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COMMITTEE ON THE PEACEFUL USES OF THE
SEA-BED AND THE OCEAN FLOOR BEYOND
THE LIMITS OF NATIONAL JURISDICTION

CONSERVATION PROBLEMS WITH SPECIAL REFERENCE TO NEW TECHNOLOGY

Note by the Secretariat

The attached document* has been prepared by the secretariat of the Food and Agriculture Organization (FAO) in accordance with the request made by the Committee on the Peaceful Uses of the Sea-Bed and the Ocean Floor beyond the Limits of National Jurisdiction at its July-August 1971 session. It will be submitted to the FAO Committee on Fisheries at its seventh session in April 1972 as indicated by the Conference of FAO at its sixteenth session.

* Owing to the limited number of copies of the document which are available in English, French and Spanish, this note is also being issued without the attachment.

CONSERVATION PROBLEMS WITH SPECIAL REFERENCE TO NEW TECHNOLOGY

prepared by

FAO Department of Fisheries

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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INTRODUCTION

1. At the session it held in Geneva from 19 July to 27 August 1971, the Committee on the Peaceful Uses of the Sea-Bed and the Ocean Floor Beyond the Limits of National Jurisdiction resolved to request the Food and Agriculture Organization of the United Nations (FAO) to prepare a document on fishery conservation problems, with special reference to new technology.

2. In accepting the request, the representative of FAO noted that his Organization had been invited to prepare a document on the conservation of the living resources of the sea and on fishing methods, dealing with the general question of rational management of the living resources of the sea, mainly on the high seas, with particular reference to recent developments in fishing technology, gear and equipment. He agreed that the paper would also discuss the main causes of over-exploitation and indicate where stocks were being depleted or were in danger of depletion.

THE NEED FOR CONSERVATION

Biological considerations

3. In the absence of exploitation a stock of fish will be relatively abundant, with many individual fish surviving long enough to reach a large size. As exploitation increases, the total catch will increase, at first nearly in proportion to the increase in the amount of fishing, though the abundance of the stock will be steadily reduced as will the catch by an individual fisherman. However, the total catch cannot continue to increase forever as the amount of fishing increases, and there is a definite upper limit to the catches that can be taken from any given stock of fish. This limit can usually be taken with a moderately large amount of fishing. It occurs when most (but by no means all) the fish that reach a catchable size are in fact caught, but they live long enough to grow to a fair weight. If fishing is increased beyond this level, the numbers caught may still increase, but they will be caught before they have had time to grow, and the total weight will decrease.

4. There is also the possibility that as the abundance of the adult stock is decreased, as is bound to occur with increased fishing, this will result in reduced numbers of young fish (the recruits) reaching a catchable size in future years. Fortunately many individual female fish can produce vast numbers of eggs - often hundreds of thousands, or even millions of eggs each - so that, under favourable circumstances only a very small adult stock is needed to maintain the production of young. Thus the stocks of bottom living fish in the North Sea (principally cod, haddock and plaice) have been heavily exploited for three-quarters of a century without restrictions on the amount of fishing other than the accidental protection of the two world wars, but are as productive as ever, and indeed recent catches have been at near record levels.

5. On the other hand, stocks of marine mammals, which may produce only one young each year, or every other year, can be very seriously affected by any reduction in the adult stock. Unless there is effective conservation, stocks of most exploited marine mammals - seals, sea otters or whales - have declined to near extinction. The best known example is probably the Antarctic whales which declined steadily until 1966 when the catches allowed by the International Whaling Commission were brought at least approximately into line with the amounts that the current stocks could sustain without further reduction. However, with good conservation measures marine mammal stocks can be restored or maintained at a level giving high sustained catches, as is shown by the highly successful management of the fur seals by the North Pacific Fur Seal Commission, and the evidence that the Antarctic blue whales have increased under the complete protection accorded them since 1964.

6. No fish stock has been quite so clearly reduced to such a low level through the effect of fishing on the abundance of the adult stocks, though probably the complete disappearance of the Californian sardine fishery (one of the biggest in the world thirty years ago) and the decline in the North Sea herring, among others, have been due wholly or mainly to too

intense fishing. For these, and many other fish stocks, there are important scientific problems to be resolved, the answer to which may differ in detail from stock to stock, concerning the degree to which the adult stock can be reduced without seriously affecting the number of young produced. On the answer depends the extent to which catches will decline at very high rates of fishing. If small adult stocks can produce plenty of young (e.g. plaice in the North Sea), then with increasing fishing, the total yield will rise toward a maximum, and then decrease little at still greater amounts of fishing. If the number of young decreases (e.g. for whales and possibly for some fish), then as fishing increases beyond the level of maximum yield there may be a rapid fall in total catch, possibly leading to extinction if the fishing is maintained.

Economic considerations

7. The total physical yield is not the only element of concern in the conservation or management of a resource, though it is clearly critical for the stocks for which too heavy fishing can lead to a serious drop in total yield. Even when the total yield is high, the fishery tends to a state where there is no net economic return, or at best, such return as there is is much less than could be obtained under rational management. This situation arises from the common property, open access, nature of the resource, and the fact that each additional fishing unit entering a fishery will reduce the abundance of the fish stock, and hence the catches of vessels already fishing. The contribution of the new vessel to the total production is given by the marginal yield, i.e. the catch of the extra vessel less the resultant loss of catch of other vessels. In practice the decision whether or not to build an extra boat is based on the expected catch of that boat, and whether it will be worth more than its total costs. Since the expected catch of the boat will always be more, and in any heavily fished stock very much more than the marginal yield, it will often happen that the expected catch will be more valuable than the expected costs, even when the latter exceed the marginal catch. Then, more vessels will continue to be added to the fleet even when they add little to (or even reduce) the total catch. This is true even when the fishermen are well aware of the situation; their decision is based on their assessment of their own probable success. In fact an awareness of the facts of heavy fishing may well encourage increased fishing by individual fishermen (or individual countries in an international fishery) in an attempt to establish a large share of the total in advance of any system of control.

8. There is for each stock of fish, for a given set of social and economic objectives of the fleets exploiting it, an optimum exploitation rate. This optimum will occur when the returns from increased fishing beyond this level, in terms of weight of fish, net economic return, or other criterion, are not worth the costs of the extra fishing. If only economic criteria are used the optimum occurs when the value of the marginal yield is equal to the costs. In any case the optimum catch will be less than the maximum physical yield from the stock. Even when the prime objective is to catch as much fish as possible, to increase the catch from say 99 to 100 percent of the maximum potential yield from a given stock of fish would be unduly costly, requiring perhaps a 10 percent increase in effort to achieve the 1 percent increase in yield. The demand for fish would be better satisfied by diverting the additional resources of capital and manpower to some other, less heavily exploited, fish stock. In the absence of conservation measures the amount of fishing tends to increase beyond the optimum level, leading certainly to a declining net income to the fishermen, increased prices to the consumer and, not infrequently, a decline and possibly a very serious decline in the total catch.

9. On the other hand, it may be noted that under optimum management there should be, for many stocks of fish, a very considerable surplus in the value of the catch over the harvesting costs. For example, the salmon catch of western North America, worth to the fishermen some $150 million, could certainly be harvested, if the most efficient gears were used for well under $50 million.

10. A similar saving - of $50 - 100 million per year - was estimated in 1967 as being possible in the North Atlantic cod fishery by reducing the amount of fishing. Since that

time the effort has increased, so that the possible savings are even greater.

11. In summary, the need for conservation of living marine resources arise from a number of factors that distinguish the fishing industry from most other activities. The first is a matter of the biology of the animals; not only is the resource limited, so that however great the efforts to increase the catch, no more than a certain amount can be taken, but also, if the amount of fishing is increased beyond a certain level, the total catch may be reduced. Secondly, the economic factors that tend to control excess input in other activities, often act only weakly in fisheries. Even when the amount of fishing is so great that the total catch is decreasing, the pressures and incentives for the individual fishermen or fishing enterprises is towards increasing yet further their activities. Finally, the growing world population, and the need for it to be fed adequately is increasing the demand for fish; combined with the enhanced technological efficiency this is driving the amount of fishing on many stocks beyond the optimum level.

Management measures

12. A variety of conservation measures are available to manage a fishery, which control either the sizes of fish caught or the total catch. These include:

1. Limitation on the size or condition of fish that can be landed
2. Closed areas
3. Closed seasons
4. Limitation on the type of gear
5. Limitation of total catch
6. Limitation of total effort.

Each of these have been used at various times in fisheries in different parts of the world either alone or in combination. Each raises particular problems in relation to enforcement, acceptability to the fishermen, or indirect long-term effects on the fisheries. For example, successful control of the amount of fishing by closed seasons, as has been done for example in the Pacific halibut fishery, may attract extra fleet capacity into the fishery, leading to a progressive shortening of the season. Ultimately the halibut season was reduced in one are to only 21 days, so that the boats and shore facilities were operating for less than 10 percent of the possible time that they could have been in operation, leading to great economic inefficiency. No single technique can be suggested that would be optimum in all conditions, and the actual measures used in any particular case will be chosen in the light of local conditions and problems. The choice of method will involve, at least implicitly, some decision as to how the savings that should be produced by reducing the amount of fishing, while maintaining or increasing the total catch, should be utilized.

13. Effective conservation requires the full cooperation of all, or virtually all those participating in a fishery. If controls are only accepted by a proportion of the participants, then the benefits will accrue almost entirely to those ignoring the controls. Since most of the major marine fish stocks are on the high seas, and are exploited by several countries, international arrangements are necessary for their conservation. A large number of international commissions have been established with responsibility for particular regions or groups of species. Their constitutions, terms of reference, staff and methods of operation vary in detail, but the basic tasks are to arrange for the collection of basic data, such as statistics of the catch, the analysis of the data to assess the status of the stocks, and, on the basis of such analysis, to make recommendations to member states on management measures. Several commissions have also some arrangements for inspection to ensure compliance with the recommendation.

14. While these international regional bodies have not yet been entirely successful - witness for example the decline of the Antarctic whales, and of herring in the Northeast Atlantic - they have not been noticeably less successful than national control over stocks - witness the extinction of the Californian sardine fishery - and in some cases, e.g. the fur seal in the Bering Sea, international bodies have been highly successful. In any case the same major tasks - data collection, analysis, and framing and implementation of management measures - need to be carried out by whatever entity is responsible for the conservation of the resource.

15. A common problem in any international fishery in which the limits of the resource are being approached is that of resolving the competing demands for this limited supply. Because of differing national interests (high employment for fishermen, good protein supply, or earning foreign exchange) countries often find it difficult to agree on a single uniform detailed system of control. Then it may be easier to allocate shares in the total permissible catch (quota) from the resource to countries, allowing each country to make its own detailed national arrangements to ensure that no more than the quota is taken. These arrangements can be chosen in such a way as to achieve the specific national objectives. For instance, to obtain maximum economic return some control on input, e.g. by a licensing system, would be required in addition to a control on total national catch. Clearly the allocation of national quotas is not easy, but some of the difficulties may be made easier by taking into consideration not only the division of the fixed physical yield from the resources, but also the division (possibly in quite different proportions) of the possible surplus (rent) of value of catch above the costs of harvest, which, as described above, might be created by effective conservation. Some countries, such as those interested in foreign exchange, might be willing to forego a share in the physical yield in exchange for a greater share in the rent.

EFFECTS OF NEW TECHNOLOGY

New technology

16. The application of contemporary technology to the fishing industry is no new thing. From the time of the development of the steam trawler, a century ago, onwards, new techniques have been continuously introduced to the fishing industries of the world. However in fisheries as in most other fields, the last couple of decades have seen an acceleration in the pace of new technological developments. Some of these involve only minor changes in fishing methods, though having a far-reaching effect on their success; for example the replacement of natural fibres (manila, cotton etc.) by synthetic materials has resulted in stronger and longer lasting nets, and eliminated the need for costly and time-consuming preservation treatment, to the benefit of the African canoe fishermen as much as the owner of the large factory trawler. Others have radically improved the basic fishing techniques, for example the use of the hydraulic power-block has revolutionized purse seining for tuna, herring and anchovy, by allowing bigger nets to be handled more quickly and by smaller crews. Stern trawling, instead of trawling from the side, though less revolutionary, has also increased the general efficiency of the vessels. Search for fish has been greatly improved by modern acoustic techniques, which allow the active pursuit of schools of fish well below the surface by purse seiners or mid-water trawls.

17. Other techniques have altered the basic strategy of fishing. Methods of processing at sea - freezing, filleting, or production of meal - either on the catching vessel iself, or on board mother ships, have given fishing fleets an unprecedented range and flexibility of operations. Such fleets can operate thousands of miles from their home base, and switch easily from one stock to another in accordance with changes in the availability of fish, or market demand.

18. Finally, changes in technology ashore has an impact on the fishery. In the absence of suitable processing, catches had to be consumed within a close range of the port of landing. The increased proportion of world catches that are either frozen, or turned into fish meal,

has greatly increased the potential markets for the products concerned. These markets are also frequently not greatly concerned about the particular species, encouraging diversion from one stock to another, as the first becomes depleted.

19. In principle new technology adds no essentially new problem to those outlined in the previous sections, but it does increase the urgency and complexities of these problems. The first effect is that reduction of costs by improved catching techniques, or the wider markets, e.g. through better processing methods, can make increased fishing effort economically attractive. For stocks previously little exploited this can be very beneficial. For example the development of modern purse-seining, and the growth of the broiler chicken industry indirectly led to the spectacular increase in the catches of Peruvian anchovy. However, improved technology can cause serious difficulties when the stocks are already heavily exploited. For example the same developments that assisted the Peruvian fishery led to the serious crisis in the herring fisheries in the North Sea and adjacent areas. Some of these herring stocks had been exploited at a rate probably not very different from the optimum. The new highly efficient technique of purse-seining allowed the fishing to increase far past the optimum. Severe restrictions have had to be applied to the fishery, and catches from the Atlanto-Scandian stock dropped from well over a million tons in 1967 to a few tens of thousands in 1970.

Speed of development

20. Another effect of improved technology is to increase the speed at which fisheries develop. Existing management practices, whether of international fisheries by regional bodies, or of national fisheries, have mostly come into operation through a rather slow process, but the developments in the fisheries themselves were usually equally slow. There was normally an interval of some decades between the time the catches from a fishery reached a significant level and the time when management action became necessary. During this interval it was possible for biological, economic and other studies of the fishery to progress to the stage when a reasonable scientific understanding of the dynamics of the fish stock was achieved, and assessments could be made with fair precision of the likely effects of management measures.

21. There was also often a period of some years between the time when effects of heavy fishing became clear, and management measures became desirable, and the time when such measures became essential to prevent serious damage to the fishery. During this period it was possible to consider the practical and administrative problems involved in the implementation and enforcement of regulations, as well as undertake lengthy negotiations regarding the precise measures that should be introduced. These latter discussions have inevitably been particularly lengthy when fish stocks exploited by several countries are concerned.

22. The rapid pace of present fishery development largely as a result of modern technology is making these rather leisurely procedures inadequate. Fisheries can now develop in a very few years from the time the first significant catches are made to a stage where management measures are needed. For example, catches of yellowfin sole in the Bering Sea were well under 50 000 tons until 1959, increased to a peak of 450 000 tons in 1961 and dropped to only 66 000 tons in 1963. These rapid increases in catches from a particular stock are often due to the activities of long-range fleets, which can easily switch their attention from one stock to another. These fleets have in fact been a major cause of the recent total expansion of the total world fish catch, and have often led to the utilization of resources not otherwise touched, even when there was a thriving local fishery on other species, e.g. the hake stock off the west coast of North America, or the mackerel and horse mackerel off Northwest Africa. However, they have undoubtedly added to the difficulties of timely and effective management. Some local fisheries have also developed almost equally rapidly, without the participation of long-range fleets - examples are the Norwegian purse-seine fishery for mackerel, the Thailand trawl fishery, several shrimp fisheries and, of course, the Peruvian anchovy fishery.

Interaction between fisheries

23. Another aspect of modern fishing is the increasing range and variety of the species being exploited, as well as the extension of fishing on a given stock to other areas and seasons. For example, fishing in the North Sea, traditionally on herring or on the larger bottom living fish such as plaice and cod, is no also directed toward such small species as sand lance (Ammodytes) and Norway pout. Off West Africa sardinella used to be exploited only during the seasonal movements close inshore, by canoe fishermen from Senegal, Ghana and other African states. Now they are also harvested at other times of the year at some distance offshore, by factory ships and other large vessels.

24. This means that the proper conservation of the resources needs to take into account the interactions of a number of different fisheries. The cod fisheries of the North Sea, or the Senegalese sardinella fishery cannot be managed in isolation. Action on the cod stocks must consider the effects of the fisheries on abundance of sand lance or herring which are major sources of food to the cod, the effects of predation of cod on the stocks of small fish, and hence on the fisheries on them, as well as the fact that some quantities of small cod may be caught by fisheries primarily for other species. Similarly any management of the sardinella off Senegal must take into account the fisheries on this stock in all parts of its range and possibly at some distance from the waters off Senegal. It would probably also need to consider the effect of fisheries on other fish species which may be predators on, or competitors with sardinella. It may be noted that some of the interaction between fisheries can be beneficial; for example, an intense cod fishery is likely to be beneficial to those on herring or sand lance. It has been suggested that an increase in shrimp catch in some areas off western North America has been due to the reduction of the hake stocks (hake feed on shrimp) by long-range fleets.

Stocks in need of management

25. Another new element in conservation of fisheries in the world as a whole is the rising proportion of the available fish stocks throughout the world that have become heavily exploited.

26. At the time of the first United Nations Law of the Sea Conference in Geneva in 1958 a map was prepared to show the distribution, on the one hand, of stocks which were then heavily exploited, and on the other, of stocks known to exist but which were exploited only slightly or not at all. At that time the heavily exploited stocks were limited to some half-dozen stocks in the North Atlantic and North Pacific, mostly of large, valuable and long-lived species (halibut, salmon, plaice or haddock), and the blue whales in the Antarctic. A similar map has been included in the Atlas prepared by FAO, referring to the present day situation. While many stocks are still under-exploited, e.g. hake and anchoveta in the Southwest Atlantic, clupeoid fish in the Arabian Sea, the number of heavily exploited stocks has greatly increased, and include stocks in all parts of the world. Fortunately only a few stocks have been so depleted that the present yield is only a small proportion of the possible yield. These include several species of whales - but not the sei or sperm whales - some seals, various pelagic stocks such as the Californian sardine and the Atlanto-Scandian herring, and haddock in the Northwest Atlantic, though in the latter cases it is not clear to what extent fishing is the sole or major cause in the decline. Many more stocks have been sufficiently depleted for the effort expanded in harvesting them to be much in excess of what is necessary, often with some decline in the total yield. In others the effort is now increasing, or is likely to increase in the near future.

27. The current situation regarding the degree of exploitation of the worlds living marine resources is summarized in the Table, which gives for each group of species, the main areas in which they occur, the estimated potential yield, that could be achieved under best exploitation, the current state of exploitation, and management. Molluscs, other than cephalopods have been omitted, because most of the production comes from cultured stocks. Also, being sedentary, the problems of management are different from those of more mobile animals.

Group of species	Main areas of distribution	Potential harvest (million tons)	State of exploitation
Whales	Worldwide, especially Antarctic	2.1	Blue, humpback, grey and right whales severely depleted and completely protected. Fin whale - depleted but under management. Sei whale - fully exploited and managed.
Small whales, dolphins	Worldwide	0.5+	Mainly unexploited. Little sign of increasing exploitation.
Seals	Sub-Arctic and Sub-Antarctic waters		N. Pacific Fur seals under management. N. Atlantic seals depleted but under management.
Large or medium fish occurring open oceans			
Salmon	N. Pacific N. Atlantic		Fully exploited. Under management.
Large tunas	Warm oceans	0.8	Heavily exploited, under management in eastern Pacific.
Small tunas	Warm oceans	2.5	Presently generally lightly exploited, but exploitation likely to increase.
Bottom fish			
Flounders	N. Pacific N. Atlantic	1.8	Most stocks heavily exploited; some management in N. Atlantic.
Cod, haddock, etc.	N. Atlantic	4.9	Fully exploited. Under partial management. Haddock in N.W. Atlantic depleted.
Hakes	Temperate waters generally	3.4	Heavily exploited in several areas (N. Atlantic, S.E. Atlantic, possibly also N.E. Pacific). Some management measures in N. Atlantic. Presently lightly exploited in S.W. Atlantic.
Rockfishes	N. Atlantic N. Pacific	1.0	Heavily exploited
Tropical demersal fish	Tropics	22.5	Heavily exploited in some areas (Gulf of Thailand, parts of West Africa). Under-expoited in other areas (Java Sea).

Group of species	Main areas of distribution	Potential harvest (million tons)	State of exploitation
Other demersal fish	N. Atlantic N. Pacific	9.0	Some stocks e.g. Alaska pollock in N. Pacific heavily exploited.
Shoaling pelagic fish			
Anchovies	Most temperate and sub-tropical areas	21.6	Largest stock off Peru fully exploited and under management. Other stocks, e.g. off California and Argentina generally lightly exploited.
Herring	N. Atlantic N. Pacific	4.0	Most stocks heavily exploited, and some severely depleted. Exploitation of other stocks increasingly rapidly. Some management measures in force, and others being considered.
Sardines, sardinella, etc.	Most temperate and sub-tropical areas	12.0	Heavily exploited in some areas (e.g. S.E. Atlantic); exploitation increasing rapidly in others (e.g. eastern Central Atlantic).
Mackerels, jack mackerels	All temperate and sub-tropical areas	8.9	Heavily exploited in N.E. Atlantic. Exploitation increasing in several other areas.
Saury	Temperate and sub-tropical areas	1.3	Heavily exploited in N.W. Pacific. Exploitation beginning in eastern Pacific.
Capelin	N. Atlantic N.E. Pacific	2.3	Heavily exploited in N.E. Atlantic. Very lightly exploited elsewhere.
Sandeels	N. Atlantic N. Pacific	24	Heavily exploited around Japan and in North Sea; otherwise unexploited.
Crustaceans			
Lobsters, Rock lobsters	Coastal areas of N. Atlantic, Southern Africa, Australasia	0.2	Heavily exploited and under national management in most areas.
Shrimps	Cosmopolitan	1.4	Heavily exploited in many areas. Exploitation increasing rapidly elsewhere.
Crabs	Cosmopolitan	0.7	King crab heavily exploited in N. Pacific. Some other local stocks heavily exploited, but generally exploitation is light.
Molluscs (Other than cephalopods)	Not discussed	See text ...	

Groups of species	Main areas of distribution	Potential harvest (million tons)	State of exploitation
Cephalopods	Cosmolopitan	10+	Heavily exploited in N.W. Pacific and eastern Central Atlantic. Exploitation increasing in some other areas, but generally very light.
Krill	Antarctic	50+	Unexploited, but experimental fishery in progress.
Small pelagic fish	Oceanic	100+	Unexploited. Technology for economic fishery not yet available.

28. It will be seen that many if not most of the stocks of the more valuable types of fish are already, or are becoming heavily exploited. The biggest opportunities for expansion are for animals like krill, or the small pelagic fish in the open oceans, for which suitable technology is only beginning to be developed. Not only is management therefore a worldwide problem, but fewer opportunities now exist to escape the consequences of failure to achieve rational management of one stock by diversion of the excess capacity to other stock still underexploited.

New needs for management

29. None of these additional effects of modern technology would seem to require a complete change in the present procedures of managing and conserving fish stocks. As has often been stressed at various international meetings, the determination of the measures to be used in any particular case will have to be a regional matter, taking into account the peculiarities of the fish stocks in the area, and of the fisheries on them. Because of the movements of individual fish of many species, and of the interaction between fish stocks of different species, it is likely that, to be effective, these regional arrangements should cover a fairly large area, probably comparable in extent with the area of competence of some existing regional bodies, such as the International Commission for the Northwest Atlantic Fisheries (ICNAF). Also because of the interaction between regions, e.g. through movement of long-range fleets from one area to another and the existence of problems of common interest, e.g., the increasing pressures due to new technology, it would be desirable for these questions to be discussed on an inter-regional basis.

30. The most pressing need is to strengthen the present arrangements for management so that effective action can be taken in time. One aspect is the improvement of the supply of information on the stocks and the fishery on which action can be based. This is a matter of the collection of such material as statistics of catches and fishery effort, sizes of fish caught, etc., and the scientific analysis of these and other data. While this work is not in general difficult, nor controversial, it is not at present given sufficient support at the national or international level. For example, at the December 1971 meeting of the International Commission for the Conservation of Atlantic Tunas (ICCAT) any decision as to whether recent catches of yellowfin tuna from the Atlantic have been too high, and thus whether restrictions should be applied, was made difficult, if not impossible, by the lack of accurate information as to the magnitude of the catches in 1970, which in turn was due to shortcomings in certain national statistics. While the benefits from good conservation, or conversely the penalties of not achieving adequate management can amount to a large fraction of the total value of the catch, the amounts generally spent, nationally and internationally, to collect and analyse the basic data, have rarely exceeded a small fraction of one percent of the gross value of the catch.

31. Even when good information is available conservation action has often been slow or inadequate. While the rate of development of fisheries was equally slow the penalties of failure to act have not, in many cases, been too large - though the disappearance of the Californian sardine and the great decline of the whales are examples of the penalties being severe. Modern technology will increase the cost of delaying action, and in fact often make it highly desirable to act before the scientific studies are completely conclusive.

32. One reason for the measures that have been taken being at times inadequate or too late has been the limited authority given to most regional commissions. As is indicated in another document which the Committee requested FAO to prepare (see report on regulatory fishery bodies), participation of States in the work of fishery bodies is entirely voluntary, although there is significant evidence of States' willingness to collaborate in the rational exploitation of common resources. Furthermore, the powers of fishery bodies are usually limited to making recommendations. In some cases, however, a procedure has been evolved whereby recommendations become binding on member countries that do not object to them within a given time-limit. Useful as it may be, this procedure has often led to the adoption of measures corresponding to the lowest common denominator. In addition, regional bodies have in some cases delayed action until the need for it had been proved beyond doubt and the measures recommended had become acceptable to all. In many cases the opposite and cautious approach is necessary, by applying restrictions to the over-rapid expansion of catches until there can be reasonable confidence that further expansion would not cause undue damage to the resource concerned.

33. Suggestions have therefore been made in several quarters, including the Committee itself, that while the mechanisms for taking appropriate action to ensure proper management of the resources are available through the various international fishery bodies, the increased pressure on the resources due to modern technological advances will require strengthening of these bodies. This strengthening applies both to the collection and analysis of the basic data relating to the resources and their exploitation and to the arrangements for considering and implementing specific management measures.

34. At its Sixteenth Session in November 1971, the Conference of FAO agreed that regional arrangements, both within and without the framework of FAO, represented the most viable solution for the rational utilization of fishery resources at the present time and expressed the opinion that their strengthening for greater effectiveness should be of high priority. The Conference also endorsed the views of the FAO's Committee on Fisheries that thay body could play a valuable role in keeping under review the status of utilization of fishery resources throughout the world, identifying areas where management action was needed, assessing the effectiveness of regulatory bodies and promoting action where required. With this in mind, the Conference recommended that the Committee on Fisheries review its ability to discharge all the responsibilities it was likely to be called upon to discharge, including those that might arise from the forthcoming United Nations Conferences on the Human Environment and on the Law of the Sea. The Committee is scheduled to consider this matter at its Seventh Session in Rome from 6 to 13 April 1972.