluded and to cover the costs of management. Consideration might be given to replacing trawls by trammel nets in the shrimp fisheries. Current programs that support mobile gear should be abolished except in special cases.

Support Stock Enhancement. In fisheries where seeding of fish or improvements in habitat can lead to increased total yields, fishermen's groups should be allowed to acquire, through sale or auction, sufficient control over the use of the stocks to warrant their own investment in the development.

Support Fishermen's Groups. It is important to encourage the creation and strengthening of both large- and small-scale fishermen's groups. In many countries, efforts have been made to create fishermen's associations, primarily for receiving and handling loans; cooperating in marketing operations; and cooperating in the use of port, marketing, and processing facilities provided by governments. Most of these cooperatives have failed for several reasons. The fishermen's groups have often had little real control

[42] In the U.S. Pacific halibut fishery, trade in fishery quotas began even before the system was put into effect.

over the programs, serving merely as conduits for outside funds. The programs have generally been imposed on the fishermen from the top rather than emerging from the perceived needs of the groups. They have also generally run counter to the traditional practices of the fishermen and to informal relationships that the fishermen have worked out for themselves.

The opportunity to acquire exclusive use rights provides a fundamental change in the incentives for group organization and cooperation. It provides fishermen with a strong motive to actively participate in management of the fishery. There are, however, many difficulties that would have to be overcome. The fishermen would have to acquire a sense of identity as a group. They would have to determine membership in the group and the criteria for acquiring membership. It is essential that they understand the implications and significance of the rights and responsibilities of self-management, as well as the benefits and costs of alternative management measures. To a large extent, these tasks will have to be handled by the fishermen themselves, but governments will have an essential role in providing information and supporting and guiding the groups.

Support the Development of Alternative Employment Opportunities. The effect of fisheries management measures on employment presents a difficult dilemma for administrators. Proposals for fisheries management should take into account the economic and social context within which the fishermen operate. Where desirable, the plans should provide alternative employment opportunities or other incentives to encourage fishermen to leave the fishery.

Strengthen Enforcement Capability. Almost all governments have adopted conventional conservation measures of one sort or another (namely, rules against small mesh in nets, against large-scale operations within a certain distance from shore, and provision of closed seasons and closed areas). Most of these regulations are desirable, but they tend to be ineffectively enforced for several reasons, including planning agencies' lack of awareness of the importance of fisheries enforcement, the consequent lack of satisfactory funds, the high costs of enforcing some of the measures, fishermen's failure to see the regulations as beneficial, and others.

Since this weakens the credibility and authority of the government, it may raise doubts about the competence of the government to enforce systems of exclusive use rights. However, payoffs to investments in enforcement can be very high where rights regimes are in effect. It is desirable, therefore, for governments to improve the perception that they are willing to ensure the maintenance of the exclusive rights.

Recommendations for Bank Strategy

The preceding discussion indicates that there are certain special aspects to marine fisheries that have not generally been taken into consideration in the Bank's past efforts. It also indicates that there are significant opportunities for fisheries projects that could make major contributions to national economic welfare. The Bank, as well as other development agencies, has long been involved in fisheries projects and will continue to be so, either directly through support of fisheries development or indirectly through support of other projects affecting fishery resources. The issue is not whether there should be fisheries projects but rather how to improve the Bank's involvement in fishery matters and take advantage of the opportunities for increasing beneficial use of these resources.

This suggests that there is a need for a new strategy and a revised approach in the Bank's consideration of projects and activities in fisheries management and development. Such a strategy should take into account the basic objectives of the Bank and the special advantages as well as the constraints that it has in providing development aid.

The new strategy should have two phases. In the first phase, the Bank should refrain from any investments and activities that directly or indirectly contribute to increases in fishing capital and effort in order to avoid exacerbating the present problems. During this phase the Bank should focus on aid that facilitates effective management measures. On completion of this phase, the Bank can undertake projects that support or stimulate investments in capital or infrastructure provided they conform to the management measures.

Some suggestions for a revised strategy are made in the following section.[43] These are followed by a discussion of specific ways in which the strategy might be implemented.

Overall IDB Strategy

There are three fundamental objectives that the Bank should seek to achieve in supporting fishery activities in its member countries. These include (1) increased contributions to national economic growth from the use of fishery resources, (2) protection and enhancement of the fishery resources, and (3) sustainable and attractive employment opportunities.

Other objectives might be considered (such as increased supplies of food at appropriate prices, increased export earnings, and reduced dependence on imports). These, however, are either inappropriate (e.g., maximum employment or production of food is inappropriate if it does not consider costs) or would be subsumed under the three basic ones (e.g., protection of small-scale fishermen is subsumed under the objective of sustainable and attractive employment opportunities).

In meeting these three objectives, the Bank would be expected to achieve favorable rates of return on its investments and beneficial responses to its technical assistance. The outcomes should be evaluated in terms of the degree to which the activities meet the objectives.

The basic conditions for achieving these objectives are the establishment of institutions that will facilitate efficient and rational private investment in fishing industries, and the creation of incentives for users to assume the rights and responsibilities of fisheries management and development. After these conditions have been met, consideration can be given to appropriate investment loans. It is possible that some investment projects will have beneficial effects in present situations, but in general they should not be undertaken until governments have made the necessary changes in the basic institutions.

[43] These recommendations put forth by the author for Bank consideration. A separate strategy for coastal and marine resources management is under review (IDB, 1997) and will incorporate guidelines for the Bank's future involvement in marine fisheries management.

This combination of objectives and conditions should provide the basis for a revised strategy for the Bank's involvement in the marine fisheries of Latin America and the Caribbean. The implementation of this strategy will require some initial steps.

The first step is improving the general understanding within the Bank of the nature of the problems so that Bank personnel can identify appropriate activities in the member countries. A second step is either recruiting specialized staff or identifying the expertise that can be drawn upon for fisheries and fishery-related projects. The third step, discussed more fully in the following section, consists of identifying the situations and opportunities for Bank support of research, technical cooperation, and investment.

This paper is a partial attempt to provide a background for understanding the nature of fishery resource problems and opportunities. Doing so requires an understanding of those characteristics of fisheries that distinguish them from other natural resources. These are (1) the natural limits to the supply of the resources, (2) the condition of free and open access, (3) the extreme range of products and kinds of enterprises, and (4) the difficulties of determining potential yields (understanding the complex interrelationships affecting yields).

More details on these aspects can be obtained from various sources. For an overall view of the global fisheries situation that provides an estimate of the economic waste and an analysis of potential international solutions, see FAO (1993). Reviews of the status of stocks in all regions of the oceans are contained in FAO (1994, 1995a). For the different types of access controls, see Mollett (1986) and Neher et al.(1989). Information on TURFs can be found in National Academy of Sciences (1986), Scudder and Connelly (1985), and Christy (1982). The experiences of development agencies are discussed in World Bank (1984, 1986), UNDP (1986), Asian Development Bank (1986), DANIDA (1989), and Christy (1987).

The areas of expertise required for an analysis of the issues and the formulation of proposals are found within economics and the other social sciences. In the past, these issues have frequently been addressed only by biologists and population dynamicists. Although the information provided by these scientists is useful, it has been devoted primarily to the health of the fish stocks rather than the health of the industry and the fishermen. This situation is similar to that in agriculture, where there is an important role for agronomists and soil scientists, but these skills alone are not sufficient for the task of formulating the programs and projects needed to improve the welfare of the farmers or the contribution of agriculture to national economies.

Of particular importance for fisheries projects are economists with knowledge and experience in the management of fisheries, as well as experience in the tropical zone fisheries of developing countries. In the North Atlantic countries, professional fisheries economists have tended to focus their studies on the theoretical aspects of open access resources, since their rewards come largely from publication of such studies in professional journals. Their knowledge also has tended to be restricted to temperate zone fishery resources, which are made up of large populations of individual species fished by relatively large-scale operations. Although there are such fisheries in Latin America (namely, the anchoveta and jack mackerel fisheries), the most difficult problems are found in the tropical zones where the resources include numerous different species, each with small populations, and the fisheries are artisanal in nature.

An increasing number of fisheries economists are specializing in the Latin American and Caribbean region, but the total number is still small. These, together with the few North Atlantic economists with appropriate knowledge and experience, provide a cadre from which the Bank can draw for its expertise.

In addition to fishery economists, there is a need for expertise in several other social sciences, such as law, common property resource management, and social organization and environmental quality management. In these cases, knowledge of the special characteristics of fisheries is desirable but not essential. The field of common property resource management has grown rapidly in the past decade with the increasing

recognition that communities and user groups have often developed sophisticated techniques for dealing with problems of open access to such resources as forest and grazing lands, water for irrigation, and fisheries.

Technical expertise is, of course, also important. This includes not only biologists but also vessel and gear technologists, processing specialists, marketing and distribution experts, etc. It is essential, however, that such expertise be secondary to the expertise of fisheries management specialists and called in only after fisheries management regulations are in effect.

Strategic Elements

There are several kinds of activities that may be appropriate for Bank involvement. Although these logically fall into three sequential steps, there may often be valuable opportunities to proceed in different order. The first set of activities is the support or conduct of research to obtain information on the benefits of institutional change and the methods for achieving it. The second is providing encouragement or support to governments through technical cooperation projects that will lead to the necessary changes. Once the appropriate institutions are in effect, there will be opportunities for investment loans.

Research activities

Deficiencies in information constitute a major impediment to improving the benefits from fisheries. The major deficiencies lie in information about the economic and social aspects of the fisheries, though there are other important gaps in information about biological and environmental elements as well. Efforts to reduce these information gaps will be useful in stimulating governments to move toward more effective management, both by indicating the significance of the benefits and the ways in which the benefits can be achieved. The Bank has an important opportunity to remedy these deficiencies by supporting and possibly conducting research. Economies of scale can be realized because of the commonality of the problems to all countries. Furthermore, the information provides an essential basis for technical cooperation and investment loans.

Some of the major kinds of economic and social information required are mentioned in the following paragraphs.

Basic Economic and Social Data. In most countries, the major deficiency is the absence of basic data on the economic and social characteristics of fisheries (employment, fishing effort, costs and prices). It is difficult and costly to collect these data. Prices, for example, vary widely, depending upon species, size and quality of individual fish, season, time and place of landing, etc. The development of improved methodologies for cost-effective collection of such data and support for national collection programs deserves high priority.

Resource Valuation. Estimates of the value of *in situ* fishery resources are important as indicators of the economic rents that could be produced through effective management and as a basis for determining allocation among competing uses. Such information would be especially helpful in evaluating the costs of overcoming trade embargoes. The methodology for resource valuation exists, although it is imperfect and dependent upon data that are not always available.[44] A series of case studies of specific fisheries can help improve the methodologies, including those that are able to deal with data deficiencies.

Means for Extracting Economic Rents. The extraction of the rents produced through effective fisheries management is important in demonstrating potential revenues to governments and in inducing them to adopt the management measures. Some systems are already

[44] See the earlier discussion of BEAM 4. Also, less sophisticated measures can provide rough indicators of resource values that can subsequently be elaborated through more refined models. For example, it has been hypothesized that a reduction in the number of trawlers operating on the west coast of peninsular Malaysia might produce economic rents on the order of $100 million per year. This estimate was derived from information that the value of the trawler landings in 1978 was 87% greater than that of 1982 but was taken with 15% fewer trawlers (Christy, 1987).

in effect (namely, the Peruvian auction of fishing rights for squid). In general, however, there has been little study of alternative systems for fisheries, in the developed as well as in the developing countries. An examination of the use of taxes, royalties, user fees, etc. in other natural resource industries would be helpful.

Management Techniques. The different measures for managing fisheries through closed access are generally well known. However, examination of their application to specific fisheries situations in the region would be helpful in providing information about their benefits and costs.

Values of Small-Scale Fisheries. Increasing emphasis has recently been given to the importance of small-scale fisheries in many countries. Studies to determine whether there are comparative advantages to small-scale fisheries over large-scale fisheries and the situations under which these occur would be useful in reevaluating support programs and policies.

Community-Based Fisheries Management. There are some situations where small-scale communities, as well as large-scale user groups operate under systems of *de facto* exclusive use rights. Institutionalization of these rights systems may often be desirable as a means for ensuring or enhancing self-management. Support to countries for inventories and analyses of these systems would increase national awareness of the importance of the systems and provide a basis for improved management.

Marketing Analyses. There are certain common problems that several states share in marketing their fishery products, the most important of which are problems of embargoes by importing countries. The alternatives available to the states are limited. They can comply with the requirements of the importing states, usually at higher fishing or processing costs; they can work cooperatively to change the requirements; they can seek alternative markets, which may be less attractive; or they can work to establish market mechanisms to resolve the conflicts over alternative values and uses. Analyses of the various ways in which they can respond would be beneficial to the states concerned.

In addition to the deficiencies in economic and social information, there are deficiencies in biological, environmental, and technical information that impede the move toward more effective fisheries management. However, since the skills required to deal with these information deficiencies lie in other agencies than the Bank, there are limited opportunities for Bank involvement. The Bank might provide support for some of the agencies and programs currently involved in the region, such as the CARICOM Fisheries Resource and Assessment Program (CFRAMP); the Instituto del Mar del Perú (IMARPE), which has received Bank support in the past; the Organización Latinoamericana de Desarollo Pesquero (OLDEPESCA); the Programa Regional de Apoyo al Desarrollo del la Pesca en el Istmo Centroamericano (PRADEPESCA); and the Market Information and Technical Advisory Service for Fish Products in Latin America and the Caribbean (INFOPESCA). It could also participate in the annual Fisheries Development Donor Consultations, which are designed to facilitate exchange of information on fisheries research and development projects and programs supported by multilateral and bilateral donors.

Technical cooperation

The information produced through these efforts should help to provide the basis and the incentives for making the institutional changes that will facilitate efficient private investment in fisheries. Technical cooperation projects can be used to implement the institutional changes and strengthen the capacity of governments to fulfill their management responsibilities.

There are two kinds of institutional changes that can be fostered through technical cooperation projects by the Bank. One is the establishment of property rights systems, which will help create the conditions for effective private investment. The other is the transfer of management rights and responsibilities to fishermen's groups, which will help provide the incentives for self-regulation.

The Bank has a particular capability to influence these changes through its direct access to the highest levels of government and especially to ministries of finance and planning. As discussed earlier, since fishery administrations do not generally have a mandate to make the politically difficult decisions on distribution of wealth that are necessary for effective management, these issues must be addressed at higher levels. Ministries of finance and planning are more likely than fishery administrations to appreciate the benefits that property rights systems can provide to national economies and also to have a greater influence on political decisions.

Several kinds of technical cooperation projects aimed primarily at the highest levels of government should be considered.

Legislation. In many countries, fisheries legislation does not make adequate provision for the establishment of property rights systems. Advisory and training programs at national and regional levels that are designed to revise legislation should be supported. These can be done either directly by the Bank or through the Law Advisory Programme of the FAO.

Property Rights Systems. Systems for closing access to fisheries need to be established as a matter of the highest priority. The Bank can support the establishment of such systems directly or indirectly through educational activities at national and regional levels, advisory programs, training workshops, the preparation of draft regulations, etc. Where feasible and appropriate, the establishment of property rights systems can be made a condition of sector loans.

Demonstration Projects. A very high priority should be given to projects that demonstrate the effectiveness of fishery management systems, in particular those using individual transferable quotas. Experience has shown that when such systems are put into effect, the considerable benefits that are produced stimulate strong interest on the part of fishermen in other fisheries. For example, to a large extent the ITQ system for the U.S. Pacific halibut fishery was adopted after the fishermen became aware of the considerable success achieved in an ITQ system in British Columbia.

Subsidies. Where open access exists, subsidies have perverse and damaging effects on fisheries and should be removed at the earliest possible time. The Bank should encourage national governments to remove such subsidies through means similar to those mentioned earlier.

Management Authority. The transfer of certain aspects of management authority to user groups (both small scale and large scale) provides a critical incentive for fishermen to regulate themselves. Other aspects of management authority must reside in the central governments. However, user groups may not be sufficiently prepared at present to undertake the necessary responsibilities. Fishery administrators also may require additional preparation for fulfilling their responsibilities. The Bank could provide support to fishermen's groups and NGOs as well as to fishery administrations for general training and education in fisheries economics and management. For small-scale fishing communities that have opportunities for community-based management through a TURF, the Bank could provide support for organization, training, and perhaps capital investment, such as processing capacity.

Economic Competence. In general, the most critical gap in fishery administrations is the lack of competence to undertake economic analyses and propose economic measures, including the means for extracting economic rents. Workshops, training programs, and other educational activities need to be provided at both regional and national levels. Training materials also need to be prepared. These activities can be carried out directly by the Bank or through support of appropriate organizations (e.g., ECLAC, FAO, CARICOM).

Enforcement Competence. An additional critical gap is the lack of enforcement capability, both in terms of physical capacity (vessels, aircraft, etc.) and staffing. The development of physical capacity should be considered under investment projects. For staffing, there is a need for increased personnel as well as

training, which should receive support from the Bank through technical cooperation projects.

Research Capacity. Some of the countries in the region have their own fisheries research institutions. However, there are usually deficiencies in economic research that need to be overcome. This might be done either by direct support or by encouraging national economic research bodies to cooperate with the fishery bodies.

Conflict Resolution Mechanisms. One of the basic characteristics of open access fisheries is the absence of a nonarbitrary means for resolving conflicts. The establishment of markets for the resources will help overcome this difficulty but will in itself be a source of conflict. Since the problems of resolving these conflicts can significantly impede the adoption of effective fisheries management measures, national governments need to adopt or improve mechanisms for conflict resolution. These might include various forms of fishery management councils on which different interests would be represented.

Investment projects

Opportunities for investment projects in fisheries should be considered in two different phases. The first phase is the present situation in most countries where open access still exists. In this phase, investment projects should be severely limited to those that do not result in increased fishing effort, or to projects that help to reduce overcapitalization. Loans should be primarily, though not entirely, to the public sector. The second phase will occur when countries have established mechanisms for controlling access to fisheries. Once such systems are in effect, the opportunities will be broadened considerably and can include loans to the private sector.

In the first phase, there are several kinds of projects that can be considered. In most cases, loans should be conditional upon the establishment of closed access systems.

Investment in Disinvestment. Loans with the greatest potential payoff are those that remove superfluous capital in the fisheries. As mentioned earlier, the economic benefits of reducing total costs in fisheries can be extraordinarily large, producing economic rents of 20% to as much as 70% or more of the annual gross revenues from the fishery. The concept of buying out excess capacity may be difficult to accept, but even more difficult is the idea that the surplus capital should generally be destroyed to prevent its shift to other fisheries. Nevertheless, the potential benefits demonstrate the importance of comprehending and accepting this concept. Investments in disinvestment must be accompanied by programs that control access in order to prevent the movement of more vessels into the fisheries and the replacement of the vessels removed.

The Bank should give highest priority to loan projects that remove surplus capital and should actively seek out projects for fisheries that will produce the highest economic returns. This, however, will not be an easy task. First, the concurrence of the government must be obtained. Second, it is necessary to involve the fishermen and obtain their cooperation. Third, information must be gathered. Many of the suggestions for research and technical cooperation mentioned earlier need to be undertaken, including estimates of economic rents available in the fisheries, adoption of management measures that include a means for extracting rents (where this is desirable), the passage of appropriate legislation and regulations, improvements in management and economic competence, and removal of subsidies. Fourth, satisfactory enforcement systems and conflict resolution mechanisms need to be put into place.

Although it is difficult to deal with these tasks, as a World Bank report points out, disinvestment from an overfished fishery will yield a net economic gain to the

economy (World Bank, 1989).[45] An investment in disinvestment could be achieved with the aid of a revolving fund that could be used to purchase the redundant vessels and that would be replenished by the rents extracted from the management system. The revolving fund could also provide money to modernize vessels during the second phase.

Enforcement. Investments in the development of enforcement capacity are also justifiable during the first phase, in certain situations. For countries whose resources attract foreign fishermen, the prevention of poaching or the assurance of foreign compliance with agreements can produce high returns, either in the form of higher domestic catch rates or higher economic revenues. Since the costs of purchasing and operating patrol vessels and aircraft can be high, careful analyses need to be made to determine whether, and what kind of, investments would be desirable.

Effective enforcement of domestic fisheries is also necessary to ensure that there is satisfactory compliance with regulations. Depending upon the fishery and the kind of regulations, some investment in patrol craft may be desirable. In most situations, however, enforcement will be most effective when the fishermen perceive that compliance with the regulations is in their own interest.

Enhancement. There are various ways that investments can improve the yield from fish stocks. These include improvements in habitats and nursery areas, implantation of fish aggregation devices, construction of artificial reefs, and establishment of reserves. Such investments tend to be small and most can be undertaken by the fishermen themselves under the right conditions. Small loans to the private sector can be made with the provision that the user groups will have exclusive use rights to the products. Such loans will be particularly useful for small-scale fishing communities.

Fishing Gear. Changes in fishing gear and techniques can be beneficial and may justify some investments during phase one. Support for the development and use of fixed fishing gear can help foster support for TURF systems. Improvements in gear selectivity will have widespread value in reducing levels of by-catch. This can have immediate returns in fisheries where the by-catch is subject to embargoes by importing countries (e.g., tuna/porpoise and shrimp/turtle fisheries). It will also provide long-term gains in fisheries in general. Loans for the development of new technologies or for conversion to desirable current technologies should be considered.

During the second phase, when countries have established effective property rights systems, a wider range of investment projects can be considered, including those already mentioned. Only a few examples need to be given.

Vessel Adjustment and Modernization. As fisheries move to closed access systems, they will generally continue to use the vessels that were in the fishery under open access. In many cases, there will be considerable differences in the vessel characteristics that are optimum for the two different situations. For example, vessels operating under open access conditions may have been subject to regulations designed to restrict efficiency (controls on size, horsepower, or kinds of gear). Or, if they were not subject to those kinds of regulations, there may have been a tendency to overinvest in horsepower to achieve first access to the stocks at the opening of the season. These kinds of vessels are not likely to be appropriate under effective systems of closed access. Construction of new vessels suitable for the new management systems will be necessary but will generally require high front-end capital expenditures. Bank lending to the private sector would be appropriate in these cases and would produce high returns.

[45] "In formulating sectoral plans, research programs, or institutional development projects the (World) Bank will support the design and implementation of...(d) programs to support management strategies at the artisanal, semi-industrial and industrial levels such as vessel buy-back programs, transferable quota and tax schemes, provided concerted actions are taken to improve employment opportunities in other sectors (e.g., through training and education)" (World Bank, 1989, pp. 32-33). Although the title of the report is "Strategy for Fisheries Development," this does not appear to be the official World Bank strategy.

Processing and Marketing Facilities. In many fisheries there are wide variations in ex-vessel prices that are related to the quality and end use of the products. There are potential opportunities for taking advantage of the higher prices. These include improvements in handling fish (for example, through the use of chilled seawater tanks on board); on-board or on-shore freezer capacity; and processing for human consumption rather than for fishmeal. Private sector loans should be able to produce high returns in these situations if closed access systems are in effect.

Infrastructure. Many small-scale fishing communities are physically and economically isolated. As they acquire exclusive use rights, it can be expected that they will be able to increase their production of high-quality fish, but they may not be able to take advantage of this without access to markets. In addition, their overall welfare will depend upon the availability of alternative opportunities for employment, including fish processing. To alleviate these difficulties, loans for the construction of roads and improvement of landing facilities may be desirable.

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Annex 1: International and Multilateral Agreements Relevant to the States of the Region

1. International agreements:

a. United Nations Convention on the Law of the Sea (UNCLOS).

b. United Nations Conference on Environment and Development (UNCED).

c. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

d. United Nations Convention on Straddling Fish Stocks and Highly Migratory Fish Stocks.

e. Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas. Approved by Resolution 15/93 of 24 November 1993 of the Conference of the Food and Agriculture Organization of the United Nations.

f. Code of Conduct for Responsible Fishing.

2. Regional agreements:

a. Convention for the Protection of the Marine Environment and Coastal Area of the South-East Pacific and Its Supplementary Agreements (Nov. 12, 1981).

b. Treaty between Argentina and Uruguay on the River Platte, 1973.

3. International agencies:

a. FAO: Food and Agriculture Organization of the United Nations.

b. UNEP: United Nations Environment Programme.

4. Regional agencies:

a. Permanent Commission of the South Pacific (CCPS).

b. Latin American Organization for Fisheries Development

c. Eastern Pacific Tuna Fishing Organization, established in 1989 by Ecuador, Mexico, Nicaragua, Perú and El Salvador

Annex 2: Summary of IDB Operations for Fisheries

PERIOD	INVESTMENT APPROVALS*	INVESTMENT DISBURSEMENTS**	TC APPROVALS	TC DISBURSEMENTS**
71-75	$120,413,000	$61,905,453	$469,000	$400,070
76-80	$391,348,309	$240,960,361	$3,625,000	$2,895,870
81-85	$87,966,000	$67,194,895	$2,668,830	$2,467,478
86-90	$0	$0	$234,000	$168,974
91-95	$0	$0	$1,296,000	$549,380
TOTAL	$599,727,309	$370,060,709	$8,292,830	$6,481,772

NOTES: * ADJUSTED, NOT ORIGINAL. EXCLUDES AQUACULTURE AND GLOBAL CREDIT OPERATIONS
** EXCEPT FOR 91-95 PERIOD, MINIMAL AMOUNTS AVAILABLE REMAINING

PERIOD	NUMBER OF INVESTMENT APPROVALS	AVERAGE $ PER INVESTMENT APPROVAL	NUMBER OF TC APPROVALS	AVERAGE $ PER TC APPROVAL
71-75	4	$30,183,250	2	$234,500
76-80	8	$48,918,539	13	$278,846
81-85	4	$21,991,500	12	$222,403
86-90	0	NA	4	$58,500
91-95	0	NA	4	$324,000

Annex 3. Fisheries Management Policies of Selected Latin American Countries

	CHILE	COLOMBIA
PROBLEMS	* Over-exploitation of fish stocks (Pelagic, demersal and benthonic) * Over-investment in vessels, gear and processing plants * Rent dissipation or transference via exports * Lack of operational procedures for comprehensive management strategies and plans * Degradation of coastal ecosystems (Pollution due to waste disposal, sediments, sawdust, minerals, etc.) * Unmanaged transboundary stocks (anchoveta and sardine; tuna; mackerels) * Resource-use conflicts between small and industrial fisheries * Ineffective monitoring, survaillance and implementation of regulatory measures; lack of infrastructure and personnel	* Over-exploitation of coastal resources * Rent dissipation * Lack of comprehensive management strategies and plans * Degradation of coastal ecosystems (mangrove conversion, pollution, solid waste disposal) * Unmanaged transboundary stocks (tuna, shrimps) * Resource-use conflicts between small and industrial fisheries * Inefffective monitoring survaillance and implementation of regulatory measures; lack of infrastructure and personnel
OBJECTIVES	* Resource conservation and sustainable use	* Resource conservation and sustainable use
POLICY	* Access restriction (closures, fishing areas) * Effort restrictions (mesh size regulation; regulation on: boat capacity power, vessels size, etc.) * Other: total catch quotas	* Access restriction (closure, licenses) * Effort restriction (mesh size regulation; boats capacity; motor power, vessels size, etc.)
MECHANISMS	* Territorial use rights * Licenses * Permits * Leases * ITQs	* Territorial use rights * Licenses * Permits * Leases
PROCEDURES	* Establishment of fishing access regimes (under-exploited; fully-exploited and on-recovery) * Determination of TACs (fully-exploited and under-exploited fisheries) * Allocating of exclusive fishing areas * Auctioning of individual quotas, fishing permits	* Yearly quotas with minimum harvest size * Determination of TACs

Annex 3. Fisheries Management Policies of Selected Latin American Countries (continued)

	ECUADOR	PERU
PROBLEMS	* Over-exploitation of fish stocks (small pelagic resources) * Coastal areas degradation (pollution, solid waste disposal, chemical discharges, mangrove conversion, sedimentation) * Rent dissipation or transference via export of shrimps * Resource use conflicts (small scale collectors vs. shrimp producers, tourism vs. fisheries, etc.)	* Over-exploitation of fish stocks (pelagic, demersal and benthonic) * Obsolescence of fishing fleet * Over-investment in vessels, gear and processing plants * Degradation of coastal ecosystems (pollution) * Food web disruptions (guano birds) * Unmanaged transboundary stocks (anchoveta and sardine, tuna, mackerels) * Resource-use conflictos between small and industrial fiheries * Ineffective monitoring survaillance and implementation of regulatory measures; lack of infrastructure and personnel
OBJECTIVES	* Conservation of coastal ecosystems and fishing stocks * Preservation of natural environments and biodiversity	* Conservation of fish stocks * Optimization of socio-economic benefits * Preservation of natural environments and biodiversity
POLICY	* Integrated coastal zone management plans * Access restriction (closure, licenses) * Effort restrictions (mesh size regulation; boats capacity, motor power, vessels size, gears, etc.)	* Access restriction (closures, licenses) * Effort restrictions (mesh size regulation; boats capacity, motor power, vessels size, etc.
MECHANISMS	* Allocation of exclusive fishing areas * Units of coordination and monitoring of aquacultural areas	* Limits to harvest rates * Control on production factors (licenses and fishing capacity) * Fishing permits and gear restrictions * Individual trasnferable quotas (ITQs) * Taxes on harvest
PROCEDURES	* Controls to: tansport illegal of mangrove, discharges of oil or toxics in the rivers or marine waters * Auctioning of individual quotas, fishing permits	* Biological, technological, social and economic fisheries assesment and periodic evaluations of stock abundance

Sources: a) Universidad del Pacífico. Centro de Investigación (CIUP). 1994. "Lineamientos para el Manejo Eficiente de los Recursos en el Sector Pesquero Industrial Peruano." Lima, Perú; b) ILANUD, PMRC. 1989. "Manual de Aplicación de Normas de Recursos Costeros del Ecuador." Quito, Ecuador; c) ICSED. 1995. "Evaluación del Stock de Sardina Zona Norte 1994." Santiago de Chile, Chile; d) CAAM. Banco Mundial. 1995. "Proyecto de Asistencia Técnica y Rehabilitación del Ambiente. Plan Integral del Golfo de Guayaquil."; and e) CEPAL. 1995. "Regulación estatal en el Manejo de Recursos Pesqueros." Unidad de Recursos Naturales, División de Medio Ambiente y Recursos Naturales.