(Taiwan) and Turkey. Of course, a detailed survey has not yet been made, the possibility of prospects of large deposits of coal in other shelf areas of this region cannot be ruled out.

Probably, beyond the coast of Red Sea, Mediterranean Sea and South Africa, Oil Shales occur in considerable quantities, which could be economically exploited. Besides, important minerals like chromite, platinum, nickel and cobalt have recently been discovered in the sea floor rifts in the Indian Ocean.

2. Surficial deposits

Marine placer deposits like tin, platinum, ilemenite, rutile, zircon, monazite, chromite and iron sand have been abundantly found in beaches and shelf areas, particularly in the coasts of India, Indonesia, Malaysia, Thailand and South Africa.

Gluconite, or "Green Sand" occurs on the outer continental shelf and upper continental slopes of Africa, Japan and the Philippines. Further barite, a barium sulphate mineral, has been found off the coasts of Ceylon and Kai Islands in Indonesia. Recently, another sub-sea surficial deposits, the metalliferous muds associated with saline brines, have been discovered in the Red Sea. These muds contain large quantities of heavy metals such as iron, manganese, zinc, copper, lead, silver and gold.

3. Petroleum resources

A feature of great interest to developing countries is the discovery of petroleum deposits in the adjacent and far off the sea coasts. Recently, the geophysical investigation of the shelf areas of Brunei (Indonesia), Cabinda, Gabon, India, Iran, Japan, Libya, Nigeria and Saudi Arabia have given a convincing proof of the occurrence of potential petroleum deposits. According to an estimation, from the total 52,600 million barrels of proved off shore crude oil reserves,

the Persian Gulf alone contains 43,400 barrels. Besides, Africa has 3,200 and the Far East 1,400 million barrels of petroleum.

A preliminary geological investigation indicates that areas adjacent to large deltas of the great rivers, Indus, Brahmaputra, Ganges, Zambezi and Congo may contain significant petroleum deposits. It is widely speculated that the abyssal floor of enclosed small oceanic basins like Indonesian Archipelago and Sea of Japan may be exploited for economically petroleum potential. Last, but not the least important is the possibility of occurrence of valuable petroleum deposits in the great oceanic basins of Indian Ocean.

4. Marine Phosphorite

Because of the man's limited knowledge no definite progress could be achieved towards the exploitation of enormous phosphorite deposited in the shelf, slope and the ocean floor of the sea. The forms of phosphorite vary from nodules to flat slabs and sand sized pellets.

The continental slope areas off North-West Africa and Equatorial West Africa are rich in phosphorite nodules. Speculation is high that the coasts of Morroco, Guinea, Ghana, and along the coast from the Straits of Gibraltar to Senegal, may also contain huge phospherite deposits. Also, there is a possibility that the shelf areas of large rivers like Niger and Congo may contain large mud deposits which could be economically exploited.

The upper continental slope of the Japanese coast near Tokyo and the area surrounding the submarine banks and ridges of the south-west of Japan may also contain phosphorite deposits. Further, geological investigations indicate that phosphorite may occur in Banda Sea (eastern part of Indonesia), east coast of Viet-Nam, the North Andaman Islands in the Indian Ocean. Finally, it is believed that the shallow waters of Malabar coasts, and the south-east coast

of India contain phosphorite mud banks rich in phosphorite minerals.

5. Potentially, the most important surficial deposit occurring abundantly on the abyssal ocean floor, submarine ridges and sometimes on lower parts of the continental slopes are the manganese nodules. These manganese nodules are of particular importance because they are also the source of many important minerals like copper, cobalt, nickel, molybdneum and zinc. The Indian Ocean is a rich source of the manganese nodules. Besides, the submarine banks of south-east coast of Japan and the sea floor along the Fuji volcanic zone have also large deposits of manganese nodules.

From the above survey it is clear that the prospects of exploitation of marine minerals in the Afro-Asian region is very wide but the knowledge about them is absolutely insufficient. The success will not only depend upon the solution of technical problems, but at the same time legal, political and economic aspects will have to be tackled simultaneously.

(vii) THE WORLD FISH POTENTIAL AND ITS REGULATION[1]

In the last few years there has been significant increase in the production of fish throughout the world. The production of marine fish (including shell fish) has increased from 27 million tons in 1958 to 56 million tons in 1969. According to FAO estimation, the total demand for fish for both human consumption and for animal feed is projected at 74 million tons in 1975 and 107 million tons in 1985.

Improvements and innovations in fishing equipment and methods, in fish handling and processing, and development of new products and markets since the first United Nations Conference on the Law of the Sea have brought additional fishery resources within the range of commercial exploitation and indeed have led to important cost reductions.

Rapid technological progress has taken place particularly in the field of fish location and the use of sonar in purse seining and aimed trawling. The adoption of a number of new fishing gear and gear handling techniques, such as mid-water trawls, mechanised devices for net handling and fish pump have resulted in increased catches. The generalised use of synthetic fibres for net construction has also had a significant impact on the development of fisheries. New freezing and processing techniques make it possible to handle and store fish on board, so that a large fleet of freezer and factory trawlers has been built and equipped to operate any where in the world. Other characteristics of the long-range fishery are mother ship operations, with one large factory vessel supported by a number of smaller catchers and a

1. Extracts from a F.A.O. Publication entitled *The State of World Fisheries*, (Rome ; 1968).

worldwide net work of fishing ports for unloading, bunkering, repair, or exchange of crews. In the wake of these significant technological developments, the traditional small scale fisheries has also been 'modernized'. The use of synthetic fibre, the mechanisation of small craft and the use of glass fibre and ferro-cement as hull material has been highly successful in yielding greater catch.

The obvious result of these new developments has been that fishing has become transformed from a harvest to a mining process. But, unlike mineral resources, marine living resources are being produced constantly depending upon the geographical location and other natural conditions.

Last but not the least important matter in this connection, is the gulf that has been created between the developed and developing countries, particularly with respect to fishing activities. Of course, fisheries beyond national jurisdiction are open to all, but few large maritime States have taken undue advantages and exploited the interests of developing constal States. These maritime States have hardly shown any keen interest in turning control of such fisheries over to any international body. The bilateral and regional agreements concluded by these States resulted only in a limited achievement. However, a significant step was taken in 1958, when the United Nations convened a world-wide Conference on the Law of the Sea.

The 1958 Conference adopted several international instruments, including a Convention on Fishing and Conservation of the Living Resources of the High Seas. The Convention, which came into force in 1966 for those who signed and ratified it, was the first attempt to deal with the problem on a world scale. Its scope is limited and it aims mainly at promoting the adoption of conservation measures and providing for machinery to facilitate the settlement of disputes. It also contains provisions stressing the special

interests of coastal States in the maintenance of the productivity of the living resources in any area of the high seas adjacent to their territorial sea and their right to take part on an equal footing in any system of research and regulation for the conservation of the living resources in that area, even though their nationals do not fish there.

The 1958 Conference fully realized that the Convention would have to be supplemented by special and regional agreements. It adopted a resolution recommending that the States concerned should cooperate in establishing the necessary conservation measures through international conservation bodies covering particular areas of the high seas or particular species of living marine resources. It also recommended that these bodies should be used as far as practicable for the conduct of negotiations on conservation measures envisaged in the Convention, for the settlement of disputes and for the implementation of agreed conservation measures. In the resolution the Conference specifically referred to the report of the 1955 International Technical Conference on the Conservation of the Living Resources of the Sea, convened at Rome to make appropriate scientific and technical recommendations in preparation for the 1958 Conference on the Law of the Sea. The 1955 Technical Conference had come to the conclusion that the system of international fishery regulation based on the geographical and biological distribution of marine populations seemed in general to be the most suitable way of handling these problems. This system was based upon conventions signed by the nations concerned.

Specialised fishery bodies

Although the International Council for the Exploration of the Sea (ICES) was formed as early as 1902, most of the existing fishery bodies were established after the second world war. Five of these were set up under the auspices of FAO, the rest as independent convention bodies.

The membership, area and scope of responsibility and main measures adopted by the various commissions have been set out in FAO reports. Most of these commissions issue extensive reports which outline not only the progress made in introducing various regulations, but also the results of the scientific research on which the regulations are based.

Certain fishery bodies were established to cover a particular sea or specified lake or river systems, for example the Joint Commission for Black Sea Fisheries and the Great Lakes Fishery Commission (GLFC). Others were set up to serve a region of the high seas which is precisely delineated by longitude and latitude, for example the International Commission for the North-west Atlantic Fisheries (ICNAF) and the North-East Atlantic Fisheries Commission (NEAFC). The area of competence of many fishery bodies, however, is defined only in general terms, for example the eastern Pacific Ocean for the Inter-American Tropical Tuna Commission (IATTC) and the Indo-Pacific area for the Indo-Pacific Fisheries Council (IPFC). Most conventions setting up international fishery bodies include in their area of competence the territorial sea of member countries. The majority of international fishery bodies were set up to deal with sea fisheries. Practically all the marine waters are covered, in certain regions several times over. This should not, however, lead to the conclusion that all living resources of the sea are the object of scientific investigation and management measures. In fact the composition, species coverage, functions, powers and activities of international fishery bodies vary considerably.

The effectiveness of these bodies depends to a great extent on the participation and collaboration of all the States concerned. Such States would normally include not only those whose nationals and vessels fish in the geographic area served by the fisheries commission or council, but also the coastal States in the area. The provisions of the basic instruments concerning eligibility for membership do not always make it possible for all these States to participate.

In several cases the fishery bodies are as it were land-based, since only States whose territories are situated in the area of competence may become members. These include the Regional Fisheries Advisory Commission for the South-west Atlantic (CARPAS) and the Regional Fisheries Commission for Western Africa (WAF), both set up under the aegis of FAO. A certain number of conventions do not provide expressly or implicitly for the possibility of later accesions, but this should not necessarily be interpreted as excluding the acceptance of new members. Several conventions provide that under certain conditions membership of the fishery body is open to States other than the coastal States in the area of competence or to States other than original members. Thus, any States whose nationals participate in fisheries in the area of competence of IATTC may become members of the commission with the unanimous consent of the contracting parties. A few commissions are open to any States which adhere to the basic instrument simply by addressing the required notification to the depository government. They include ICNAF, the International Whaling Commission (IWC), and NEAFC.

Many international fishery commissions and councils were set up to deal with all fishery resources within their area of competence. Notable exceptions are the International Whaling Commission, the North Pacific Fur Seal Commission, the International Pacific Halibut Commission, the Inter-American Tropical Tuna Commission, and the International Pacific Salmon Fisheries Commission.

There are in practice marked differences in the manner in which fishery bodies deal with any particular stock of fish. This depends to a great extent on the functions of the body concerned. These may be divided into three

categories :

1. Fishery bodies which deal mainly with the encouragement, promotion, and co-ordination of research and which, in the course of their activities, may offer advice and make recommendations on the need for conservation measures. Examples of this type of body are the International Council for the Exploration of the Sea, the International Commission for the Scientific Exploration of the Mediterranean Sea (CIESMM), and the commissions and councils set up under the Constitution of FAO.

2. Fishery bodies whose main function is to formulate conservation measures on the basis of scientific research, this research not normally being carried out by their own staffs (e.g., the International North Pacific Fisheries Commission, the Joint Commission for Black Sea Fisheries, the North-East Atlantic Fisheries Commission). The last of these bodies receives its scientific advice from the International Council for the Exploration of the Sea, included in the first category.

3. Fishery commissions which formulate conservation measures on the basis of scientific investigations carried out by their own staff. They include the Inter-American Tropical Tuna Commission, the International Pacific Salmon Fisheries Commission, and the International Pacific Halibut Commission.

Conventions do not always specify the type of conservation and management measures that may be formulated by the international fishery bodies they establish. Detailed listing of conservation measures shows that these are normally confined mainly to prohibitions and limitations : these include most of the measures listed at the beginning of

the previous section—open and closed seasons or areas, minimum sizes of mesh of fishing nets, size limits of fish and regulation of the use of certain types of fishing gear, appliances and equipment. In a few cases, such as the International Commission for the North-west Atlantic Fisheries, the International Whaling Commission, and the International Pacific Halibut Commission, conservation measures expressly provide for prescribing a maximum or overall catch limit. Few commissions expressly include limitation of effort, and the North-East Atlantic Fisheries Commission places limitation of effort (and catch) in a separate, inactive, category of regulations which can only be actively considered after a specific recommendation to this effect has been passed by the commission.

Very few conventions list specific measures of a positive nature. An exception is the convention setting up NEAFC which provides that the commission may elaborate measures for the improvement and increase of marine resources which may include artificial propagation, and the transplantation of organisms and of young.

In most cases member countries are not under a legal obligation to comply with the conservation and management measures formulated by fishery bodies. The power of the majority of existing commissions is limited to making recommendations, either because the convention concerned expressly so provides or because conservation measures have to be approved by member countries before they can be applied.

In a few cases a procedure has been evolved to facilitate acceptance of the measures formulated by commissions. These measures may be called potentially binding recommendations or conditional decisions. Thus NEAFC may recommend a number of conservation measures and member countries undertake to give effect to any such recommendation adopted by not less than a two-thirds majority of the

delegations present and voting. However, any member country may object to the recommendation within a specified period, in which case it is under no obligation to give effect to it. Other member countries may then similarly object within an additional period. If three or more member countries so object, all member countries are relieved of the obligation to comply with it. A somewhat similar procedure exists with respect to the measures formulated by the International Whaling Commission.

When conservation measures are binding on member countries, each country is required to ensure their application on the high seas by its own nationals and vessels. There is, however, a trend toward a certain measure of international control. In fact, several conventions establishing fishery bodies (e.g., the International Pacific Salmon Fisheries Commission, the International North Pacific Fisheries Commission, the International Pacific Halibut Commission, the Japanese-Soviet Fisheries Commission for the North-West Pacific, and the North Pacific Fur Seal Commission) grant to each member country the right to check the general application of conservation measures on the high seas by the contracting parties. With certain differences of detail, they prescribe a procedure whereby duly authorised officials of any member country may search and seize vessels of other member countries which are acting in violation of the convention or of regulations adopted under it. Such vessels must be delivered as promptly as practicable to the authorised officials of the member country having jurisdiction over them. Only the authorities of that country may conduct prosecutions and impose penalties.

Though these commissions with international control measures at present in operation have limited membership (a maximum of four countries), efforts to ensure international control are not restricted to commissions with a small membership or a limited species coverage. The Convention for the Regulation of Whaling was amended to enable the

International Whaling Commission to deal with methods of inspection and an international observer scheme has been devised but it has not yet proved possible to bring it into operation. Both the International Commission for the Northwest Atlantic Fisheries and the North-East Atlantic Fisheries Commission have also concerned themselves recently with the international enforcement of regulations in their area of competence and have this under active consideration. ICNAF arranged the exchange of inspection visits by enforcement officers of various member countries; NEAFC set up in 1964 a Special Committee on International Control which is studying the possibility of introducing a system of international inspection on the high seas in the near future.

Several conventions contain certain provisions on the manner in which the yield from the resources is to be apportioned among member countries. The convention setting up the International Pacific Salmon Fisheries Commission lays down the principle that the two member countries (Canada and the United States) should share equally in the fishery, and consequently one of the tasks of the Commission is to regulate the fishery with a view to allowing, as nearly as is practicable, an equal portion of the fish that may be caught each year to be taken by the fishermen of each member country.

The convention establishing the North Pacific Fur Seal Commission, which has four member countries, provides for a system of quotas to ensure the distribution of the resources which migrate between the territory of certain member countries and the high seas. As all member countries agree to restrict killing of fur seals to the home islands and to prohibit sealing on the high seas in the Pacific Ocean north of 30° N. Lat. a portion of the total yield is granted to those member countries which do not own any islands on which the seals breed and which otherwise would have no share in the fishery as a result of their agreement not to engage in sealing on the high seas. Of the total number of sealskins taken commerci-

ally each season on land, both the United States and the U.S.S.R. deliver to Canada and Japan 15 percent each of the gross take in number and value.

The convention setting up the International North Pacific Fisheries Commission also contains provisions on the subject, as it embodies rules laying down what is known as the principle of abstention. According to this principle, States not fishing a specific stock in recent years are required to abstain from fishing this resource when States participating in the fisheries have created, built up, or restored the resource through the expenditure of time, effort and money on research and management, and through restraints on their own fishermen. It should, however, be scientifically established that the continuing and increasing productivity of the resource is the result of and dependent on such action by the participating States, and that the resource is so fully utilized that an increase in the amount of fishing would not result in any substantial increase in the sustainable yield.

Most conventions do not prescribe how the yield from the resource should be allocated. International fishery bodies have thus to face this problem at the time of fixing the maximum catch to be taken.

For example, every year since 1961 the Inter-American Tropical Tuna Commission has recommended the establishment of a total catch limit on yellowfin tuna in a specified area of the eastern Pacific and the cessation of fishing operations when the quantity landed plus the expected landings of vessels at sea reach an amount slightly less than the total catch permitted. Under this system, fishing countries can freely compete for a maximum share within the total limit set by the commission. This requires of course not only the agreement of member countries but also the co-operation of other countries fishing in the area. As certain countries would prefer to be allotted a national quota, efforts are being made to reach a solution.

Antarctic whaling may be cited as an example of a shift from the principle of free competition within an overall catch limit to the adoption of national quotas. While for many years the expeditions from the Antarctic whaling countries took part in what were known "whaling olympics," in an effort to maximize their share of the total quota set by the commission the countries started negotiations in 1958 with a view to agreeing on national quotas. An instrument was signed in 1962 for a four-year period. The overall limits are fixed by the International Whaling Commission, but the arrangements on the distribution of the total catch are made by the countries concerned.

The general problem of allocation of yield from the resources of the sea was considered to some extent by the 1955 International Technical Conference on the Conservation of the Living Resources of the Sea and to a greater degree by the 1958 United Nations Conference on the Law of the Sea. Discussions at the 1958 conference centered on the principle of abstention and on the concept of a preferential share for coastal States. No specific provision pertaining to the apportionment of the yield from the resources was included in the Convention on Fishing and Conservation of the Living Resources of the High Seas. However, the conference adopted a resolution on the special situation of countries or territories whose people are overwhelmingly dependent upon coastal fisheries.

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(VIII) SUMMARY OF THE REPORT OF THE CONSULTATION ON THE CONSERVATION OF FISHERY RESOURCES AND THE CONTROL OF FISHING IN AFRICA[1]

Prepared by
the A.A.L.C.C. Secretariat

At the invitation of the Government of the Kingdom of Morocco, the FAO convened a 'consultation on the conservation of fishery resources and the control of fishing in Africa'. The consultation was held in the capital city of Casablanca, from 20th to 26th May 1971. The participating countries were : Burundi, Congo (Brazzaville), Ghana, Ivory Coast, Liberia, Senegal and Sierra Leone. A detailed information on the nature, abundance and distribution of the fishery resources around Africa, and on the present status of exploitation and utilization of these resources was presented to the Meeting by the FAO Secretariat.[2]

Status and Utilization of Resources

Since the width of the continental shelf of the eastern coast of Africa is narrower than the western coast, the extent of fishing grounds around Africa also varies accordingly. In the shallow waters of the continental shelf demersal fish and other important pelagic stocks (except tuna) are widely distributed. Off the coast of Somalia and the desert area of the western Sahara and Namibia, the fish stocks consist of temperate and sub-tropical species of a high commercial value like sardine, sardineela, horse mackerel, hake and sea breams. On the other hand, the Mediterranean—off the coast of East Africa, and parts of tropical West Africa

1. This Summary has been prepared from the FAO Fisheries Reports, No. 101, Vol. 1, published in June 1971.
2. See Document FID : CFRA/71/4.

contain the species of tropical stocks of a much larger variety among which sardinella is the most important.

The production of fish stocks also varies from the east to west coast. The areas off the coast of north-western and south-western Africa are among the most productive in the world. On the other hand, the productivity in some parts of the tropical West Africa and the Mediterranean coast is rather low.[1]

Traditionally, African fisheries are carried out with canoes scattered over vast geographical areas with primitive supporting facilities. The gear used from canoes are handlines, longlines, gillnets and seines, etc. Fishermen engaged in such subsistence or artisanal fisheries far outnumber those conducting industrialized fisheries. Although motorization has improved the efficiency of canoes, their productivity is limited because of their inability to use more effective gear. The techniques used for processing and conservation of fish, as well as the infrastructure for the distribution of fish, hamper the development of these fisheries.

Several countries, in particular those having large fishery resources off their coasts or those which have large populations, have during the last two decades, developed industrialized fleets of medium-sized trawlers, seiners, and more recently shrimpers. The development of these fleets is hampered by lack of skilled crews and officers, and of cheap and productive techniques for processing and conservation of fish, and by inadequate port facilities and distribution networks. Most of these fleets exploit the inshore pelagic and demersal stocks. Navigation is mostly carried out by

1. According to the latest statistics, the production in the west coast was 5.4 million tons (3.4 million south and 2 million tons north of the Congo river). Further, 3,00,000 tons were produced from the east coast and 100,000 tons along the Mediterranean coast of Africa. Nearly 60% of this catch were taken away by the non-African countries from Europe, America and Asia.

land bearings and fish-finding equipment is limited to echo sounders.

A few African countries have developed long-range fishing fleets, for instance Ghana with large stern trawlers and Senegal and Ivory Cost with large and medium-sized tuna seiners. The effect of these fisheries on the stocks has been the subject of a number of scientific studies, particularly by scientists in some individual countries along the African west coast and by international groups convened by regional fishery bodies or by FAO such as the CECAF Working Party on Regulatory Measures for Demersal Stocks.

These studies have determined that various stocks of fish off Africa are being heavily fished. The catches from some of these can only be increased by appropriate conservation measures, such as a regulation of mesh size, or a limitation of the amount of fishing. Most of these stocks, however, can still give an increase in catch from increased fishing, although this would involve a reduction in the catch-per-unit effort.

The heavily fished stocks include many of the major stocks in the upwelling zones off West Africa, as well as some of the more limited stocks in the tropical zone. In the Indian Ocean where, except for tuna and shrimp in some areas, no large-scale fishery has developed yet, there are opportunities for a substantial relative increase above the present low level of total catch, but in absolute terms the increase in catch is not likely to be very large with the exception of resources off Somalia. In the other areas where the resources are limited, e.g. the Mediterranean Sea and in the tropical zone off the west coast of Africa, any increase in catch would also be small in absolute terms and in these areas many of the more productive stocks are already heavily fished. Catches can be increased mainly by fishing less productive and presently under-utilized stocks (e.g. the off shore demersal stocks in the tropical zones of West Africa). There could be also a better utilization of the

various small-sized species which are important elements of the biomass in tropical zones. Aquaculture can also be expected to grow considerably in the coming years, provided aquatic pollution is kept under control.

There are also great opportunities for making more effective use, especially for the benefit of African countries, of the present volume of catches. For example, large quantities of pelagic fish are used for fish meal, by both factory vessels and in coastal countries where the existing markets for fresh or canned fish cannot use all the quantities produced.

Fresh fish marketing plays an important role in African coastal districts but poor collection and distribution systems, small-scale operations and inadequate handling and preservation techniques limit the possible expansion under present conditions. Of the catch of African countries destined for human consumption generally more than 50 percent is smoked, salted, dried or processed by a combination of these methods. Smoked or sub-dried products are being increasingly employed. Industrial methods of fish preservation absorb only limited quantities of fish for the home market. Freezing and canning facilities, available in a number countries, have been primarily set up to serve export markets in developed countries, particularly frozen tuna for further processing, canned tuna, canned sardine, frozen shrimp and high valued ground fish species. Fish meal for export plays a significant role in the utilization of landings in three coastal countries.

There is substantial intra-regional trade in cured fish, provided both by countries with important freshwater fisheries such as Chad, Mali, Niger, Tanzania and Uganda, and by some other African countries with large marine resources. But, unless the products are upgraded and diversified, the freshwater fisheries may in the long run be affected by the increasing supplies from marine fisheries.