

Emerging Patterns of International Fisheries Development

JOHN GULLAND
*Food and Agriculture Organization
of the United Nations¹
Rome, Italy*

Abstract

The development of fisheries involves many international problems. Some are common to other problems of development, whether in agriculture, forestry or fisheries, and include improvement of technology in underdeveloped countries, training of personnel and supply of capital for investment. There are also international problems specific to fisheries, knowledge of the resource, especially concerning potential fisheries on stocks not yet exploited; and the problem of the proper management of the fishery resources of the high seas, which is mainly, but not exclusively, relevant to fish stocks already heavily exploited.

Until recently, quantitative evaluations of fishery resources could only be made with any useful precision with data from an established fishery. Recent developments in technique now make it possible to estimate the magnitude of an as yet unfished stock, and also the potential average annual yield from it, and the likely catch rates (e.g. in terms of tons per day for a standard boat). This enables the development of a fishery to be better planned, or indeed the suggestion of investment in a fishery to be refused if the resource would not support it. Such resource studies can be national, but because of the expense and especially the shortage of qualified scientists and suitable vessels are more effectively done internationally.

International action (both scientific and administrative) is essential for managing high seas resource. In the absence of such action, the world catch has been less than it could be and the cost of fishing the catch unnecessarily large, and the differences are likely to increase. Three possible management regimes are expansion of exclusive national limits; international ownership of the resources beyond the present national jurisdiction; and a continuation of the present arrangements. All have severe disadvantages. Discussion is needed to find the best solution and methods of overcoming its disadvantages.

INTRODUCTION

THE FOOD AND AGRICULTURE ORGANIZATION of the United Nations is charged with a wide range of responsibilities in the field of fisheries, aimed at helping to increase the production of fish, especially in the developing countries. Many of the problems in this work are common to development in the other fields of responsibility of FAO—agriculture and forestry. These include such things as the improvement of the technology in these countries—better boats, better fishing gear, better marketing, processing and distribution, training of scientists and fishermen, and the supply of capital for investment. These problems require a great deal of international action for their speedy and effective solution, but

¹The views expressed in this paper are the personal views of the author and not necessarily those of FAO.

are essentially national. Fisheries also face a range of special problems, essentially international because of the international ownership (or lack of ownership) of the resource.

These concern a knowledge of the magnitude of the resource, the potential catch from it, and the effect of fishing on the resource. Before any fishery develops, the precision required is not very large. In the first instance all that may be needed is some general knowledge of the ecology of the region to suggest its general potential; thus 20 years ago enough was known about the waters off Peru—that there was a strong upwelling, high primary production, abundance of birds—to be fairly sure that there was a fish potential of at least several million tons. The next stage is to provide better information on the fish, their distribution, patterns of behavior, movements, shoaling, and on methods of capture for definite plans for developing the fishery to be drawn up and put into operation. At the same time the estimates of the potential catch must be improved, so that the planned scale of development remains within the attainable limits. Finally, as the catches approach the potential from the resource, quite accurate estimates of the latter and of the effect of fishing on the resource are necessary so that suitable management measures can be considered and implemented.

All these require international action. The preliminary identification of the resource potential is largely a matter of comparison between similar areas in different parts of the world, and estimating the potential of one area by analogy with similar but better known areas in other parts of the world. This is one aspect of the survey of the world's potential fish resources at present being carried out by FAO as part of its Indicative World Plan, though this survey is also concerned with reviewing and collating the more precise data on developing and developed fisheries.

RESOURCE SURVEYS

The more detailed investigations into the potential for developing a fishery are more national. In the simplest case where one country is considering exploiting a stock of fish restricted to its own waters, international action may be limited to the provision of technical or other assistance. Most fish stocks are not restricted to one country's waters, and then the survey is much better carried out regionally as a single operation covering the whole area inhabited by the stock. For example the Guinean Trawling Survey carried out a survey of the demersal stocks along most of the tropical waters of western Africa. In the same area a series of national projects under the UNDP Special Fund, carried out by FAO, are concerned with evaluating the resources of pelagic fish, and are linked by a single regional program. In the Caribbean area FAO has two regional fishery projects—for the Caribbean, including most of the islands, and for Central America.

These projects are tackling the common problems of experimental fishing—determining the most suitable fishing techniques of vessels and gear for the local species and conditions; and exploratory fishing—charting the distribution, usually as catches per unit of effort of some standard gear, of the important stocks in space and time. Recent developments are improving the efficiency of this work. Modern equipment, particularly the latest types of sonar, makes it possible to chart the distribution of pelagic and many demersal fish very

quickly with a fair degree of quantitative precision, with the more lengthy task of fishing being needed only occasionally to identify the species of fish in echo-traces. Other methods being used in an increasingly quantitative manner include the use of surveys of eggs and larvae of the fish of interest. The pelagic eggs of many species are particularly suitable for quantitative study because they are among the few organisms in the ocean which do not dodge from the mouth of the net, or, with suitable gear, pass through the meshes.

This survey work is becoming increasingly important as the pace of fishery development increases. Development is no longer a matter of starting with one or two small boats, and if these prove successful building a few more rather bigger ships until saturation of the market or depletion of the resource slows the process down again. Now fishery development consists to a great extent of large, multi-million dollar projects, financed by private industry (often from abroad), national governments, bilateral aid, or one of the international development banks. All these require a good assessment of the economic prospects of a proposed scheme. On the shore side this can be done with fair precision. The price of the boat, running costs, crews' wages and other costs, and the price received for the catch can be estimated closely. The unknown factor is the likely catch rate of the proposed vessels in terms say of tons of fish per day. Even when this is known for existing vessels the effect of adding the new vessels on the resource, and hence on the catch rate, is often difficult to assess.

Despite the fact that the uncertainty in catch rates is sometimes as much as a factor of two in either direction, and a difference of only 20% can make the difference between a highly profitable operation and one that makes a loss, this work of resource appraisal has been largely neglected until recently. Partly this is due to the expense, and particularly the time, involved. The field work of a survey alone must, if the seasonal patterns are to be studied, cover a complete year, and preferably two, to allow for possible year-to-year changes. This is far too long for advice concerning a particular investment project. However, those responsible for international or national investment programs are now recognizing the importance of resource information.

MANAGEMENT PROBLEMS

The biggest international fishery problems are related to the management of the high seas resources. In the first instance this concerns developed fisheries, but the present general failure to achieve proper management in these fisheries is having an adverse effect in other fisheries. Excess capital and other resources are being tied up in the developed fisheries—e.g. in exerting perhaps twice the desirable fishing effort in the North Atlantic cod fisheries, or in harvesting the Pacific salmon by extremely inefficient methods. Not all these economic resources are mobile, but if only part could be diverted into other less heavily fished stocks of fish, there would be an appreciable increase in the world's fish catch. Also development is restricted by the realization that, however profitable and attractive a developing fishery may appear to be at present, an unregulated increase in fishing is likely to rapidly reduce the returns from it to a low level.

The biological factors underlying this situation are well known. As fishing increases, the catch is at first proportional to the fishing effort, but the curve of catch against fishing effort flattens out, so that further increases in fishing

give only very small increases in catch. For certain stocks, a clear example being whales, further sustained increases in fishing effort will lead to declining yields, so that there is a certain level of fishing which corresponds to a well defined maximum catch. For other stocks there are at least good theoretical grounds for supposing that the catch will still increase, if extremely slowly, with increasing fishing, up to quite high levels of fishing, especially if the sizes of fish caught are suitably adjusted. For stocks with a pronounced maximum it is clearly foolish to allow a greater amount of fishing than is needed to take this maximum catch, but considered in terms of the yield from the ocean as a whole it is only slightly less foolish and wasteful to allow excess effort when there is not any pronounced maximum.

For instance in the North Atlantic the present catches of cod are some $2\frac{1}{2}$ -3 million tons per year, worth on an average rather more than \$100 per ton, or a total conservatively estimated at \$300 million at the point of landing; the costs of harvesting this catch must be about the same. The relation between the amount of fishing and the average catch is not known precisely and depends on how the fishing is distributed among the dozen or so independent stocks, but it is known that reduced effort, down to perhaps half the present level, will, in the long run, give a total catch not greatly different from the present. Probably the greatest catch, about 10-20% above the present, could be taken at about two-thirds of the present effort; but the maximum might, especially if large meshes are used by the trawlers which account for the bulk of the catches, occur at levels of effort even above the present. Consider then a reduction of effort to two-thirds of the present; the catches will be between about 95% and 120% of the present, and worth \$285-360 million. In a perfectly rational world the costs of fishing could be reduced in proportion to reduction in the amount of fishing, i.e. to \$200 million. This would give a surplus of value of catch over total costs of \$85-160 million, of which the major part, even when the lower level of effort gives the maximum catch, is due to reduction of costs, rather than an increase of catch of cod. If the general objective is an increased total catch of fish from the sea rather than a diversion of some of these potential economic benefits to other purposes, then this maximum sustained catch will be achieved by using the savings in the costs of fishing for cod to fishing for other species which are at present less attractive and rewarding to the individual fisherman.

Whether the optimum use of the sea is defined in economic or physical terms, proper management of the cod stocks requires the reduction of the total amount of fishing, while allowing the permitted amount of fishing to be carried out as efficiently as possible. In addition some protection of small cod is necessary to allow them to grow to a reasonable size. Similar measures are necessary in many other fisheries either to provide better reproduction—protection of berried female lobsters, or of female whales with calf—or to allow the animals to grow to a better size before being caught e.g. minimum legal sizes of fish, or of mesh sizes of trawls etc. These regulations usually apply universally throughout a fishery, cause comparatively little direct interference with fishing operations, and more important, do not interfere with the desires of any country or other groups of fishermen to increase its share of the total, or of a new entry to start fishing. The introduction of such measures therefore does not pose insuperable administrative and political problems, though there are scientific problems of determining the best mesh

size, and the administrative problem of enforcement. Despite these latter, regulation of minimum size of fish or whales and of mesh size have been successfully introduced in many areas, including the North Sea, where there is a very wide range of countries involved with quite different interests as regards methods of fishing and preferred species. Much remains to be done, especially in areas where new fisheries are developing. There is at this moment an urgent need for the use of larger mesh size for trawler fishing for hake in the southeast Atlantic, which is being met by the setting up of a suitable regional Commission. The general principles and methods for further progress seem clear, but effective and efficient control of the amount of fishing remains the major and unsolved problem except in some special cases.

If the requirement to maintain efficiency is ignored, then the fishing effort can be reduced by banning the most efficient gears, as is done for example on the Pacific salmon. Generally this is undesirable, and fishing can only be kept at the proper level by preventing at least certain people at certain times from fishing when they would like to. In practice this either means a closed season when no one can fish, or restricting fishing to a certain group and allowing no one from outside the group to fish. Seasonal closures, either for a fixed term or with a variable date set so as to limit the total catch to some predetermined level, have some great advantages. Enforcement is relatively easy, and during the open season fishing can be open to all and carried out with full efficiency. Most of the international Commissions which have successfully restricted the amount of fishing—the International Pacific Halibut Commission (IPHC), the International Whaling Commission (IWC), and now the Inter American Tropical Tuna Commission (IATTC)—have been based on a closed season. (It should not be forgotten that despite the Whaling Commission's failure to set the correct quota, especially in the period 1960-1965, it has a long record of success in the administrative field of having some restriction of effort applied in a multi-national industry). In these fisheries seasonal operations are either a natural feature (e.g. Antarctic whaling) or are acceptable to the industry.

In other fisheries seasonal closure is less attractive; a clear example is the North Atlantic cod. There are several more or less distinct stocks, which for best results should be managed separately, though at various times many of the ships concerned exploit more than one stock. Separate closed seasons for each stock would mean that the mobile fleets would move from stock to stock. The likely effect on any one stock would be to have approximately the same total annual effort as before but concentrated, possibly with some loss in efficiency, in a short season rather than spread through the year, and there would be little positive benefit. Alternatively, the effort could be restricted by a single closed season for all cod fishing, but this would not be acceptable to the considerable part of the fish industry concerned with the fresh fish market for cod.

MANAGEMENT METHODS

Some other approach must be considered. For the North Atlantic a working group of the International Commission for Northwest Atlantic Fisheries (ICNAF), with collaboration from FAO, the International Commission for the Exploration of the Sea (ICES) and the North East Atlantic Fisheries

Commission (NEAFC) has discussed the problem. In its report the only method of restricting fishing which lies within the terms of reference of the present commissions and which would enable the efficiency of the fishery to be maintained would be a total quota, of which a definite share would be allocated to each country. There was some doubt whether it would be better to measure the total quota and the national shares in terms of catch, with due allowances for fluctuations in the stock due to year-class differences etc., or in terms of fishing effort, with the very great difficulty of establishing properly comparable measures. It was felt that, by having nationally allocated shares, each country could take advantage of conservation measures to pursue its national policy for the fishery—more fish, cheaper fish, maximum net yield, etc.—by suitable national measures to enforce the quota.

Such a system raises the immediate problem of how the shares should be allocated. If done in proportion to the previous year's (or average of several years') catches, this will not be attractive to those actively developing their fisheries. Alternatively the share of catches in the coming years, in the absence of regulation, might be predicted from present catches as well as national development plans, since nearly all the ships which will fish for cod in 1970 are already built or being built. An immediate objection to such a scheme is that a country might be unwilling to accept a reduction in its share of the catch just because it is failing to increase its effort, in a fishery where the effort is already too high, as fast as the general average. However, to be realistic, the English fishing industry for example seems likely, regulation or no regulation, to see its share of the total cod catch in the North Atlantic go down, and may well prefer to have the opportunity to at least take this reduced share at a lower cost.

The short-term problem of allocation seems soluble, as indeed it was solved in the Whaling Commission. The long-term problem is harder. It is hoped and expected that, as the effort is reduced, the stocks will recover, and the value of the Atlantic cod catch will considerably exceed the cost of capture by the \$85-160 million mentioned earlier. The demand by the present countries to increase their share, and for new countries to enter the fishery will become intense. The problem is to decide who shall have this \$100 million or so, if it is not to be wasted by excess costs of fishing. This problem is related to, but can and should be distinguished from, the problem of who catches the 2½ million tons of cod.

Two solutions that are simple to describe are that the cod should become the property of some definite organization, which could then issue at a suitable fee the required number of licenses. The owners proposed have been either the coastal states or, since most of the cod are taken outside the present exclusive fishery limits, the United Nations or other international organizations. It would be expected that the gross annual value of the license fees in the long run, for the cod for example, would be \$100 million.

Another solution would in effect vest ownership for a strictly limited time in the nations presently fishing. If the period chosen was 20 years, then each year rights to 5% of the total quota would have to be renewed. If the demand for this share by new countries and established countries wishing to increase their share was too large, then allocation would be decided by giving the share to the highest bidder, the money going, perhaps less commission expenses, to the country relinquishing the share.

Another solution would be to combine some of the elements of an international commission and jurisdiction by the coastal state. In this, decisions as to the need for regulation and the size of the annual quota, if such were needed, would be taken by the international commission. If a quota was set, and there were difficulties on allocation, then again these could be decided by issuing licenses to the highest bidder, the license fee going to the coastal state, again possibly less expenses of the commission.

There are clearly difficulties, scientific, legal, administrative, etc., in each and all of these possible solutions, but there may be one or perhaps more which will offer a better and more effective solution than has so far been achieved in managing international fisheries. Successful management has so far been limited to certain special cases, especially when only two or three countries are involved. Throughout most of the world the total amount of fishing is expanding uncontrolledly and the number of countries involved in high seas fishing is increasing rapidly. For many types of fish—tuna, shrimp, and large bottom fish (cod, hake, etc.), it may not be possible much longer to use the classic response of the fishing industry to overfishing, i.e., to move a little farther afield where stocks are still unexploited. A close and detailed examination of the present methods of fishery management and the possible alternatives is therefore needed to see how the world can improve in rational use of the seas resources.