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India Government Report of the fish

Title

Sub-Committee

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GOVERNMENT OF INDIA
DEPARTMENT OF EDUCATION, HEALTH AND LANDS

REPORT
OF THE
FISH SUB-COMMITTEE
OF
POLICY COMMITTEE No. 5
ON
**AGRICULTURE, FORESTRY AND
FISHERIES**



PUBLISHED BY THE MANAGER OF PUBLICATIONS, DELHI,
PRINTED BY THE MANAGER, GOVERNMENT OF INDIA PRESS, NEW DELHI,
1945

Price As. 5 or 6d.

REPORT OF THE FISHERIES SUB-COMMITTEE

I. Introduction

1. The Policy Committee on Agriculture, Forestry and Fisheries in its 2nd meeting held at Simla from June 26th—30th 1944 recommended that a Sub-Committee on Fisheries be appointed to suggest within three months how the production of fish in India may be increased [Resolution No. V(vi)].

2. The Sub-Committee with the following personnel was constituted on 29th August 1944:—

- (1) Mr. Fazal I. Rahimtoola, C.I.E., *Chairman*.
- (2) The Hon. Nawabzada Khurshaid Ali Khan, M.B.E.
- (3) The Director of Industries and Commerce, Madras.
- (4) Mr. A. Karamally.
- (5) Mr. B. K. Dubash.
- (6) Mr. Jyotish Chandra Biswas.
- (7) Pir Muhammad Haji Juman.
- (8) Dr. C. C. John.
- (9) Mr. S. Najmul Hasan, M.L.A.
- (10) Dr. Bains Prasad, O.B.E., *Member Secretary*.

3. The very difficult nature of the task which was assigned to the Sub-Committee and which had to be accomplished in a short time under great limitations would be clear from the following brief review of the present position of the Fisheries and the Fish Trade in India:—

The view of the Interim Commission of the United Nations Conference on Food and Agriculture that "Few, if any, types of food production yield returns as quickly as does fishing" while essentially correct is not universally applicable. In India, for example, the intensive development of its fishery resources as a short term project is beset with numerous difficulties. Neither any detailed surveys of the Inland Fisheries are available, nor has anything like Close's Fishing Chart of the North Sea been prepared for the marine fishing areas in the Arabian Sea and the Bay of Bengal. Added to this there is the almost complete absence of essential biological data in regard to all classes of fish and fisheries of the country which must form the basis of all planning for their development along proper lines. While inland fisheries, which are the easiest to exploit, have been and continue to be overfished, marine fisheries are hardly touched. Fisheries of India are not localized: the inland fisheries are spread through the length and breadth of the country, while the marine fishing centres are scattered all along the extensive coast-line. In view of the very limited communication facilities by road, rail and boats, quick transport and distribution of catches from the fishing to the consuming centres present serious obstacles. The fishermen on whom naturally the prosperity and development of the fisheries of a country depend are, in general, highly ignorant, conservative, miserably poor and chronically indebted. They possess neither the energy and initiative nor the means for the development of fisheries. The boats and nets used for fishing have undergone practically no change with the passage of time. The fish trade in the country is very ill-organized. The methods of handling, packing, transport and marketing are extremely primitive and highly wasteful, and in spite of the great limitations resulting from the very perishable nature of fish and the exigencies of climate, neither sufficient supplies of ice nor cold storage facilities are available for the storage of fish for any length of time in a state fit for human consumption. Some 50—60 per cent of the marine fish supplies, which cannot be consumed in the fresh state, are processed by drying, salting, smoking etc., but the methods used are generally very unhygienic and wasteful, and the products far from satisfactory. Fisheries being a transferred subject, the Central Government had until very recently not taken any share in their development. The Fishery Departments of most Provinces and States, where they exist, are a comparatively recent creation. They are all very inadequately staffed and scarcely any expert technical personnel, and research and experimental stations so essential for

the development of the fishery resources—are available. There are also no institutions in the country for the training of the fisheries technical staff. Starting from scratch great efforts have therefore to be made in the near future if fisheries of India are to be properly developed for supplying the food requirements of the large population of this vast sub-continent.

4. In view of the great urgency of the problem and the limited time available, the Sub-Committee in its first meeting at Bombay from October 4th—7th, 1944, decided to

(i) send out a Questionnaire (Annexure 1) to all Provincial Governments and States and various interests of the Fish Industry for eliciting information.

(ii) conduct such urgent enquiries as were essential by visiting important fishing centres, markets, cold storages, fish-landing sites, transport arrangements, boat-building facilities and Fish Curing Yards etc., in a few selected centres, and

(iii) invite such oral and written evidence as may be able to supplement the information available in official records and reports.

5. The Sub-Committee held 2 meetings at Bombay during October and November 1944, and one meeting at New Delhi in January 1945. It examined some 30 witnesses, and visited a number of fishing centres and fish curing yards in the Bombay Presidency, while the Chairman with Mr. A. Karamally and Mr. B. K. Dubash visited some additional fishing and assembly centres, and the salt works at Uran.

6. In all 28 replies to our Questionnaire were received. These included replies from the Governments of Ajmer-Merwara, Assam, Baluchistan, Bengal, Bombay, Central Provinces and Berar, Coorg, Madras, North-West Frontier Province, Punjab, Sind and the United Provinces, and the States of Baroda, Mysore and Travancore, prepared by the Fisheries Departments of the areas concerned. The Madras Government circulated the Questionnaire to 21 commercial organizations, merchants and others interested in the Fish Trade, and 9 replies were received from the following:—

- (1) Sri C. S. Krishnaswami Naidu, Chaliyam.
 - (2) The Secretary, Vivekudayam Reading Room and Library, Calicut.
 - (3) Rao Sahib M. A. Abbavi Nayudu, Vice President, District Board, Nellore.
 - (4) Mr. Kunhi Mahamad Sahib, Tanur.
 - (5) Mr. C. Madhavan Cannmore, Secretary, Threwani Dharmeparipalana Aryan Samajem, Tellicherry.
 - (6) Mr. F. A. Rahman and 8 others of Malpe.
 - (7) Sri K. Narain Das, Mangalore.
 - (8) Manager, Godavari Fisheries Corporation, Rajahmundry.
 - (9) Secretary, Parvatha Rajakula Fishermen's Cooperative Society, Tanjore.
- From Bengal non-official replies were received from Mr. Jyotish Chandra Biswas, Calcutta, a member of the Sub-Committee, the Goalundo Ice Distribution and Fish Despatch Committee, Goalundo, and the Kolay Market Fish Dealers Association, Calcutta. The only non-official body from Bombay which sent a detailed reply to the Questionnaire and supplemented it with oral evidence was the Bombay Muslim Chamber of Commerce.

7. The replies received are unfortunately neither all sufficiently detailed nor do they in several cases conform to the plan of the Questionnaire. All the same they have provided valuable up-to-date data in regard to several aspects of the fishing industry in the country. The Chairman and the members of the Sub-Committee would like to record their indebtedness to all who have collected and supplied the necessary information at such short notice.

8. We have also found the Report on the Marketing of Fish in India compiled in 1941 (still in manuscript) of great help in connection with our work,

and, in the absence of other statistical details and information about the fish and fisheries of the country, have freely drawn on it for necessary facts and figures.

9. While we are fully conscious of the incomplete nature of our Report as also of the abstract rather than concrete character of our recommendations, it must be emphasized that considering the vast nature of the problem, the lack of reliable up-to-date information, the short time available for the collection of necessary data and the preparation of the Report, and the limitations and handicaps under which our work had to be carried out, it was not possible to deal with the situation in any other way. We have tried to restrict our enquiry and recommendations to major aspects of the industry and to suggest ways and means which, with the available resources and limitations due to the war-time conditions, would help in increasing supplies of fish and make it possible to utilize to the full all catches of fish throughout the country. All such measures, however, are of the nature of emergency projects and cannot solve the problem of the minimum fish supplies required for some 200 millions of India's fish-eating population. Development of the vast fishery resources and the organization of the fish trade of the country through a carefully drawn up long-term plan alone would provide plentiful and cheap fish supplies of a quality which could stand the rigid tests of hygienic purity so essential for the nutritional requirements of the underfed millions in this country.

10. In connection with the urgency of planning development of the Indian fisheries, we have after careful consideration of the existing conditions and the future potentialities come to the definite conclusion that no real advance is possible unless the Government of India forthwith accept full responsibility for placing the fishing industry of the country as a whole on a firm foundation, and, as has been done by the Governments of almost all European and American countries and even Japan, and provide finance for both direct and indirect assistance essential for this very backward and neglected industry. Direct assistance will have to be in the form of grants of subsidies and bounties for the provision, construction and repair of improved types of crafts and gear, cold-storage facilities for storage and transport of catches and so on; such equipment, it may be added, is normally beyond the capacity of small fishermen and even of large concerns. This policy of direct assistance implies that the Government bears a large part of the cost of the fishing operation till producers are in a position to do so themselves. In Japan where grants are made only to co-operative associations of fishermen the government has generally borne the entire cost of establishing new ventures on a sound footing. In the United Kingdom, during 1917-23, 436 loans of a total of £101,315 were granted to induce fishermen to instal motor power in their boats. While a sum of £65,000 out of these loans was recovered, an amount of nearly £36,000 had to be written off as a subsidy. Similar grants are made by Canada, Germany and other countries. Cold storage equipment has been subsidised on a large scale in Canada, Norway and Japan, while grants for the repair and replacement of fishing vessels have been made in Germany, New Foundland and Japan. Indirect assistance consists in the grant of preferential rates of transport for fish and fish products, the development and promotion of internal markets, subsidizing exports for foreign markets, development of additional and the improvement of existing harbours by the construction and repair of breakwaters, improvement of landing facilities, provision of motor winches for facilitating the beaching of boats and other cognate activities. Loans in connection with such activities are granted to fishermen from public funds in Canada, France, Germany, the Irish Free State, United Kingdom, Italy, Norway and Portugal. In other cases governments instead of directly advancing money to the fishermen guarantee loans raised from private sources; this has been the case in the United Kingdom, Canada and Norway. In England and Wales, for example, many small fishery harbours received assistance from the Development Fund

which was established under the Development and Roads Improvement Funds Act of 1909. From 1919-1931 this Fund gave grants amounting to nearly £97,000 and advanced loans of about £20,000. In addition in 1932 the Committee on the Fishing Industry appointed by the Economic Advisory Council recommended that the "Development Commission should carry through as speedily as possible, in consultation with the English and Scottish Fishery Departments, a general survey of the problems of the inshore fishing ports" in reference not only to the ports but also of the economic position of the fishermen by whom they are used. In Scotland from 1922-32 grants amounting to £215,100 and loans amounting to £92,500 were sanctioned from the Development Fund for the assistance of Scottish harbours. In connection with the dislocation caused in the Herring industry as a result of the World War of 1914-18 and the great fall in the price in the home markets, the British Exchequer granted a subvention of the amount of £1,700,000 for stabilising the prices. Japan's annual budget in connection with the promotion and development of its fisheries has been stated to be in the neighbourhood of 60 lakhs of rupees, while that of Canada at 45 lakhs.

We have cited above examples of the expenditure incurred from public funds for the development of fisheries in countries with already well developed and organized industries so as to bring out in bold relief the urgent needs of the highly backward and undeveloped fishing industry of India.

The Facilities and Administrative Services provided by large and adequately staffed departments of fisheries in most European and American countries in connection with the development, improvement and conservation of fisheries and the development of fishery industries are dealt with later on under research and experimental work, handling, transport and marketing facilities, and improving the condition of fishermen.

II. Present Position of Indian Fisheries

11. As a source of food Fisheries stand almost on a par with Agriculture and Animal Husbandry. It may, therefore, appear to be a truism to stress the importance of fish as a valuable item of diet, but in view of the relatively small attention so far paid to the conservation and development of fisheries in India there can be no question that its significance as an important constituent in the dietary of the people of India has not been adequately realized. This is a matter of grave concern, particularly as the food of relatively large percentage* of the population, who subsist on cereals including tapioca, is very unbalanced; it is deficient in proteins or body building materials, vitamins, mineral substances and assimilable fats. Most of these constituents are available in varying proportions in different species of fish, but as a result of the undeveloped fishery resources of the country the available supplies of fish are quite inadequate to meet the demands of the rapidly increasing population. Within recent years the demand for fish has increased very considerably in almost all parts of the country. This is specially so in the large manufacturing areas and larger cities where there has been a great influx of labour, and population has increased at a very rapid rate. In addition there is an ever growing demand from the large numbers of fighting forces stationed in various parts of the country. Unfortunately no detailed statistics of the increased demand are available but information received from various parts of the country clearly indicates that supplies are quite inadequate for meeting the demand. According to an Enquiry on the Marketing of Fish in India completed in 1941 the *per capita* consumption of fish and fish products in India as a whole was 3.4 lbs. per annum. The following comparative figures of the *per capita* annual consumption of fish in other countries as given in the *Final Report of the Mixed Committee of the League of*

* In the 1931 population figure of 340 millions Dr. Radhakamal Mukherjee estimates that rice-eating people number 240 millions.

Nations on the Relation of Nutrition to Health, Agriculture and Economic Policy (Geneva, 1931) are of interest in this connection: United Kingdom 40 lbs., United States of America 15 lbs., Germany 18.22 lbs., France 18 lbs., Italy 11 lbs., Switzerland 6.6 lbs., Denmark 24 lbs. In the absence of adequate statistical material these comparative figures have only to be taken as illustrative rather than exhaustive, and it has further to be remembered that in all these countries large quantities of animal products in the form of all meats (United Kingdom 63.7 kg. U. S. A. 61.2 kg.) eggs (United Kingdom 172, U. S. A. 252), Butter (United Kingdom 11.4 kg.) U. S. A. 7.8 kg.) and Cheese (United Kingdom 4.3 kg. U. S. A. 2.1 kg.) are also consumed. For comparison no detailed statistics for India are available but Dr. Radhakamal Mukherjee's statement that in India meat is eaten by solvent cultivators only once a month or less often reflects more or less correctly the position for the large rural population of the country. As the major part of the fish production of India is consumed in the country, the low *per capita* consumption is a clear index of the country's very limited fish production. As a result of the Marketing Enquiry and the replies received to our Questionnaire it can be concluded that while wide fluctuations occur in the total production of sea fish from year to year very little progress has been made, within recent years for the proper development and exploitation of the marine fisheries, and that in the case of freshwater fisheries the annual catches have progressively declined.

12. The annual production of fish in India and the prices realized were estimated by the Marketing Enquiry referred to above as follows:—

	Quantity (in lakhs of maunds)	Value (in lakhs of rupees)
Freshwater fish (excluding fish caught by non-professional fishermen)	62.6	742.3
Sea fish (including fish caught in estuaries and backwaters)	116.7	302.7
Total	179.3	1,045.0

Dr. Radhakamal Mukerjee's estimate in 1938 of 700,000 tons as the annual yield of fish of India is roughly 60,000 tons higher than the estimate of the Marketing Enquiry.

In the Memorandum on Agricultural Development in India prepared for the Imperial Council of Agricultural Research the total requirements of the country for a balanced diet in respect of meat, fish and eggs computed on a minimum allowance of 2.3 ounces per day for each adult were estimated at 6.9 million tons, while only 1.5 million tons were reported to be available at present. In view of what has been stated above, we consider this estimate much too low and are inclined to adopt the estimate of the late Sir K. G. Gupta of 1 maund on the basis of 2 chhatacks per day, as the minimum annual requirement of each adult. On this basis and taking the fish-eating population of India as 50 per cent of a total of roughly 389 millions, as it was estimated for 1941, the minimum annual production of fish should be at least 200 million maunds. This means that fish production of the country should be increased at least 10-11 times of its present figure.

While the annual yield of sea fish in India is almost double that of the freshwater fish, the value of the latter is about two-and-a-half times that of the former. Sea fish does not fetch as high a price as freshwater fish, firstly owing to the very limited facilities for rapid transport of catches to consuming centres which are generally situated at long distances from fishing areas along the sea coast, and secondly because supplies of sea fish in the catching and the assembly centres are very irregular and generally much larger than can be consumed in the fresh state.

13. Details of the supplies of freshwater fish for different areas were estimated as follows:—

Province/State	Production (in thousands of maunds)	Estimated value (in lakhs of rupees)
<i>British India</i>		
Assam	721·6	46·22
Bengal	3,133·2	432·92
Bihar	959·5	95·99
Bombay	81·0	9·82
Central Provinces and Berar	156·0	16·28
Coorg	0·1	0·02
Delhi	5·6	0·80
Madras	187·0	13·96
North West Frontier Province	1·5	0·24
Orissa	326·0	34·92
Punjab	25·0	3·99
Sind	266·5	38·56
United Provinces	147·0	22·77
Total Provinces	6,010·0	716·49
<i>Indian States</i>		
Baroda	9·8	1·99
Cochin	15·5	0·83
Gwalior	8·1	1·25
Hyderabad	20·0	2·17
Jammu and Kashmir	17·8	2·88
Mysore	10·3	1·55
Travancore	74·8	4·01
Other States	92·6	11·16
Total States	248·9	25·84
Total India	6,258·9	742·33

14. According to the same Report the estimated production and value of sea and estuarine fish were as follows:—

	Production (in thousands of maunds)	Estimated value (in lakhs of rupees)
1. Baluchistan	92·6	5·0
2. Sind Coast	197·6	10·6
3. Western India States	99·8	5·4
4. Bombay Coast	1,361·1	73·0
5. Madras Coast	7,882·6	163·0
6. Orissa Coast	303·3	11·1
7. Bengal Coast	1,729·0	34·6
	11,666·2	302·7

No later statistics of fish production are available, and it is not, therefore, possible to assess the exact position of supplies at present.

15. As a result of the war there has been, in general with other articles, a great rise in the price of fish; according to the reports received it has been as much as 800 per cent in several cases. But so far as our information goes this increase in prices has not resulted in any marked increase in production. On the other hand, as a result of the scarcity of ice required for the preservation of

fish during transport, restrictions in the already limited transport facilities due to the abnormal conditions resulting from the war, and the primitive methods of handling and transport even the available supplies do not in most cases reach the consumers in a condition, which according to the standards laid down in most civilized countries, would be accepted as fit for human consumption.

16. This state of affairs is very unfortunate in view of the fact that the fishery resources of India are not only very extensive and varied, but extremely rich both in regard to the types and numbers of fish of prime edible qualities. In Day's two volumes on Fishes in the *Fauna of British India* series published in 1889, which still continue as the standard work on Indian fishes, 351 genera and 1,418 species of fish are enumerated. 85 new genera and some 200 species consisting mainly of deep-sea forms from the collections made by the Royal Indian Marine Survey Steamer "Investigator" were described by Alcock and his colleagues, while as a result of the work of the officers of the Zoological Survey of India and other zoologists in this country and abroad some 200 new species have been discovered. All these species are not of equal importance. Not more than 200 species of economic value divided into 6 artificial classes are mentioned in the Preliminary Guide to Indian Fish etc. published by the Agricultural Marketing Department of the Government of India in 1941. In addition there are very large and valuable fisheries for prawns in the Gangetic Delta, Chilka Lake, the backwaters and foreshores along the East and West Coasts of Peninsular India and in Kathiawar. The Shell fisheries of India as a source of food, are only of minor importance. It is, therefore, apparent that while India compares very favourably with almost any country in the world in regard to the richness and variety of its piscine fauna, the undeveloped nature of its fisheries alone is responsible for the very limited supplies of fish which are available for its teeming millions.

17. *Fishery Reports, etc.*—The earliest reports on the fish and fisheries of India are Dr. F. Day's two reports "*Freshwater Fish and Fisheries of India and Burma*" and "*Sea Fish and Fisheries of India*" published in 1873. They were the result of detailed enquiries conducted in his capacity as the Inspector-General of Fisheries in India and Burma. In the report on the freshwater fisheries he directed attention to the deleterious effects of irrigation work on fisheries, and the widespread destruction of brood fish and fry through indiscriminate fishing. He urged the provision of fish-ladders in weirs and dams for unrestricted migration of fishes up-and-down stream, and of legislative measures for the conservation and protection of the fisheries in general. With reference to sea fisheries Dr. Day's recommendations were mainly confined to providing on a liberal scale duty-free salt to fishermen for preserving fish under supervision in fish curing yards. His recommendations in reference to the supply of salt were accepted, and after lengthy correspondence with the Provincial Governments an Indian Fisheries Act (Act IV of 1897) was passed. Under this Act the use of dynamite or other explosive substances, and poison, lime or other noxious material for catching or killing fish was totally prohibited, and local Governments were empowered to make rules prohibiting or regulating.

- (a) the erection and use of fixed engines,
- (b) the construction of weirs, and

(c) the dimension and kind of nets to be used and the modes of using them.

Finally they could also prohibit all fishing in specified waters for a period not exceeding two years. No detailed programmes for the conservation and development of fisheries were, however, laid down. A Punjab Fisheries Act was passed in 1914, while the Madras Act II of 1929 and the Travancore Act of 1914 are only slightly amended versions of the Indian Fisheries Act of 1897 to suit the individual Provincial or State needs.

18. *Fishery Departments* were started in a number of Provinces and States within the last 40 years or so. The work of the Provincial Departments has

consisted mainly in administering the Fishery Acts, the management of the fisheries by issuing licenses for fishing, leasing government fisheries etc., collecting and increasing revenue. In the absence of the necessary staff, essential data, research and experimental facilities, they have, with the notable exception of Madras, not been able to serve as efficient agencies for the improvement and development of fisheries, bettering the socio-economic position of the fishermen, organising the fish trade, and above all to conserve and increase the fish supplies in the country. Preliminary enquiries were carried out by a number of Provinces and States in reference to the existing condition and the prospects of developing the fisheries of their respective areas, but these have not been followed by detailed surveys. As a result very little information is available regarding the extent and distribution of the fisheries of various classes, their annual and seasonal yields, quantities of different species of fish caught in each area, numbers of fishermen, nets and boats engaged in the industry, markets, transport and marketing arrangements, economic condition of the fishermen etc. The work of the Fishery Departments in India has also been seriously handicapped by the absence of any machinery for the collection of essential biological, ecological and physiological data which can be obtained only through carefully planned long-term schemes of research and experimental work in properly equipped laboratories, and experimental stations and by detailed studies in the field. Although attempts have been made to solve several major fishery problems by following lines of work which had yielded valuable and even spectacular results in the case of the European and American fisheries, they ended in failure in almost all cases. With the exception of Madras and Travancore, little attention has been paid in the Provinces and States to **urgent technological problems** connected with the development of the fishing industry. Among the more important of these may be mentioned the designing of more efficient, suitable and improved types of crafts and tackle, refrigeration and freezing at various temperatures for preventing deterioration through autolysis and bacterial contamination, methods of drying, salting, smoking, canning etc. for surplus supplies which cannot be consumed in the fresh state, preparation of fish liver and other oils, isinglass, etc. and utilization of waste products, offal etc. as fish meal manure etc.

19. The experimental attempts made by the Governments of Bengal, Bombay and Madras for exploiting by means of trawlers the deep-sea fisheries along their coasts may also be mentioned here. These experiments were undertaken with vessels which unfortunately proved unsuited to conditions in Indian waters, while trained crew and fishermen for work on these fishing trawlers were not available in the country. Paucity of data regarding the location and extent of the fishing grounds, their suitability or otherwise for trawling, the distribution, prevalence and migrations of various species of fish of economic importance, and other essential biological and hydrographic factors seriously handicapped the work of these trawlers, while the provision of refrigeration facilities on board the vessels, and of carrier launches for taking catches to the shore, the absence of landing facilities and cold storage at ports, limited facilities for transport of fish to inland centres, the undeveloped nature of the markets which could not absorb large but irregular supplies of a highly perishable commodity raised problems for which no solution could be readily found. In view of the **heavy expenditure** involved and of the slender prospect of their proving a commercial success in the near future, the trawling experiments had soon to be discontinued. While the views of various authorities regarding the great potential richness of the marine fisheries of India were fully confirmed as a result of these experiments, it became abundantly clear that trawlers of the European type were not suited for fishing in Indian waters, and that carefully planned experimental fishing on an extensive scale with various types of power-vessels and even sailing junks and indigenous crafts of larger build and tonnage fitted with auxiliary engines was essential for determining the **most suitable type of craft for auxiliary** in Indian waters. Similarly nets and tackle of various types must be tried for **assessing their relative utilities under Indian conditions.**

20. The active interest which Government of India have begun to take in the development of the fisheries in the country is reflected in the detailed Memorandum on the *Post-War Development of Indian Fisheries* prepared at their instance by Dr. Bains Prasad. We are glad to note that the Policy Committee on Agriculture, Forestry and Fisheries, which considered this Memorandum in its 2nd meeting at Simla in June 1944 has in general approved its recommendations. We have considered the programme of development laid down in the Memorandum and strongly recommend that the Government of India should take early steps to implement its recommendations. We have also examined the scheme for the establishment of a Central Fishery Research Institute at a capital cost of about Rs. 21 lakhs and an annual budget of about Rs. 3½ lakhs prepared by the Imperial Council of Agricultural Research. In drawing up its proposals the Council was apparently influenced by considerations of economy rather than of the urgent needs of the very backward fish industry. The Institute will have to serve not only as the central agency for fundamental research and for co-ordinating and collating research in various branches and aspects of fishery science carried out in different parts of the country, but it will be the only institution where advanced theoretical and practical training could be arranged for research and development personnel of the Provincial and State Fishery Departments. As a result of the almost complete ignorance in regard to life-histories of Indian food fishes, their larval stages, food, rates of growth, migration, etc. and the magnitude of technical problems requiring solution it will not be possible without extensive research to launch comprehensive programmes for the development of Indian Fisheries. To make up for the time-lag and speed up investigations we consider it imperative that all sections of the proposed Institute should have adequate numbers of fully qualified and properly trained research and teaching staff. Two stations, a main for Marine Fisheries and a sub-station for Inland Fisheries have been provided for the Central Research Institute. Considering the very extensive nature of the country and the widely different characters of the fisheries, we feel that two stations will hardly be sufficient, and recommend that, in addition to the regional stations to be set up by Provinces and States for their respective areas, at least two Marine stations and three Inland Fishery stations should be started in connection with the proposed Institute. As a natural sequence of this recommendation the research and development staff will have to be increased at least three to four times of that proposed in the Imperial Council of Agricultural Research Scheme, and the proposed scales of salaries radically altered. While it is not possible for us to give detailed estimates of cost, we are of the opinion, that the capital grant will have to be increased to about Rs. 50 lakhs and the annual budget raised to a figure of some Rs. 15 lakhs. These figures are in no way excessive if they are evaluated with reference to the present position and the future possibilities of development of an essential food producing industry.

In connection with the "Grow More Food" campaign a Fishery Development Adviser to the Government of India and a Deputy Adviser have recently been appointed for helping various Provinces and States to draw up schemes for the development of fisheries, increasing production and improving conditions of the fish trade in their respective areas. In addition to providing technical advice the Central Government have agreed to give necessary financial assistance for all suitable scheme of development.

We would like to direct special attention to some very important recommendations from the Government H. E. H. the Nizam of Hyderabad which have been forwarded to us for consideration. It has been suggested that Fishery Departments in the Provinces and States should be considered as Development Departments; we strongly endorse this recommendation. The same Government has also recommended that a "Central Board of Fisheries under the Chairmanship of the Fisheries Development Adviser to the Government of India should be set up which should consist of all the Fisheries Officers from the Indian Provinces and States. This Board should meet at least twice a year to discuss different problems for the development of Indian fisheries, and the

States and Provincial Governments should contribute to the cost of research schemes and other expenses of the Board." While we recommend that such a Board should be constituted to consider and discuss not only different problems for the development of Indian Fisheries but also the yearly programmes of work, we do not feel that it is possible for us to make specific recommendations regarding the apportionment of the costs of research and the expenses of the Board. Finally we recommend that the possibilities of establishing a Central Fish Committee on the lines of the Committees for Cotton, Jute, etc. already established by the Government of India should be explored. Such a Central agency devoted entirely to the development of the fisheries and the fish trade in the country should go a long way in placing this industry on a firm footing.

III. Research and Experimental Work

21. It is now universally recognized that the development of the fisheries of any area is impossible without detailed biological and physico-chemical data both in regard to fish and their environment. Such essential information, which is unfortunately not available in regard to Indian Fisheries, can only be collected by patient and long-term research and experimental work in fully equipped laboratories and experimental stations by large bands of properly trained and experienced workers. As has been remarked earlier in this Report there are no institutions in the country where such work could be carried out, nor is hardly any research and experimental staff available. Fisheries as a transferred subject have so far been the sole concern of the Provincial Governments, and have not received any attention from the Government of India. Fishery problems are generally neither regional nor provincial and as such artificial divisions of the country into provinces and states are without any significance in connection with any schemes for their elucidation. From the information made available to us and the replies to our Questionnaire we are glad to note that steps are being taken to strengthen the Fishery Departments in various Provinces and States. The proposed increases, however, in our opinion, are far from sufficient for meeting the multifarious needs of the fishery industry. For the proper conservation and development of the fisheries in the country we strongly recommend that :

(i) a permanent organisation be set up at the Centre for co-ordinating and directing fishery research on an all-India basis;

(ii) necessary research and experimental stations be established as early as possible, not only as the Central organization but also as regional research and experimental farms in all Provinces and States for carrying out work on local problems and demonstrating improved methods of fish farming. While the recurring expenditure for such regional stations should, as far as possible, be provided by the Provincial or State Governments concerned, the Central Government should give adequate financial assistance towards the initial cost of their establishment;

(iii) arrangements be made both in the country and abroad for the training of the necessary technical staff required for the Central Research Institute and for the Provinces and States;

(iv) detailed surveys be carried out and statistics collected of :

(a) existing fishing grounds, with reference to their extent, resources, yield and conditions,

(b) areas which could be developed as fisheries,

(c) fishermen, vessels, boats, nets and other appliances used in different types of fishing throughout the country,

(d) annual and seasonal production of fish in different parts of the country, and

(e) marketing arrangements and prices;

(v) staffs of the Provincial and State Fishery Departments be further increased particularly with reference to the personnel required for socio-economic work, collection of statistics and for improving the marketing section of the industry;

(vi) special staff should be appointed for ascertaining the extent of indebtedness of the fishermen in different areas, and for establishing fishermen's sale co-operative societies.

This latter step alone would make it possible for the fishermen to have their due share in the fishing industry. The establishment of a Central organisation to study the problem of the chronic indebtedness of the fishing communities on the lines of agricultural indebtedness with a view to freeing them from the clutches of financiers and middlemen, and suggesting ways and means for setting them on their feet as effective members of the fishing profession, by being associated with specially organised co-operative societies, with adequate funds and technical assistance appears to be the first essential. In this connection it has been suggested in one of the replies received from Madras that a Debt Relief Act should be introduced for dealing with the problem. We endorse this proposal for the consideration of the Government of India.

22. We would like to reiterate that no short-term programmes of development can possibly yield results of permanent value unless they are supplemented by long-term programmes of research and experimental work. Such work is undoubtedly an expensive undertaking, but we are definitely of the opinion that the Government of India should provide the necessary funds and essential machinery for it. We would like to invite the attention of the Government of India to the large sums spent for the development of the Fish Industry by the Governments of the United States of America and the United Kingdom. While properly organised and adequately staffed Fishery Departments are maintained by all States of the Union, the aggregate investment of the Federal Government of the States in connection with the U. S. Bureau of Fish and Fisheries amounted in 1909 to over 1½ million dollars and its budget for 1917 was \$1,144,850. In the United Kingdom according to the Report of the Committee on the Fishing Industry (1932): "The English and Scottish Fisheries Departments each possess a scientific staff, well-equipped laboratories, a research vessel of the large steam trawler type, and a smaller motor vessel for inshore work. Moreover, in furtherance of the policy of linking up the activities of marine research workers in Great Britain the main Marine Biological Stations in the country, particularly that at Plymouth, have been placed on a satisfactory financial footing by means of grants from the Development Fund, so that they may continue to carry out the general work on marine biology and hydrography which is required to supplement the more specialised work of the Departments. The staff of the Marine Institutions and of the Departments work in close touch with one another. There is no hard and fast line of demarcation, but, broadly speaking, researches deliberately planned to find a solution of problems affecting the commercial fisheries ('directed researches') are entrusted to the Departments, and researches the object of which is the general advancement of the knowledge of marine life in relation to its environment ('free researches') are allotted to the independent Institutions."

"The International Council co-ordinates the work of the fifteen countries represented on it, and its publications keep fishery research workers informed of the progress made in the different branches of the subject in all the participating countries. Its annual Meetings at which programmes of work are framed and adopted, furnish also an opportunity for exchange of ideas between marine workers from almost the whole of Europe. Furthermore, at meetings of the Challenger Society, which are held three times a year, British scientific workers engaged in marine research have an opportunity of meeting together and discussing matters of common interest."

"The main divisions of research in relation to the problems of fishing industry are:

- (a) marine research dealing with living fish and their environment,
- (b) research into methods of preserving fish from the time of capture to the time when it reaches the consumer, and
- (c) research into the design and equipment of fishing vessels."

23. In 1960, the total expenditure from public funds on fishery research

Research on the transport, storage and transport of fish subsequent to its catching is carried out under the aegis of the Advisory Council for Scientific and Industrial Research at Torry Research Association at Aberdeen for which the expenditure in 1930-31 amounted to £11,400. Research into the design and equipment of fishing vessels is carried out at the National Physical Laboratory, Teddington, but exact details of cost are not available. In addition, according to the Report on the Fishing Industry (1932) the Government proposed to place a sum of £500,000 into the Development "for capital expenditure for the benefit, among other subjects, of Fishery Research." In the Report of the Committee on the Herring Industry of the Scottish Home Department (1944) it was stated:

"As appears throughout this Report there is in our opinion a strong case for generous assistance to enable the industry to restart after the disorganisation of the war years. The industry has, as a result of years of depression, quite insufficient capital resources to provide for adequate re-equipment and expansion. We therefore recommend initially:

"(1) That section 3 of the Herring Industry Act, 1938, be continued for five years with the powers proposed in this Report, and that the sum of £200,000 be made available during that period for administration, research and market development.

"(2) That section 4 of the Herring Industry Act, 1938 be continued for five years, and that the sums made available as grants for re-equipment be extended to the purchase of nets and gear, as well as to boats, and be augmented to a total of £820,000.

"(3) That section 5 of the Herring Industry Act, 1938, be similarly continued for five years and that the sum made available for loans be augmented to a total of £1,300,000.

"(4) That, for the purpose of acquiring and chartering boats, as mentioned in paragraph 141, a special grant, not exceeding £50,000 be made to the Herring Industry Board.

"We wish to make it clear that these figures are tentative and that the sums required for equipment and development must depend upon the conditions of the industry as they develop. We would emphasize again the need for a remunerative price for the product, given which the financial problems of the industry can certainly be solved, but without which no credit or grant facilities will be of any lasting advantage."

IV. Fisheries

24. Fishery science, as it is understood in all civilized countries at the present day, is practically non-existent in India. As has been hinted earlier, the intricate problems concerned with the proper conservation, development and exploitation of fisheries are invariably so difficult of elucidation and solution that only carefully planned, long-term schemes of research and experimental work can provide the basic essential data. The conclusion of Dr. H. Maurice a well known fishery research worker of the United Kingdom, Ministry of Agriculture and Fisheries, fully bear out our views.

"One point must not be forgotten by the people who are impatient for immediate results and definite pronouncement by the scientist, and that is the immense amount of work which is necessary before the smallest fact can be found out Results can only be obtained slowly for no true scientist is going to make rash claims that cannot be substantiated by observations over a long period."

This principle was ignored in connection with all earlier planning of fishery development in India, and only limited results of lasting value have so far been achieved in any part of the country. We would, therefore, like to stress once again that our recommendations in connection with the development of the fisheries of the country are made only with a view to meeting the present emergency and cannot possibly serve as a solution of the main problem.

25. The fisheries of India may be divided into two main classes: (1) Inland Fisheries, and (2) Marine Fisheries. The inland fisheries have further to be divided into freshwater and estuarine, while the marine fisheries have similarly to be considered under the heads: foreshore and offshore fisheries and the deep-sea fisheries.

1. Inland Fisheries

26. (a) *Freshwater Fisheries*.—These fisheries at present constitute the mainstay of inland fisheries of India and are carried out in rivers, canals, irrigation channels, lakes, *jhils* or *beels*, *haors*, bunds, burrow-pits, tanks, ponds and in fact in depressions of any size which hold water perennially or for the greater part of the year. The extent of these fisheries varies with the seasons of the year. For example, during the rainy season when large parts of the country, in provinces like Bihar, Bengal, Orissa and Assam are under water, the entire areas constitute vast inland fisheries. Further, in the rice and jute growing areas the fields, which are flooded during the rains, serve as the breeding grounds and nurseries of various species of fish, harbouring in addition to large numbers of brood fish myriads of fry and small fish of all types. The late Sir K. G. Gupta in his report on the Fisheries of Bengal calculated the perennial riparian surface in the province of Bengal (as it was demarcated in 1906) at 2,250 square miles, on the basis of a length of the main rivers at 9,000 miles, and of a minimum breadth of $\frac{1}{4}$ of a mile. For the whole of India this area has to be multiplied several times when the extensive expanses of the Gangetic system in the United Provinces, the Brahmaputra in Assam and Eastern Bengal, the Mahanadi in Orissa, the Nerbada, the Tapti, the Godavari, the Kistna and Cauvery systems in Central and Peninsular India, and the rivers of the Indus System in the Punjab are taken into account. In fact the only parallels to the very rich extent of India's inland riparian areas are to be found in Canada and the United States of America.

27. Irrigation channels and canals form very extensive net-works in most parts of the country but in view of their specialized function and periodical drying up they are responsible for a great loss of the fish life of these waters. There are, in addition, many large and extensive artificial reservoirs which have been built up at the sites of dams in the course of rivers and streams. In spite of the fact that fishing is generally prohibited in these waters, they have not in any way contributed to the conservation or development of the fisheries except in Mettur and Mopad reservoirs in Madras.

28. Large Indian lakes of importance as inland fishing centres are the Loktak Lake in Manipur, Assam, the Chilka Lake in Orissa (the water of this lake is brackish for 6-7 months in the year, and its fisheries are, therefore, of a mixed freshwater and estuarine character) and the Manchar Lake in Sind. The Wular in Kashmir, and the mountain lakes in the Tal area of the United Provinces are relatively less important. In addition, numerous small lakes and *beels* are found in Assam, Bengal, United Provinces, Central India, Rajputana and Peninsular India. Tanks, ponds and other extensive areas of impounded or enclosed waters constitute a valuable but ill-developed source of fisheries throughout the country. Detailed data are unfortunately not available regarding the extent of these fisheries, but they constitute a major source of fish supply for large inland tracts in various provinces, notably in Bengal, Bihar, Madras, Central Provinces and the Hyderabad State.

29. In addition to natural fisheries a relatively unproductive type of carp culture has been carried on from times immemorial in Bengal, and within more recent times in parts of Bihar, Orissa, Assam, Madras, Bombay, Punjab and the United Provinces. This culture consists in stocking enclosed areas of water with the fry of carps captured from rivers and the flooded areas when the fish breed with the onset of the monsoon rains. This helps to a limited extent in stocking areas of otherwise more or less fallow expanses of water with edible fish and thus add to the fish supplies of the adjacent countryside. Owing to the primitive and wasteful methods of culture, the mixed nature of the fry, lack of

essential data in regard to pisciculture and the lines along which stocking is carried out, the produce of these fisheries in general is very limited.

50. (b) *Estuarine Fisheries*.—These fisheries are confined to the deltaic areas, backwater areas, lagoons, etc., and generally constitute very rich potential fisheries. While the fisheries in some areas such as the Chilka Lake, the backwaters in Madras, Travancore and Cochin are extensively exploited, those in the extensive deltaic area of the Sunderbans, the delta of the Mahanadi, etc., are hardly tapped. With the paucity of biological information available regarding these fisheries it is not possible to make detailed recommendations for their improvement and development, but most authorities with firsthand knowledge of these fisheries are agreed that for some time to come all that is possible for the proper exploitation of these fisheries is to (i) provide more suitable and efficient types of fishing boats and nets for the fishermen, (ii) make available ice at cheap rates for the preservation of fish, (iii) provide for rapid collection and transport of catches by power launches, and (iv) arrange better marketing facilities.

We understand that a scheme for the extensive exploitation of the fisheries of the Sunderbans is under consideration by the Governments of India and Bengal. According to this scheme it is proposed to set up an agency for exploiting the fisheries from a number of selected centres. The centres, which will work as independent units, will consist of a varying number of fishing boats working from a flat anchored in a suitable locality. The flats will serve not only as the base for fishermen and boats, but will also be fitted with ice plants for the manufacture of ice required for the preservation of fish. The fish caught by various boats of each unit will be collected by two or three motor carrier launches, and rapidly transported to suitable railheads whence it will be distributed to consuming centres. Special arrangements for transport by rail, road and marketing will be made to ensure proper handling, transport, distribution and sale of the produce.

While the proposed scheme is concerned entirely with the exploitation of fisheries, it is essential that the Government should simultaneously appoint special scientific staff for carrying out detailed biological and biometric studies so as to devise suitable measures for the conservation and development of the fisheries through regulated and restricted fishing, close seasons, stocking, etc. In the absence of such measures the fisheries may be entirely depleted and even ruined beyond any hope of resuscitation through over-fishing, as has happened in the case of some very valuable fisheries in other countries. While under the existing conditions the setting up of a large monopolistic concern for working these fisheries on an extensive scale may be justified on the grounds of the large scale of operations and the capital outlay involved, it is essential that the Government must exercise necessary control for safeguarding the interests of both the producers and consumers. Further, suitable steps must be taken for improving the economic condition of the fishermen and training them in the use of up-to-date and efficient methods of fishing, and preservation, transport and marketing of catches, so that they may in due course of time at least partly replace the monopolistic concern.

The great impoverishment of the fisheries of the Chilka Lake is due to two main causes: (1) silting up of the channel by which it was connected with the Bay of Bengal and through which its fisheries used to be regularly replenished. Consequent on the closing up of this connection its less saline waters are not so rich in planktonic life, and this change in the *milieu* has materially impoverished its fisheries, and (2) unrestricted, intensive fishing without any measures whatever being taken for conservation and development. The Chilka Lake has immense potentialities—as a source of fish provided a suitable organization somewhat on the lines of the Tennessee Valley Authority (T.V.A.) is appointed for the proper conservation and development of the natural resources of the area as a whole. This organization will have

to concern itself with the development of all land and water resources of the area and amongst its activities will have to be included such varied projects as flood control, agriculture, forestry, fisheries, salt and lime manufacture, etc., and starting and fostering industries suited to the resources and conditions of the area. In connection with the proper preservation, handling and transport of the increased fish supplies of the area, it will have to arrange facilities for cold storage, rapid transport and processing of fish, and finally organize marketing of the fresh and processed fish. The rich resources of the area, if developed along these comprehensive lines should add materially to the prosperity and progress of the Orissa Province.

Until such a scheme materializes measures such as the opening up of the channel with the Bay of Bengal, restricting fishing, stopping capture of young and immature fish, and stocking are urgently called for to restore the fisheries to their normal condition. Very extensive and important fisheries of this class are also constituted by the continuous chains of lagoons or as they are termed backwaters, running almost parallel to the coasts in Peninsular India. While receiving the drainage of a number of rivers they are connected with the sea by a number of outlets. They are generally very irregular in form, varying in breadth from a few yards to as much as 25 miles and are found both along the East and West Coasts of Peninsular India. The most extensive backwaters are found in Travancore and Cochin; in the former State their area has been estimated about 300 square miles. These backwaters offer excellent grounds for developing estuarine fish-farming of rapid growing species of mullets, bekti, pearl spot, etc., and we recommend that special attention be paid to this line of development.

31. As a source of food inland fisheries have unlimited possibilities of development provided cultural methods, more or less similar to agricultural practices, as have proved so successful in the case of the fisheries of the United States of America, China, Japan, and more recently Egypt, are adopted for augmenting the supplies of suitable fishes. The fisheries of most of the major rivers of India have suffered seriously consequent on the harnessing of waters for extensive irrigation and hydro-electric projects. In Punjab, for example, as a result of the ever increasing network of canals practically all water of the rivers is diverted into the canals leaving the river beds almost dry except during the flood season. Similarly large hydro-electric projects are responsible for a great shrinkage of the volume of water below the dams constructed in connection with such schemes.

32. While the proper conservation and increase in the fish populations of rivers and streams is undoubtedly a long-term project, we would like to stress the urgency of all possible steps being taken to see that these valuable fisheries are not utterly destroyed for want of necessary measures being adopted by the Fishery Departments of the various Provinces and States. We are, however, of opinion that no real advance is possible unless the problems of conservation of the river fisheries including pollution of waters are dealt with on an all-India basis by a suitable Central authority. This recommendation of ours is, in fact, an endorsement of that of the Imperial Council of Agricultural Research for the establishment of a Water Board, consisting of engineers, fishery experts and administrators to carry out a detailed investigation of the problems of the river and canal fisheries in India, and suggest suitable measures including legislative provisions for their proper conservation and development.

33. A certain amount of conservation of the existing resources has been effected by protective legislation in the Punjab and Madras. We are informed that progressive legislation is being planned to stop the destruction of brood fish and immature stages of important food fishes in all inland waters of Madras. Measures already enforced here, we understand, resulted in the conservation of the fishery resources in some of the deep rivers of the province, for example, certain areas of the Cauvery, the upper reaches of the Bhavani and Moyar, and the Godavari and Kistna. We recommend that this programme of work should be extended and enforced all over India.

34. In regard to fish passes at dams for migratory fishes, data regarding the contour, current, gradient, force of fall, velocity of flow, leaping capacity of the species concerned and their migratory movements, etc., have to be collected before proper fish passes can be designed. We understand that the question is under consideration, and a special research programme has been financed by the Imperial Council of Agricultural Research for the collection of essential data in this connection. This line of work is very important and we feel that adequate steps should be taken to accelerate development.

35. The question of the utilization of big reservoirs or *sagars*—such as are found in Hyderabad, Mysore, Madras and Bombay, etc., at the sites of dams in the course of streams and rivers—as areas for stocking fish should also be considered. These reservoirs are of varying depths from near the dams where they are deepest to the periphery where they are shallow. Fish in these areas will be found at all depths, and a certain amount of fishing should be permitted periodically to thin out the stock and reduce the number of fish competing for food, more particularly the older age-groups—which have grown past the age of effective reproduction, and make available more room and food for the growth of the younger groups. With the provision of fish passes at dam sites, referred to earlier on and the necessity for which is being increasingly realized as a very necessary step for the conservation of freshwater fishes all over the world, a steady influx of fresh groups of migratory fish may be expected to colonize these reservoirs. These immigrants will increase the competition in feeding areas, and the limited amount of well-regulated fishing, both as regards season and size of fish, suggested above, would not only not interfere with hydro-electric functions of the reservoirs, but also help in maintaining a healthy stock of fish from which tanks, ponds and wells in adjacent areas could be fed.

36. Extensive development of fisheries in tanks, bunds and other enclosed areas of water should be taken up by making them suitable for pisciculture and by stocking them with fry and fingerling of carps. The success of this line of work would depend on: (i) the establishment of a properly equipped and staffed fresh-water fishery research station for the study of the multifarious problems—chemical, physical and biological—connected with pisciculture; (ii) surveys of fisheries in all provinces with a view to discovering, conserving and developing the natural spawning grounds of rapid-growing carps and other suitable species; (iii) establishment of hatcheries and nursery tanks for rearing the fry in suitable centres and making arrangements for the transport of fingerlings; (iv) starting chains of demonstration stations with trained personnel for guiding and supervising piscicultural activities by the public and for propaganda work; (v) providing subsidies, where necessary, for the improvement of tanks and other enclosed areas of water, and (vi) supplying fry and fingerlings for pisciculture free or at cheap rates. All suitable areas of impounded waters whether private or government-owned should be stocked. In the case of small holdings, as in most parts of Bengal and Orissa, it may even be necessary to acquire the tanks. Most of the existing tanks and the large series of those now being excavated for irrigation purposes in different provinces can, with only minor alterations, be used for raising fish by stocking them with fingerlings. We are glad to note that a Rural Fishery Demonstration and Fish Farming Scheme for such work has recently been started in Madras.

37. Increasing the fish population of rivers and streams all over the country by planting fingerlings of fish must be taken up as soon as sufficient supplies become available through the establishment of hatcheries and nursery stations. Work along these lines on a limited scale is already being carried out in Madras.

38. Preservation of brood and young fish is a vital measure for the conservation and development of fisheries. Capture and destruction of very large quantities of young and immature fish has been reported from almost all provinces. Capture of brood fish in large numbers particularly when they migrate

into more easily accessible shallow areas for breeding purposes has also been recorded. These practices combined with intensive fishing are responsible for the rapid deterioration and impoverishment of the freshwater fisheries, and must, if necessary, be stopped by legislation. Detailed enquiries by Fishery Departments of the various provinces are, however, essential before concerted action on an all-India basis can be taken. As very little information is available regarding the breeding seasons of various species of economic importance and the deleterious effects of the existing uncontrolled fishing on their fisheries. It is not possible at present to recommend any close seasons for fishing. The criterion of breeding seasons for fixing a close season cannot unfortunately be applied in all cases. For example, the most productive fisheries for the *Hilsa* and *Topsi*, two fish of great economic importance in Bengal, take place when the fish are ascending the streams for breeding purposes. These fishes and others, however, so far as is known at present are so prolific breeders that conservation measures in the initial stages need only be confined to the preservation of the young and immature forms by regulating modes of netting and capture, and if necessary by restricting fishing during a definite period in selected areas. We are informed that with the subsidence of floods and as the waters become shallow very large numbers of fingerlings and young fish of carps are caught and marketed throughout the Gangetic Plain. While bringing a small immediate return to the fishermen this involves a very great wastage of the potential fishery resources of the country. We would have suggested legislative measures for stopping the capture and sale of these young fish, but refrain from doing so in view of there being no efficient machinery available for enforcing such measures. According to the information supplied to us certain areas in the Punjab where young fish are available in large numbers after the floods have been declared as sanctuaries. As the waters dry up the young fish are salvaged so far as possible and transferred to deeper pools till they can be utilized for stocking. Two schemes for stocking these grown up fingerlings in tanks and similar areas are being taken up in the Punjab and the United Provinces during the months of January to March. We would recommend the extension of these lines of work, which, in our opinion, offer unlimited possibilities not only for the conservation of the young fish but also stepping up fish production as a short-term project.

39. The craft and gear normally employed for fishing in inland waters are not suitable for deeper waters. The rich fisheries of the deeper waters, such as lakes, reservoirs, perennial ponds and deeper areas of rivers cannot for lack of suitable fishing techniques be adequately exploited all the year round. Experimental work is essential for finding improved methods of capture and devising implements suitable for varying depths and contours, and waters containing abundant aquatic vegetation, etc. We are informed that the Madras Fisheries Department has under consideration the appointment of a Craft and Tackle Officer for such work, while the Bombay Fisheries Department propose to carry out experiments with different types of tackle in large reservoirs and deep lakes. We recommend that this line of work be taken up and extended to other Provinces and States.

40. In connection with the conservation and development of the very important inland fisheries of Bengal, we would like to invite the attention of the authorities to two very pressing problems, *viz.*, 1. the water-hyacinth, and 2. the silting of rivers and streams and of the mouths of large numbers of streams where they open into the Bay of Bengal. The problem of water-hyacinth has been engaging the attention of the Government of Bengal for many years, and a Water-Hyacinth Eradication Act was passed in 1936. Following the passing of this Act, however, little attempt appears to have been made for its eradicating on an extensive scale. The problem is so urgent both for the conservation of fisheries and keeping the waterways open for riparian traffic, that we strongly recommend the appointment of a special Commission

of Enquiry for investigating the position and suggesting ways and means for its early eradication. Our attention has been directed to a great deterioration of the estuarine fisheries in the Gangetic Delta as a result of the silting of the river mouths and of the channels of numerous rivers and streams. In the absence of detailed data we are unable to make any specific recommendations in this connection, but suggest that the urgent attention of the Government of Bengal be directed to it with the request that this should receive prior consideration at the hands of the newly established River Conservation Board of that Government.

2. Sea Fisheries

41. The coast-line of India is roughly 3,200 miles long, and the fishable area has been estimated at over 100,000 square miles, but only a very small portion of this extensive area is exploited by the Indian fishermen. Sea fishing is carried on mainly in small crafts, catamarans, and boats of a displacement of under 5 tons in coastal waters some 5-7 miles from the shore. This area can be divided into the following seven divisions, which correspond roughly to the coastal boundaries of various provinces and states.

1. Baluchistan Coast from Gwadar to Cape Monse.

2. Sind Coast from Cape Monse to the Sir Creek.

3. Coast of the Western India States including the Gulf of Cambay.

4. Bombay Coast from Daman to the mouth of the Bhatkal near the southernmost coastal limit of the Bombay Province.

5. Madras Coast including the Malabar Coast, Cochin and Travancore States, the Gulf of Manar area, the Coromandel-Coast area and the Telugu area up to the northernmost limit of the Madras Presidency.

6. Orissa Coast from the southernmost boundary of the Chilka Lake to the northern border of Orissa above Balasore.

7. The Bengal Coast from the border of Orissa to Cox's Bazar.

42. All major marine fisheries are confined to comparatively shallow waters over narrow belts of continental shelves and slopes. In these areas also the good fishing grounds or banks—where fish are plentiful—occupy only a fraction of the entire belts between the coast lines and the continental slopes. The greater depths beyond the 200 fathom line are almost barren from the standpoint of commercial fisheries. This is not because fishing is not possible at such depths but because owing to the small numbers of fish the catches in such areas are uneconomic. It has further to be remembered that though the number of marine species of fish is very large, only a limited number of these can be regarded as food fish. Consequently there is little reason to hope that any extensive fisheries could be developed outside the continental slopes marked by the 200 fathom line. For all practical purposes, however, the 100 fathom or 200 meter line is generally taken as the limit for commercial trawling, though certain useful varieties of fish are found up to the 200 fathom line.

43. A glance at the physical map of India shows that the continental shelf of this sub-continent marked by the 100 fathom line constitutes a very narrow strip running almost parallel to its coast-line. All along the East Coast it runs very close to the shore and seldom exceeds 20 miles in width except at the apex of the Bay of Bengal between the mouth of the Mahanadi river and Akyab on the Burma Coast. On the West Coast the continental shelf is comparatively wider—the widest region is found between Karachi and Ratnagiri on the Malvan coast, with a maximum width of nearly 200 miles in the region north of Bombay. There are also patches of shallow areas within the 100 fathom line surrounding the small islands off the Malabar coast collectively known as the Maladive and Laccadive groups. Judging the scope of fisheries from the area of fishable waters, it is found that the most suitable areas are in the Arabian Sea and in the Bay of Bengal along the coasts of Bengal and Orissa with a few banks in certain special areas along the Coromandel coast. We have already referred to the unsuccessful attempts for developing deep

sea fishing in Indian waters by the Governments of Bengal, Madras and Bombay, but it has to be noted that Ceylon succeeded in establishing deep sea fishing round its coast on a small scale. The chief reason for the failure was the lack of detailed surveys of fishing grounds—there was no fishermen's chart corresponding to Close's chart of the North Sea. The unsuitability of the vessels, limitations due to climate, absence of suitable harbours and the lack of refrigeration, transport and marketing facilities are also serious handicaps in the way of the development of the marine fisheries of India.

44. The produce of the marine fisheries of India constitutes about $\frac{2}{3}$ of the total fish supplies in the country. The relatively large quantity is mainly the product of the foreshore fishing areas. To increase fish production the extensive offshore fisheries have to be exploited, and for this bigger boats and better gear are essential. The best catches are obtained along the West Coast to which region shoaling fishes migrate seasonally, apparently for food which is abundant over the muddy bottom in the comparatively surfless region. The poor catches along the East Coast are due to the absence of the shoaling fishes in any numbers owing probably to the sandy bottom and heavy surf beating all along the coast. Further the fishing in this area is carried out by a highly primitive though efficient craft, the catamaran, as the heavy surf on this Coast precludes small boats or canoes being employed throughout the year. There is no room in a catamaran, and even in a canoe or small boat for free movement necessary for using nets effectively, while the time such crafts can stay out at sea and their cruising capacity is strictly limited. Owing to the smallness of the boats the duration of each trip is short and usually the fishermen can never stay out at sea for more than 24 hours. In our opinion a considerable expansion in the activities of the Fisheries Departments of the maritime provinces must take place before the sea fisheries of India can be adequately developed. It is essential to discover and locate the good fishing grounds, the seasons of abundance of fish, and to employ efficient fishing craft and tackle. It will also be necessary to disseminate among the fishermen information regarding the best and most profitable fishing grounds, the most fruitful fishing season, etc., and to train them in the use of better types of craft and tackle. After the fishing grounds have been located and properly charted it would be necessary to make available power boats and trawlers for their proper exploitation either through large commercial concerns, or what we consider proper, by organizing the fishermen on co-operative basis and supplying them with power crafts and nets through the grant of subsidies and loans from public funds.

45. The Government of India are exploring the possibilities of obtaining marine diesel engines for use in fishing boats. We recommend that, as in the case of the United Kingdom fisheries, the Government of India should as a short-term measure in the first instance, obtain as large a number of marine engines as possible. These if installed in suitable country made fishing boats would enable the fishermen to exploit, to some extent, the rich offshore marine fisheries of India by reducing the time taken in journeys to and from the fishing grounds, carry on fishing for longer periods and transport fish in a better condition, and finally be not dependent on wind and tide as they now are.

46. We have generally considered the proposed programmes of the Madras and Travancore Fisheries Departments for the development of marine fisheries of their respective areas, and recommend that these should receive early consideration so that the work of development may not be unduly delayed. Similar programmes for the development of fisheries of other maritime Provinces and States should be drawn up and put into operation at an early date.

V.—Fishermen.

47. The prosperity and development of the fishing industry of any country is naturally dependent on the socio-economic position of its fishermen. In India fishing industry is neither organized nor it is, as in the case of most maritime countries in Europe and America, localized in any area or areas. The fisheries and the fishermen in India are scattered throughout the entire

length and breadth of the country, while along the vast coastal belt numerous concentrations of fishermen are found in small villages, inaccessible, in most cases by road, rail or sea, from minor and major towns and ports. Whereas in the earlier times the fishermen belonged to the *Sudra* caste fishing now-a-days is practised by members of all religions, such as Hindus, Muslims, Christians, Budhists, etc., drawn from a variety of races with very different habits and customs and speaking a great variety of languages. Naturally with this great diversity there is a great variety in different parts of the country in regard to the methods, types and sizes of boats, nets and other appliances used for catching fish. These great varieties of indigenous boats, nets and gear are of a primitive character and have undergone comparatively little change from their original condition. While fairly effective for catching fish of certain classes, they are not suited for fishing on an extensive scale. Fishing, in general, is a hereditary profession carried on from generation to generation with almost all the members of the family taking part in it to a varying degree. In certain inland areas fishermen also own and ply boats, and no hard and fast distinction can be made between fishermen and boatmen. The professional fishermen of India are very ignorant, superstitious and highly conservative. They belong to the lowest stratum of society, and fishing is generally regarded as one of the meanest of all trades and professions. From the point of view of literacy also the fishing population is very backward. In general, they are very poor, and except for their miserable huts and tenements and some goods and chattels have very little of worldly possessions. In most cases the boats and more expensive nets do not belong to them and practically nowhere in the country do they own the fisheries or the fishing rights. No separate statistics of the indebtedness of the fishermen for different parts of the country have so far been collected, but from the available data and reports received from various sources it is beyond doubt that their indebtedness to middlemen and financiers in most parts of the country is on so large a scale that they are no better than serfs or slaves. Though the retail prices of fish are fairly high, it has been estimated that the fishermen's share in most cases seldom exceeds more than four annas in the rupee. In view of their meagre earnings, therefore, they cannot carry on their profession except by constant borrowings from the middlemen financiers. Leaving out of consideration the individual fishermen who fish singly with cast nets and other similar implements, all relatively large-scale operations are ostensibly carried out by parties working on a co-operative basis: the catches to be shared between the fishermen and the owners of boats and nets; the latter, however, by virtue of their hold as financiers, owners of the fishing paraphernalia and the sole agency capable of marketing the highly perishable commodity in distant markets are invariably able to collar all catches at prices much below the prevailing market rates. In some cases, as in Bombay, middlemen enter into annual contracts with the fishermen for taking over the entire catches at agreed rates irrespective of the market conditions. As a result the part of the fishermen in the fishing industry is generally restricted to catching fish, retail sales of fish on a small scale in their native villages and the adjacent areas, or as in the case of fisherwomen in larger cities like Bombay of selling in the retail markets fish purchased from middlemen and wholesalers.

48. Classified tables in connection with 1941 Census operations have not been published, but according to the 1931 Census Report the total fishing population of India was 1,689,625. The numbers of adult male fishermen and of both males and females employed in subsidiary occupations such as distribution, marketing, retailing and curing of fish were computed respectively at 550,610 and 179,135. Since the population of India has increased by 15 per cent. during the decade ending 1941, it would not be incorrect to assume a corresponding increase in the numbers of fishermen and their dependents. With the exception of the Punjab all replies received in response to our Questionnaire are unanimous that there has been a marked decrease in the number of fishermen particularly in the maritime areas. Our enquiries also have confirmed this view.

though it has not been possible to obtain any statistics of the decrease in numbers or to determine the causes of the changeover of the fishermen from fishing to other professions or trades. It has been stressed that with the great rise in prices the fishermen find fishing unremunerative. Compared to the uncertain and hazardous nature of their profession they find service on fixed daily or monthly emoluments much more attractive, and large numbers have either joined the fighting forces in various capacities, or taken up work as oarsmen on canal boats in South India, as sailors on coastal vessels and so on. At Karwar in Bombay the Sub-Committee saw a number of large fishing vessels being used as carrier vessels for grain and general merchandise along the West Coast. Within recent years the fishermen in some provinces, such as Orissa and Assam, have lost large numbers of boats, and nets as a result of natural calamities like cyclones and floods. These, owing to the difficulty of securing the necessary materials and the prevailing high price, the fishermen have not found possible to replace. Similarly the famine of 1943 in Bengal was responsible for a large number of deaths among the fishermen. As a result of the war-time conditions fishing has been entirely stopped in a number of operational areas, while along the coast restrictions have been placed on fishing and on the movements of fishing vessels. In the ports, the facilities for landing of fish and docking fishing boats have been greatly restricted, while several sites which fishermen had been using since times immemorial for landing fish, drying the nets, curing fish, etc., are no longer available to them.

49. Concurrently with these restrictions the prices of all raw materials required for the manufacture of fishing gear such as boats, nets etc., in the form of timber, copper sheeting, nails, steel, cotton yarn, coir, coal tar, resin, wooden stakes, baskets, wooden boxes, etc., have increased from 3 to 8 hundred per cent. and consequently the cost of manufacture and repairs has gone up very high. Further, in most cases no supplies at all are available. With the limited supplies of kerosene oil which are issued to the fishermen they cannot carry on night fishing, nor are they able to prepare new nets or to mend the old ones; these operations in normal times were all carried out at night after the day's fishing. In addition, the Sub-Committee have received numerous complaints against the inadequacy of the scale of rations allowed to the fishermen. It was stated that the quantity of rations allowed was hardly sufficient to sustain the fishermen for the hard labour involved in fishing operations, while the restrictions on movements at sea are responsible for the fishermen being unable to carry out fishing in areas far away from their homes.

50. A general review of the position of fishermen has been given in earlier paragraphs but we include here the replies, both official and non-official, received in response to our Questionnaire. It may be observed that no replies were received in most cases, and while the information supplied is not sufficiently detailed for assessing the exact position in any area, it generally bears out the views expressed in the earlier paragraphs of this Report.

Punjab.—"Trade and economic condition of fishermen have not improved during past 5 years in spite of sufficient rise in prices of fish."

Sind.—"The trade and the economic conditions of the fishermen have been adversely affected by the monopoly and exploitation of a handful of the few capitalists who advance money, provisions and other necessities of life and their occupation with the view to secure their output at rates much below the prevailing market rates. Some of these capitalists have become licensees for the issue of duty free coloured salt and they invariably issue the required salt for curing on the credit to assure the delivery of their (fishermen's) cured products at a disproportionate advantage."

Bengal.—"Fishermen as a class is the most exploited section of the people. They are handicapped by a thousand and one difficulties. The prevailing conditions of trade and transport have given rise to a chain of middlemen with the result that the fishermen only get Rs. 10 to Rs. 12 per maund while the final consumer has to pay about Rs. 120 per maund. As the fishermen

are too poor they have to rely absolutely upon the money-lenders to whom they are compelled to sell the fish at a very low price. Since Japan's entry into the war the denial policy of the Government has deprived them of their boats and also prohibited them to fish in the coastal areas, thus imposed upon the majority of them a forced idleness. Moreover the high prices of cotton yarn and other materials indispensable for fishing have caused a great handicap to the poor fishermen. Above all these the fishermen were the worst affected class in the terrible famine that swept over Bengal in 1943. As a consequence of all these about 75 per cent. of the living fishermen have been forced to work as day labourers."

"From 1937 up to 1941 the condition of the trade and fishermen was to some extent tolerable, and due to the use of motor boats as carriers the fish production was on the increase. But due to the increased war activities in the Bengal and Burma zone, dislocation in the trade and the economic condition of the fishermen gradually became worse. The trade was handicapped due to:—

- i. Enforcement of the Denial Policy and in consequence the total stoppage of fishing in the Sunderbans and along the shore.
- ii. Destruction or withdrawal of fishing boats from the Denial area.
- iii. Rotting of nets due to their being not used.
- iv. Non-availability of yarn and tanning material for making nets.
- v. Deaths and destitution due to last year's famine and in consequence the dearth of fishermen for catching fish.
- vi. Inadequate number of boats for the fishing trade.
- vii. Existing restrictions on movements of boats in the fishing areas of the Sunderbans.
- viii. Non-availability of quick transport through motor boats.
- ix. Scarcity of ice.
- x. Stoppage of railway freight bookings from some sources of supply.
- xi. Irregularity in train and steamer service.
- xii. Requisitioning of motor boats and trucks which were in use for carrying ice and fish, for military or A. R. P."

Madras: Mahe.—"They remain indebted to middlemen as they had hitherto been. The middlemen derive the lion's share of the fishing industry."

Nellore.—"Middlemen traders who advance money to fishermen without interest used to get fish at $\frac{1}{2}$ market rates up to 1940, now at 25 per cent. less than the market rate."

Baroda.—"There is a growing exploitation of the fishermen by middlemen."

Mysore.—"Some 50 per cent of the fishermen have given up fishing as a result of the unsatisfactory position of the trade."

51. We were convinced that all these factors combined together have made it impossible for the fishermen to carry on their traditional normal activities to which they are fitted, much less to resort to fishing on an extended scale. As a result, production of fish has been materially reduced in a number of areas. We, therefore, strongly recommend that immediate measures may be taken by the Governments concerned for removing the handicaps of the fishermen detailed in the preceding paragraphs and for providing the necessary facilities for enabling them to carry on fishing operations.

52. We, however, regard the introduction of co-operative movement among the fishermen as essential for improving their economic position and making it possible for them to take up their due share in the fish-industry. We discuss this question in some detail in the following paragraphs.

VI.—Co-operative Movement.

53. The main object of fishermen's co-operative societies should be to enable the members to buy boats and tackle required for their profession at a lower cost than would otherwise be possible and to market their catches at most favourable rates.

54. In India, with very few exceptions to which reference is made in the next paragraph, fishermen's co-operative societies have been mainly of the

nature of co-operative credit societies, and as a result the movement has not helped in any way to secure the badly needed improvement in the condition of the fishermen. According to the Marketing Report referred to above there are in all about 200 societies throughout India; these according to the Report "finance their members and sometimes assist them in the sale of fish; the number of these institutions which undertake the assemblage and distribution of the members catches is very few."

55. At present the number of societies carrying on co-operative work on improved lines is strictly limited; these are 6 in the South Canara and Malabar districts of Madras, 1 in Orissa and 2 in Bengal.

The Ajanur Fishermen's Co-operative Society, South Canara, Madras, during 1941, attempted the pooling of catches by its members for sale either fresh, cured, or converted into manure, through other co-operative sale societies in the province. The Society was granted a "ticket" in the Hosdurg Fish Curing Yard during 1942; this was the first time for a co-operative body to be granted a "ticket" for operating in a fish curing yard. Loans are granted by the Society to only those members who agree to sell their catches through the Society. The fish catches are pooled and cured in a hygienic manner under the supervision of the Society by the members themselves. The processed fish is sold in distant markets and the proceeds shared according to their individual shares by the members contributing to the pool. The Society also proposes at a later stage to purchase boats and nets for the use of its members.

The Chittagram Matsyajibi Samabaya Samity Ltd., registered in 1938, was established for helping the Chittagong fishermen who carry out fishing in the Sunderbans area. The Society out of a loan annually taken from the Provincial Co-operative Bank, advances money to solvent *bahardars* at 12 per cent. interest on the security of boats, nets and other unencumbered material assets. The fish caught is dried and made over to the Society's representative at the fishing sites. The Society arranges for its transport and sale as soon as possible. The sale proceeds after meeting establishment and other charges are distributed among the *bahardars*, liberal bonuses are granted to the *bahardars* for the purchase of boats and nets, and a small bonus is also paid to each fisherman. In due course it is proposed that the Society should have its own boats and nets for hire to *bahardars*. Out of the profits the Society sets aside a fair sum for providing medical help to its members and for construction of convenient sheds, etc., for drying and storing fish.

The Bidhadhari Spill Matsyajibi Semabaya Samity, Datterabad (near Calcutta) has taken on lease the swampy margins of the Bidhadhari river from the Government and is assembling and marketing fish caught from these waters by its fishermen-members. Boats and nets to catch fish are provided by the Society. The entire catch is taken by the Society, and after weighment is sold every morning by auction on the spot to wholesale or more often to retail fish-merchants of the Calcutta markets.

56. The need for co-operative movement amongst fishermen was realized in the United Kingdom during the early part of this century and as a result of the recommendations of the Committee of Enquiry in the Fisheries of Devon and Cornwall and the Departmental Committee on shore fisheries a central organization known as the Fisheries Organization Society (F.O.S.) was instituted in the year 1914, for fostering co-operation among those engaged in inshore fishing in England and Wales. This society had also to organize co-operative societies among fishermen for "the better marketing of fish by more direct supply, finding fresh outlets, grading and bulking of products, reducing carriage and in general for the improved organization for collection, transport, sale and distribution of fish and fishery products." This society has also acted as a liaison channel between the Government and the fishermen. Since 1914, a number of co-operative societies were started in England by this central organisation, and at the commencement of the present war there were 46 properly organized societies with a total membership of 1,846.

In 1941, Ceylon took the initiative of introducing co-operative fishing societies among her fishermen. There are two main types of such societies in Ceylon

at present; those that own their fishing implements separately but market their catches jointly, and those that own and operate their implements as a society and jointly market their catches.

57. The Rural Supply Co-operative Societies for agriculturists offer the best model for fishermen's societies. They are an attempt on the part of small- or medium-sized agriculturists to reduce their cost of production and, at the same time, to secure for themselves the benefit of technical progress without losing their economic independence.

Even when originally established for the purchase of agricultural implements, etc., they often provide their members with consumption and household goods and fairly frequently undertake the marketing of their members' products.

In one or other of these forms economic relations between consumers' co-operative organizations and Agricultural Marketing Organizations have been established in almost every country where the two types of organization are sufficiently developed. (*Vide International Labour Office's Report on Co-operative Organizations and Post-War Relief*, published in 1943).

58. We recommend that, after thorough examination by proper authorities, action may be taken to prepare a general plan for establishing Fishermen's Co-operative Societies throughout the country somewhat along the lines of societies for agriculturists mentioned in para. 57 above.

VII.—Fishing Crafts and Tackle

59. It is not proposed in this Report to discuss in detail the great variety of crafts and tackle employed by fishermen in different parts of India for the exploitation of its inland and marine fisheries. It may, however, be noted that in general the implements used are highly ingenious and are constructed of all available materials, mostly by the fishermen themselves. They are extremely primitive, and their use in most cases involves a great deal of waste of time and man-power. While some of the types are very efficient and highly destructive, in general the small catches obtained hardly justify the time and labour involved.

60. *Fishing Boats*.—No detailed information regarding the number of fishing vessels and their distribution in various provinces is available. The only estimate of the numbers as given in the Marketing Report shows the approximate numbers of boats carrying on sea fishing in most of the maritime provinces, but it will be seen that even in connection with this enquiry it was not found possible to estimate the numbers of boats in Orissa and those employed in estuarine and sea fishing in Bengal.

Table showing the approximate number of vessels used for sea fishing in India.

Station of the coast	Plank built boats	Masula	Dug-out canoes		Catamarans
		Boats (without frames or ribs)	Large	Small	
1	2	3	4	5	6
West Coast.					
Sind	100	...	...	270	...
Gujerat	500	...	...	1,070	...
Bombay City	125	...	...	200	...
Konkan	2,460	...	...	6,930	...
Kanara	400	400*	...	2,620	...
South Kanara . . . . .	...	225*	1,090	5,250	...
Malabar . . . . .	...	...	2,760	3,490	...
Cochin . . . . .	...	...	1,350	1,720	...
Travancore . . . . .	...	...	3,960	...	1,000

**Padaru* boats used for operating the Rampani net.

1	2	3	4	5	6
East Coast					
Tinnevely	90	...	...	880†
Ramnad	180	...	50	120
Tanjore	890	...	...	2,582
Chingleput	360	...	...	4,300
Nellore	390	...	...	1,000
Guntur	110	...	8	715
Kistna	790	...	485	775
West Godavari	760	...	235	115
East Godavari†	140	...	9	1,105
Vizagapatnam	1,860	...	50	11,200‡
Total	3,585	6,195	9,160	27,427	23,852

† Boat-catamarans.

‡ Pakhyra dug-outs in use.

§ Includes built-up canoes on a Catamaran base.

In general it may be noted that all fishing vessels are country made crafts, varying from catamarans, dug-outs, canoes, and the non-rigid *Musula* boats to fairly efficient solid and well-built plank boats or *Machwas* of 5-10 tons displacement, measuring from 26 to 35 feet in length and 5 to 8 feet in width. Smaller boats are used by the drift-net fishermen near the shores. The river crafts consist of rafts and dug-outs, plank-built small and large fishing boats extending to as much as 30 to 50 feet in length. The great variety of fishing boats enables the poor fishermen to carry out fishing in all waters, but the results are by no means commensurate with the amount of labour involved, and in any case they are entirely dependent on weather and tide conditions. In general it may be added that the present position in regard to fishing boats and crafts in the country is far from satisfactory. We have carefully considered the situation, and are of the opinion that a long term programme will have to be drawn up for providing suitable type of boats and crafts and, where necessary, power engines for fishing both in inland waters and in the sea.

61. *Fishing Tackle*.—The implements of capture used in different parts of India are very varied and include: (a) fixed engines and nets, (b) movable engines, nets, traps, and other contrivances, (c) fishing hooks used with rods and lines or on long bottom lines, (d) missile implements, such as spears, arrows, etc., and (e) fishing in shallow waters and muddy bottoms by hand. Invariably the main concern of the fishermen using any of the numerous varieties of implements is to catch fish of all kind and sizes that may be found in the waters where they fish. They are not concerned with the conservation or development of the fisheries, and their only interest is in the catch that they can secure. There can be little doubt that such methods of intensive fishing coupled with the lack of any measures for their conservation and development are responsible for the great deterioration of fisheries in different parts of the country. In the following paragraphs we deal with some general questions in regard to the nets and their preservation, as they are of prime importance in connection with fish production and the development of the fisheries of the country.

61a. *Nets*.—In spite of the passage of time fishing nets in India have undergone very little change. The types of nets, the materials, the methods of their manufacture and the substances employed for their preservation are practically the same as they were several hundred years back. While a number of types are very efficient for special classes of fisheries, others are extremely cumbersome and quite uneconomical both in respect of cost and labour, and the catches. There are innumerable varieties of cast nets, fixed or stationary nets, bag nets, seine nets, drift nets, gill nets, inshore drag nets, scoop nets, etc., in use in different parts of the country. According to the nature of the nets they are used either by single fishermen or by parties of them, both from the shore and from boats and canoes of all types. In very few cases, however, are the catches commensurate with the labour involved. The introduction of

Rampani and *Payodha* nets in parts of Bombay and South Canara within recent years for catching shoaling fishes, such as mackerels, has materially helped in the exploitation of shoaling fisheries, but as they are worked from the shore their area of working is strictly limited. These nets are also very wasteful both in regard to number of men required to work them and the quantity of fish captured by them.

61b. The process of making nets by hand is extremely slow and costly, but in general the fishermen owing to their extreme poverty cannot afford to purchase even the manufactured twine much less made-up nets. In the case of nets prepared from cotton yarn, the fishermen themselves in most areas twist the home-spun yarn into twine of requisite count, and make it up into nets. Before the war Bombay fishermen had taken to using twine imported from Italy, Japan and other countries for making nets, but almost all supplies of imported twine were either soon exhausted or available only at very high prices. We were informed that to help the fishermen the Textile Controller, Bombay, recently arranged for the manufacture of twine by a mill at Bombay, and shops have been opened at Versova and Khar for the sale of this twine at controlled rates. It is also contemplated to start more twine shops in other fishing centres as supplies become available. This is a welcome move, and we suggest that similar arrangements for the supply of twine to fishermen should be made by all Provincial Governments and States. As probably very few mills in the country have the necessary machinery for the manufacture of twine, the possibility of meeting the requirements of all parts of the country from Bombay should be explored. While we realize that the standardization and manufacture of nets by machinery are long-term projects, we recommend that steps in this connection be taken at an early date.

61c. *Long-line Fishing*.—Long-lines with large numbers of hooks attached to them are also extensively in use in most maritime provinces and states for exploiting the sea fisheries. This type of fishing is not so productive in India as it is in most Western countries: this is partly due to the smaller length of the lines and the much smaller number of hooks attached to each line. All the same fairly large catches of the demersal type of valuable food fishes are landed by long-line fishermen at Bombay, in Travancore, Cochin and Madras. Before the introduction of steam trawlers, long-line fishing in the North Atlantic region was one of the principal methods of fishing in Scotland, and in 1894 the annual catch from it amounted to some 70,000 tons. The lines used to be as much as 7 miles in length, with snoods or small pieces of line 2-3 feet long with attached hooks fixed at regular intervals; each line had several hundred hooks fixed to it. The line was shot at night and fished up in the morning; its position being marked by buoys. Until steam trawlers or other suitable types of power vessels can be introduced for exploiting the marine fisheries of India, long-line fishing, therefore, appears to be the most promising line of development, and we recommend that early efforts should be made for improving and developing it along up-to-date lines on as extensive a scale as possible. In this connection it may be added that the installation of suitable types of power engines on fishing boats, making available at cheap rates hooks of right quality in sufficient numbers, and of providing lines of sufficient tensile strength are urgent pre-requisites for the success of this type of fishing. Our information is that in pre-war days hooks of Swedish manufacture were available in Indian markets in sufficient quantities, and in spite of their high prices had come generally into use for long-line fishing. At present, however, practically no hooks can be obtained in the country, and we are informed that owing to no suitable hooks being available large number of boats at Bombay and other places have had to stop fishing. Reference may also be made to the fact that Shark fishing, on which the very important shark liver oil industry of India—which has made a great headway since the war owing to the large demand for this oil for therapeutical purposes—is almost entirely dependent on the availability of the right quality and type of hooks. Madras and Bombay Governments, we are informed, tried to get hooks manufactured locally, but due to

the poor quality of the steel and faulty methods of manufacture the results were far from satisfactory. We are glad to note that the Government of India are endeavouring to import fishing hooks from abroad, and hope that they will succeed in securing sufficient supplies.

62. *Preservation of nets and long-lines.*—The rapid deterioration of fishing nets and long-lines owing to faulty methods of preservation is another serious problem. The main causes of deterioration are faulty materials, action of water, bacteria, mould, etc., if nets are stowed in the wet condition, mechanical wear and tear, and heating induced by storage. Tanning materials extracted from barks, galls, etc., of various trees, and cowdung are employed for waterproofing and preserving the nets. Within recent years coal tar also had been increasingly used for this purpose, but only very limited supplies of tar are now available. The difficulties experienced by the fishermen in obtaining even sufficient quantities of indigenous materials were stressed by witnesses who appeared before the Sub-Committee. Since no fixing agent, such as Cunningham's 'Blue-Dip', is employed, the tanning materials used are washed out after the nets have been in commission for short periods, and the tanning process has to be repeated. It is essential that the technical aspect of the question be investigated at an early date, but meanwhile we advocate that Provincial and State Governments should take necessary steps for the liberal supply of indigenous tanning materials and tar to fishermen. In this connection *Cutch* a concentrate of tanning extracted from the wood of *Acacia catechu* should be given an extensive trial. Copper oleate, which within recent years has been found to be very efficacious for the preservation of nets in the United States of America, should also be tried under Indian conditions.

63. We do not propose to consider in this Report various types of fixed engines, traps, missiles used in different parts of the country, as they are not of any great importance for increasing fish production in the country.

64. We have not been able to obtain detailed and accurate statistics of the rise in prices due to the war of various articles required by the fishermen in connection with their profession, but we give below a summary of the information received in reply to our Questionnaire.

	1	Pro-war Prices	1994 prices
		2	3
		Rs.	Rs.
<i>Punjab</i>			
Cotton yarn (bundle of 5½ seer)		2/12	13.
<i>Bengal</i>			
"In regard to boats, prices of boats have gone up 500% and the black market prices of other goods show a such bigger increase; coal tar price is Rs. 60 a maund against the standard price of Rs. 4 a maund."			
Cotton yarn (for 10 lbs.)		4	25
Coal tar (per maund)		1/8	60
Wood (per ton)		280	900
Nails (per owt.)		9	11
<i>Sind</i>			
"Supplies very scarce and cost prohibitively high"			
<i>United Provinces</i>			
"Prices of craft and tackle material have gone up about 400%."			
<i>Madras</i>			
"It is difficult to procure or build new fishing boats today. Timber supplies are all controlled, so are copper sheets and the steel products required for the building of boats. Great difficulty is experienced in procuring supplies of fishing hooks."			
"Yarn, ropes and jute prices have gone up very high. Prices of oil preservative gone up 400%."			

	1	2	3
		Rs.	Rs.
Bombay			
Coal tar (per maund)		—/13	7
Cotton yarn (per maund)		20	112
Resin (per maund)		1/4	60
Ropes and nets		150	650
Timber (per kandy)		15	150
Sail cloth		...	5-8 times of pre-war prices.
According to the Memorandum submitted by the Bombay Muslim Chamber of Commerce prices of twine cotton, hemp, tar, coir ropes, hooks, etc. have gone up "8 times the pre-war prices".			
Baroda			
Cotton yarn (bundle of 10 lbs.)		5 12/8	20
Hemp (per maund)		16	40
Coir rope (per md.)		12/8	26
Tar (per md.)		7	200
Bark (per md.)		2	8
Mysore			
Prices of yarn and hooks gone up 300%.			

The poverty stricken fishermen find it beyond their means to purchase the articles required for their profession at the prevailing high rates. The costs are so high that it is not possible even to carry out urgent repairs much less to think of renewals. The Sub-Committee are glad to note that the Government of India are exploring the possibilities of meeting the requirements of fishermen by bulk purchase of the articles and distributing them at controlled rates. We recommend that supplies of controlled articles, such as timber, steel, copper, etc., be released as far as possible for meeting the urgent needs of the fishing industry, and the supply of more expensive crafts and gear subsidised by Government.

VIII.—Assembly, Transport, Distribution, Marketing and Prices

65. The organization and arrangements for handling, assembly, transport and distribution of fish vary widely from province to province and even from centre to centre. In general they are very primitive, and highly unsatisfactory from the point of modern standards of hygiene and the interests of the producers and consumers. A good general account of these is to be found in the Marketing Report, and all that we propose to do is to point out the most serious defects and handicaps of the industry, and, so far as possible, to suggest ways and means for improving the existing conditions.

66. Fish, it need hardly be stressed again, is a highly perishable commodity, and in tropical conditions such as prevail in almost all fishing centres, the chances of its becoming tainted and decomposed through bacterial action and autolysis during the relatively long interval that elapses between its capture and the time it reaches the consumer are very considerable. It does not seem to have been realized in this country that the real value of fish does not consist in quantity but on the condition in which it is made available to the consumer. In Europe and America strict adherence to hygienic and improved methods of preservation and packing coupled with efficient and rapid transport arrangements ensure that the fish even from distant fishing centres reaches the market in a more or less fresh state. Rigid inspection and control are exercised by the health and sanitary authorities to see that no fish which is not fit for human consumption is sold in the markets. It is thus clear that equally with such measures as may be taken for increasing production of fish in the country it is essential that efficient arrangements are made for the handling and preservation of the catches and for their proper preservation, storage and rapid transport from the fishing vessels to the consuming markets.

67. Unfortunately very little attention has so far been paid to the essential requirements of fish trade in connection with preservation, handling and transport, and as a result even the relatively small produce of India's undeveloped

fisheries cannot be fully utilized. Several instances of large catches of fish having to be destroyed for lack of adequate facilities for their preservation and transport have been brought to our notice. Our attention has also been directed to the very primitive and wasteful methods of curing of fish by drying, salting, etc., which are in vogue in most maritime provinces and states for some 50-60 per cent., of the total catches of sea fish; for want of adequate facilities these cannot be transported in the fresh state from the fishing to the consuming centres.

68. Proper preservation of fish, on which naturally depends the condition in which it reaches the shore and assembly centres, is not possible on board the type of fishing crafts plying in Indian seas. There is no place in a catamaran where the catches could be safely stored and preserved through cold storage equipment or with ice. This is equally true of the larger boats. Further, as all crafts take a fairly long time in getting back to the shore considerable time must elapse between the time of capture and landing of the fish. During this time even in the larger boats fish are heaped pell-mell in the open holds where they remain exposed to sun and weather. These crafts are not equipped with any cold storage plants, and the fishermen seldom are able to take ice with them for preserving their catches. The position of the ice supply for fishing industry in India is very acute, but, even if sufficient quantities were available, its use would to a great extent be militated by the limited space available on board the vessels and the long time taken in journeys to and from the fishing grounds. Practically in no case are fish gutted and cleaned prior to storage, and covered as they are with slime and blood the chances of their deterioration during the time that elapses between capture and landing are very great. As after arrival on shore also practically no precautions are taken for preventing further decomposition the catches have to be either quickly disposed of in the nearest markets or preserved by drying or salting. This state of affairs naturally greatly limits the range of distribution for most of the catches, particularly in the extensive coastal areas. Very little attention is also paid to cleanliness in handling and packing of fish. Fish from the boats are usually carried in open baskets which are seldom cleaned; they are often encrusted with slime, dried blood and dust. Even fish in prime condition when carried in such containers is susceptible to contamination by contact with putrifying remnants in the containers, and its chances of reaching the market in a wholesome condition are materially lessened. Even where fish are packed with ice for transport over comparatively long distances, no attention is paid to the quantity of ice required for the proper preservation of the fish in each consignment. Usually fish are packed in baskets or boxes with a thin layer of crushed ice over the top layer. While the distributor may feel satisfied that he has packed the maximum quantity of fish in the minimum number of boxes he forgets that fish so tightly packed with only a limited quantity of ice above it cannot possibly arrive in a condition suitable for human consumption. Similarly loosely packed fish with insufficient ice are through rough handling during transport invariably crushed and squeezed out of shape. In addition to the minimum quantity of ice required for proper preservation, which is about half the weight of the fish, full allowance must be made for its melting *en route*. In short there are four important factors which have to be considered in connection with the proper preservation of fish: (1) interval between capture and icing, (2) method of handling and icing, (3) quantity of ice in proportion to the weight of fish and (4) suitable boxes in which the fish should be properly packed. In regard to packing boxes it may be noted that even in temperate countries where this system of transport is adopted, insulated boxes are used as far as possible. For example, boxes made of Balsa wood—which has an exceptional low thermal conductivity—are used for distribution of fish in some parts of the United States of America, where cold storage wagons are not available for transport. Experiments will have to be carried out to find some suitable Indian light timbers with a low thermal conductivity for fish boxes in India. In this connection we would invite attention to a light cheap, non-returnable type

of insulated box made of woven bamboo plates insulated with straw and lined internally with ordinary paper rendered water-proof by chemical treatment, made by the Department of Marine Biology and Fishery of the Travancore University. It weighs 10-11 lbs. and its fish carrying capacity is 70 lbs. The boxes, we are informed, have been found satisfactory for transport of frozen fish from Trivandrum to Bangalore, a journey of over 48 hours involving two transshipments *en route*.

69. In the absence of modern appliances such as suitable types of cold storage plants for the freezing of fish, refrigerated vans and insulated cold storage wagons in the country, ice is the only agency which has to be used for the transport of fresh fish over any distance. Even before the war the position of ice supply in the country was far from satisfactory. According to the Marketing Report there were about 275 ice factories operating in India in 1939, but the supply from very few of them was exclusively reserved for the fish trade. As a result only limited quantities at uneconomic prices were available for the fish trade. In most inland areas, however, where ice is available it is used for the transport of fish to distant markets especially during summer, but as a result of heavy cost the quantity used is seldom sufficient for the proper preservation of fish during the time taken in transport over relatively long distances. On the other hand, in most of the coastal areas where large quantities of sea-fish are caught, there are no ice factories and practically nowhere ice is readily available; even at present the fish-carrier launches of Bombay have to carry necessary supplies of ice with them on the outward trip. Practically all the witnesses who appeared before us were unanimous that owing to the exceptionally heavy demand for ice only very limited quantities of ice are now available for the fish trade, while the prices of ice have shot up beyond all limits. This is also borne out by the replies to our Questionnaire. In some of the provinces it has been found necessary to control prices of ice, but in the absence of sufficient supplies these measures are not likely to prove effective for meeting the essential requirements of the fish trade. We are informed that a number of factories have stopped working as the necessary chemicals and spare parts of the machinery are not available in the country. In the interest of the fish trade and urgent considerations of public health we recommend that all attempts should be made to get more factories established in as many fish trade centres in the country as possible and that the produce of these factories be reserved for the fish trade. In the absence of detailed information we are not able to make specific recommendations in regard to the number of factories, but suggest that the Provincial Governments and State authorities should immediately undertake a survey to find out the minimum number of factories which are considered essential for each area. Meanwhile the Government of India should explore all possible avenues for importing the necessary machinery and plant for such factories and give all essential help for their erection and working.

70. The importance of mechanical refrigeration for the preservation, storage and distribution of fish was realized in Europe during the first decade of the present century and great advances were made in the development of efficient machinery following a period of trial and error investigations and discoveries of new processes. In 1920, the United Kingdom Board of Scientific and Industrial Research appointed a Fish Preservation Committee constituted of Professors Bayliss, Stanley Gardiner, Hopkins, McLennan and Nuttal, and their interim report on the methods of freezing fish with special reference to the handling of large quantities in gluts (H. M. Stationery Office London, 1920) provides a valuable document in regard to the more suitable methods for the preservation of common fish. Great advances have since been made both in Europe and America, but unfortunately in the absence of necessary guidance and supervision by the authorities, construction and maintenance of cold storage plants in India has been carried out on anything but up-to-date lines. As a result of the Sub-Committee's inspection of the several cold storage

plants for the preservation and storage of perishable food materials such as vegetables, fruit, meat and fish in Bombay, we are of the opinion that practically none of these are really suitable for the proper preservation of fish. While the importance and usefulness of mechanical refrigeration have been well appreciated by enterprising capitalists, the lack of technical guidance and the complete absence of Municipal or Sanitary legislation relating to the preservation and storage of food materials are responsible for the unsatisfactory condition of the storage plants and the imperfect and unhygienic methods followed for preservation and storage. The fish stored under the existing conditions not only involves a great deal of wastage of good food but is a source of serious danger to public health. We have no doubt that in any other civilized country most of the fish in these cold stores would be condemned as unfit for human consumption. All the plants in Bombay which we examined are constructed more or less on the same plan, employing the "direct expansion system" in which liquid ammonia is delivered directly to the coils in the storage rooms for evaporation. Most of these plants also manufacture ice. In some of the plants separate rooms are set apart for different commodities, but in the smaller ones all types of perishable articles are stored in one or more rooms. Large quantities of fish, both big and small, are heaped on the floor and only in exceptional cases are they arranged on shelves. Before the monsoon months large quantities are also frozen in ice blocks irrespective of whether the particular species of fish are suitable for such treatment. If one may judge from the fact that the cooling coils were not frosted at the time of our visit, the temperature in the cold storage rooms could hardly have been below 32°F. Inside the rooms the atmosphere was stale and foul smelling, and it was hardly possible to stay there for more than a few seconds. The fish in storage showed none of the signs of well preserved fish—in most cases the skin was dull, spotted or slimy, the scales loose, eyes cloudy, wrinkled or sunk in, gills yellowish or brown, flesh soft, and the entire fish had a flabby and limp appearance.

71. We are therefore of the opinion that the system of working of the existing plants requires thorough overhauling, and that definite rules and conditions should be laid down for their working and for the erection of new plants. Above all it is essential that cold storage plants should be set apart exclusively for fish and under no circumstances should they be allowed to store other food materials with fish.

72. Detailed experimental work in the country is also necessary for determining whether the "direct expansion system" or the "flooded system" is more suitable for Indian conditions. Further, while it has been established that brine freezing gives much better results than air freezing, none of the plants which we have examined, with the exception of a small antiquated plant at Chandia near Karwar, are employing this process in the country. On the whole the position is unsatisfactory, but for lack of essential data it is not possible for us to make any definite recommendations.

73. As has been noted earlier in this Report, the sea fishing industry of India is scattered, and there are numerous important assembling centres all along its extensive coast-line. Very limited facilities, however, are available for the transport of fish by road or rail from these assembling to the consuming centres in the interior. In Baluchistan, the Las Bela authorities state that the available fish supply exceeds demand, but in the absence of roads it is not possible to transport the fish in the fresh state. In Bombay there is an almost complete absence of coastal communications with the interior either by road or rail. In 1933, the Bombay Fisheries Department tried to meet the situation by introducing power propelled carrier launches for the rapid transport by sea of fish to Bombay from outlying areas such as Karwar, Bhatkal, Daman and Kathiawar, but the problem of supplies to the interior cannot be solved until suitable road and rail transport arrangement can be made. In the case of Madras it is stated that facilities for the transport of "fish from assembling

to consuming centres are non-existent in most areas and unless such facilities are provided, efforts at increased output are not likely to yield much benefit to the community at large. There are at present few good roads connecting fishing villages with consuming centres and unless a network of roads is developed fisheries will never be able to pull their full weight in the national diet. A list of important fishing villages and the main distribution centres to be connected by roads with necessary maps showing the location of the fishing villages and the distribution centres has been sent by the Fisheries Department to the Road Development Engineer in connection with the post-war road development schemes. With a network of good roads the question of transporting fish will become easy." Similarly we are informed that a road construction scheme for connecting the rich fishing areas in the delta of the Mahanadi with Cuttack in Orissa is under consideration of the Government of Orissa. A good network of roads, and a fleet of insulated motor vans would go a long way towards solving the problems of transport and distribution of fish. We, therefore, recommend that the question of providing suitable road communications between important fishing centres and the large consuming areas in all Provinces and States should receive immediate attention.

74. Railways are one of the most important agencies for the transport of fish, both fresh and preserved in the interior. A good account of the arrangements and concessions allowed in tariff rates is to be found in the Marketing Report. We have received a number of complaints regarding the unsatisfactory situation in regard to rail transport resulting from the prevailing wartime conditions. In view of the great importance of fish as an important article of food and its very perishable nature, we would urge that high priority be allotted to consignments of fresh fish, and in the case of the more important consuming centres arrangements be made for the rapid transport of as large supplies as possible. Special facilities should also be provided for the transport of stock-fish, fry and fingerlings required in connection with the development of fisheries. As conditions improve arrangements should be made to provide refrigerated wagons for the transport of fresh fish from main fish supply centres on the sea coast to all large towns in the interior of the country; such an agency alone will make available at reasonable rates sufficient quantities of good and fresh sea fish in the inland towns.

75. Harbour facilities for fishing boats in India are extremely limited. While there are a number of good harbours along the Arabian Sea coastline, the number of such harbours on the eastern coastline in the Bay of Bengal is quite negligible—this is why catamarans are the main type of fishing crafts of this area. Even in the case of the really good harbours, such as Bombay, only very limited facilities are available in respect of docks, jetties, landing piers, cranes, winches and other equipment required in connection with fishing activities. We were told that in the Bombay harbour no *Bunder* is reserved exclusively for the requirements of the fish trade, and that there are no facilities for the speedy and efficient unloading of fish or for loading of ice and other materials required by the fishing boats. The existing facilities are totally insufficient even for the requirements of the undeveloped fish trade of India. Therefore, if the sea fisheries are to be effectively developed, suitable port facilities must be provided for trawlers and other power vessels which would be required for the purpose. At the same time the needs of the smaller crafts must also be kept in view. In this connection we would also recommend for the consideration of the authorities, the provision of necessary space for the beaching of fishing boats, drying of nets and other cognate activities. Space for the establishment of cold storages and ice factories near the fish landing sites will also have to be provided. We are informed that the Madras Fisheries Department have already sent up proposals to the Government of Madras in regard to the need for providing harbour facilities on the East Coast, and suggest that these should receive early consideration. To sum up, we have no doubt that the problem of harbour facilities is so serious that we strongly

recommend that, as in the case of the United Kingdom, a special Commission should be appointed to carry out a general survey of harbour facilities and cognate requirements for the development of the fishery industry in the country.

76. The middlemen have been and are still using fast boats for collecting and transporting river fish and sail-boats for collecting sea fish from the fishing grounds in the foreshore area. While the limitations of these crafts are obvious, power propelled boats have the advantage of speed, greater cruising capacity and finally of not being dependent on wind or tide. Motor and diesel oil engine boats were first used in Bengal, in 1929, for the transport of fish catches from different parts of the estuarine areas of the Sunderbans to the Calcutta markets. Details of the exact number of boats working in the area are not available, but it is stated that they resulted in a great development of the fish trade in the area. These boats, however, stopped working since 1942. In 1933, the Government of Bombay initiated a scheme with one power propelled boat and further boats were added from time to time and in 1941 the number had increased to 10. The quantity of fish carried by these launches increased from 2662 lbs. in 1933, to 11,95,736 lbs. in 1940. Since that date a number of the launches were diverted for war work, while some have been laid up owing to no suitable marine diesel engines or spare parts for replacement being available in the country. A number of launches with converted land engines still carry on transport of fairly large supplies of fish to Bombay after the monsoon. Suitable marine engines are, however, essential for efficient working of such launches, and we are glad to note that the Government of India are taking necessary steps for their import from abroad. For reducing to the minimum the time taken for the transport of catches from the fishing boats to assembly centres on shore the use of power propelled vessels with insulated holds in which fish can be carried in ice, appears to be the only solution.

77. The conditions both in the wholesale and retail fish markets throughout the country are highly unsatisfactory. We feel convinced that no real reform is possible unless the entire system of fish sales is changed, and special markets run under the direct supervision of sanitary and Public Health authorities are organized at least in all the larger towns having populations of over 25,000 inhabitants.

78. Prices in general are regarded as a good index of the degree to which the potential demand for a commodity is being met by the available supplies. No detailed statistics of the increase in prices of fish throughout India since 1939 are available, but from the replies to our Questionnaire it is clear that the prices in most large towns in practically all the provinces have risen very high. In some cases they are reported to be 5-6 hundred per cent. above the pre-war level. This is a more or less conclusive proof of the supplies being very much less than the demand. Normally price should be such as to ensure for the producer a fair return for his labour and investment. The fishermen unfortunately working under the handicaps detailed in earlier paragraphs seldom receive a living wage much less a fair return, and practically all the plums of the trade are collected by the middlemen wholesalers, who constitute the sole distributing agency. The number of middlemen varies with the scope and density of the fishing operations, the regularity of the supplies, the nature and extent of the processing operations such as cold storage, drying, salting, canning etc., the retailing and delivery services, the transport facilities and the volume of the trade and finally the rate of turnover. As distribution constitutes only the final link between the producer and the consumer, trade margins should be subject to adjustment based on a correct evaluation of the cost of materials and charges for labour and service. The prices of various articles as also the charge for labour required for preservation and packing of fish have increased very materially within recent years. and transport cost per mile is also fairly high, but the large margins between the producer's shore

and the price which the consumers have to pay can hardly be justified by these increases, and such fair margins of profits which the traders must realize on the capital investment involved as also on the volume of turnover. A review of the present position leaves no doubt that while both the producers and consumers continue to suffer, the middlemen-traders make enormous profits at their cost. At this stage it is obviously impossible to make any specific recommendation but we are of the opinion, that the problem of devising methods which would help in the development of fish trade along proper lines and improve the economic position of fishermen deserves most earnest consideration on the part of not only the Central Government, but also all the Provincial and State Governments.

79. Certain stages of distribution appear to offer considerable scope for reduction of costs, for example savings on transport and handling costs resulting from centralization of distribution over a large area should result in great economy. Similarly the distribution of dressed fish rather than whole fish would materially reduce the total weight to be transported. At the same time the establishment of large central markets where producers and consumers could meet and themselves perform part of the functions now performed by the trade would eliminate some of the middlemen. We understand that State intervention to eliminate middlemen and control price of fish, is being attempted on a small scale in the United Provinces and the Central Provinces; we welcome this move, but would like to add a note of caution against extending it all over the country without a careful consideration of all the factors involved. Some Provincial governments have prohibited or restricted exports of fish from their respective areas, while others have contracted to arrange supplies on a large scale without accurate data in regard to annual production, normal requirements of the area calculated on a *per capita* provision for their fish-eating population, estimates of present exports, surplus available and other allied factors. In our opinion such measures should not be taken up without a searching enquiry and collection of necessary data, which alone would enable an all-India policy being laid down for the proper distribution and full utilization of the available supplies.

The available information in regard to production, distribution and marketing of various species of edible fish all over the country is quite inadequate for determining the costs of production, and fixing equitable wholesale and retail prices. Unless detailed data becomes available, it is not possible to suggest any measures for the fixation of fish prices. The only available information in the *Report on the Marketing of Fish in India* is neither sufficiently specific nor detailed, and we, therefore, recommend that special staff be appointed for collecting detailed data in regard to the costs involved in production, preservation, handling, transport and marketing of fish in a number of selected areas in various Provinces and States.

IX. Curing or Processing of Fish

80. In all fishing centres where facilities for quick transport are not available, curing is resorted to for conserving the surplus catches. To encourage this branch of the industry various Provincial and State Governments have established fish curing yards at most important fishing centres. The curing yards, however, are not constructed on up-to-date lines: there are in most cases no facilities for hygienic curing and the salt supplied is of poor quality. As a result the cured fish besides being poor in nutritional value is very foul smelling, and unattractive. Some curing in Sind, Bombay and Bengal is also carried out on board the fishing boats, but the results in these cases also are not very satisfactory. There are sufficient reasons to believe that if the curing yards were provided with efficient arrangements for washing and cleaning, for salting and drying, and if all operations were carried out under the supervision of properly trained officers, the quality of cured fish could be very considerably improved.

81. The main defects of the present systems of curing may be summarised follows:

(1) Curing is usually done when fish are already partially decomposed. There is a considerable interval between the time of catch and the time of curing and during this period exposure to natural conditions causes partial decomposition.

(2) Curing is conducted under very unhygienic conditions. On reaching the shore fish are carried in wicker baskets, which are usually encrusted with dirt, slime and blood accumulated through repeated use, and in the curing shed heaped on bare ground. The sheds are often insanitary and the workmen constantly trample the fish with dirty feet. In short every stage in the process of curing and packing is characterised by complete disregard of any hygienic principles.

(3) Salt used for curing fish is generally of inferior quality. It contains a very appreciable percentage of salts of calcium and magnesium and organic matter of marine origin. The presence of calcium and magnesium salts causes a definite whitening and stiffening of fish. Moreover both these salts impart a strongly bitter taste to the salted fish. The presence of these impurities makes ordinary common salt highly hygroscopic, and this in turn affects the keeping qualities of cured fish.

(4) The arrangements for the drying of fish are very primitive and highly unsatisfactory. Usually fish are spread on the sandy shore to dry in the sun, though sometimes matting is also used. During the process they often become fly-blown and maggots are commonly found in the semi-dried fish.

(5) Packing for transport is very imperfect. In most places, especially in South India, cured fish is tightly packed in ordinary palmyra mats.

82. The dried and salted fish produced in India is of a very inferior quality and in most cases is very foul smelling. The crude unhygienic methods of fish curing now in vogue are very wasteful and uneconomical, and as a result a very large percentage of the total fish supply of the country is rendered unsuitable for general use.

83. In the following table taken from the Marketing Report are given details of the fish curing yards in the different Provinces and States:

Table showing the distribution of the fish curing yards and the average quantities of Fish salted in them.

Name of district or section	No. of yards.	Length of coast line.	Average quantity of	
			fish brought for curing.	salt issued.
			Mds.	Mds.
West Coast				
1. Ratnagiri district	18	90	6,974	1,979
2. North Canara dist.	14	80	7,395	1,969
3. South Canara dist.	22	150	6,585	3,636
4. Malabar dist.	34	90	17,767	
5. Cochin	2	41	15,954	1,700
6. Travancore	12	172	5,635	1,486
East coast (Madras)				
7. Southern Section	14	1,150	4,159	872
7a. Central Section	9		10,029	1,499
7b. Northern Section	26		3,664	498
8. Orissa	4	..	..	..

The fishcuring yards of India, 155 in number, are a unique official institution, and were started for controlling the issue and use of duty-free salt for fish curing. They were established as a result of the recommendations made by Dr. Francis Day following his extensive enquiries on the marine fish and fisheries of India in 1873, and have to some extent helped in improving the quality of cured fish. In the yards salt is issued duty-free, but the poor fishermen find

cured outside the official fish curing yards in different Provinces and States is about three times of that processed in the yards themselves; and of this the sun-dried fish amounts to nearly 2½ times that of the salted fish. The following statement from the Marketing Report shows the amounts of fish cured by different processes in various maritime Provinces and States:

Statement showing the amount of fish cured in India. (in thousand maunds.)

Province/State	Government fish-curing yards.			Outside fish-curing yards.			Grand Total
	Wet-salted	Dry-salted	Total	Sun-dried.	Salted.	Total	
Sind	9	44	53	22	Neg.	22	75
Bombay	101	210	311	453	24	477	788
Madras	120	1,200	1,320	1,609	85	1,694	5,014
Travancore	Neg.	68	68	410	1,274	1,684	1,752
Cochin	7	27	34	167	9	176	210
Orissa	2	19	21	95	3	98	119
Bengal . . . . .	..	..	..	850	150	1,000	1,000
Baluchistan . . . . .	..	..	..	15	20	35	35
Kathiawar . . . . .	..	..	..	20	1	21	21
Assam . . . . .	..	..	..	50	15	65	65
Other areas . . . . .	..	..	..	21	3	24	24
	239	1,568	1,807	3,712	1,584	5,296	7,103

84. In general the type of curing depends upon the amount of fish to be cured, the season, the materials available for curing, and finally the length of time for which it is proposed to store the fish before consumption.

85. The basic principles in connection with the preservation of fish by salt are fully discussed by Mr. H. F. Taylor, Chief Technologist, U. S. Bureau of Fish and Fisheries, in his paper "Principles involved in the Preservation of Fish by Salt" (1922), and the following paragraph from this paper deserves special attention in connection with the salting of fish in India.

"The details as conveyed to the fishermen for handling the fish were:

(1) Avoid (a) bruising the fish in removal from gill nets; (b) walking on, and (c) piling deep in boats; (2) salt as soon as possible, (3) wash and scale in cold water; (4) behead and eviscerate and (a) scrape out kidney or (b) split nearly through to the back and lay open; (5) wash in weak brine to remove all traces of blood. (6) rub with fine salt of a high degree of purity and pack backs down in a barrel, leaving fish lightly covered to form their own brine: (7) after they have been struck through pack down and add other fish of the same lot to fill barrel and (8) in conclusion, (a) heap up barrel and pour saturated brine into bunghole to cover fish for storage, or (b) if to be sold for consumption at once, take out of the brine and rub in fine dry salt, then pack in sugar barrels or other light containers and ship immediately."

86. As is clear from the observations quoted above, care and cleanliness in the handling and gutting of fish, temperature, purity and quantity of salt, salting as soon as possible after capture and for sufficient period, and finally careful packing are essential for the success of salting operations.

87. The salt supplied in fish-curing yards is invariably the so-called solar salt prepared by the slow evaporation of brine obtained either from the sea or subsoil in open pans. Solar salt of this type generally contains about 4.5 per cent of saline impurities (calcium and magnesium sulphates and chlorides), 0.5 to 1.0 per cent of insolubles and 12 per cent moisture. Impure salt of this composition is not at all suitable for fish curing and it is essential that supplies of better quality of salt should be made available for fishing industry. Increased costs and arrangements for manufacture are factors to be considered in connection with the supply of pure salt, but our attention has been directed to an improved method of salt manufacture recently perfected by the Travancore University. In this method no elaborate arrangements or machinery are

necessary, and it can be easily adopted by the salt manufacturers of India, without radically altering the layout of their existing pans. At the same time it ensures the production of very good salt which contains only 1.2 per cent of saline impurities, 0.2 to 0.5 per cent. insolubles and 5.8 per cent. of moisture. The saline impurities, can be further reduced by a final spraying with fresh water, and the moisture content can also be lessened through further drying. With these additional precautions it should be possible to obtain salt almost as pure as any imported salt.

88. In view of what has been stated above there can be little doubt that unless as pure a quality of salt as possible is supplied there is little hope of bringing about any improvements in the cured fish products. We therefore strongly recommend that the matter should receive immediate attention at the hands of the Government of India, and that early arrangements be made for improving the quality and providing sufficient quantities of salt at cheap rates.

89. We have already referred to the almost complete absence of research work on the processing of fish in the country, and in this connection would invite the attention of the Government to the great importance attached to it in other countries. For examples, in 1927 the Imperial Economic Committee (Fifth Report—Fish Comd. 2934, paras. 77 to 98 and 162 (XV to XXIX) emphasised the importance of this kind of research and made a number of recommendations including the following:

“We believe that first essential the *sine qua non*, for all improvement of organisation lies in the study and application of better methods of preserving fish at an economic cost.

“So we reach our principal recommendation, which is, that research should be instituted with a view to improving the methods of preserving fish from the moment when it has been caught to the moment when it reaches the consumer.

“We think that this Research should be based on (a) a Central Station at a fishery port in Great Britain; (b) a specially constructed vessel.....”.

“As a result of the Committee's recommendations increased funds were made available by means of grants from the Empire Marketing Board, and the Department of Scientific and Industrial Research established a research station at Torry on Aberdeen harbour. This station consists of two buildings, formerly part of a shipbuilding yard. One has been converted into biochemical and bacteriological laboratories, and the other has been equipped for various experiments in connection with cold storage, smoke-curing, oil-extraction, etc.” The research at Torry Station is carried out in two main fields, namely, work on the preservation of fish for consumption and work on such processes as salting, smoking, the extraction of fish oils, etc. “The micro-organisms which are largely responsible for the rapid deterioration of fish are being studied at Terry in co-operation with the Bacteriological Department of Aberdeen University. A preliminary investigation made at sea in the summer in 1927 showed that the rapid deterioration of fish caught and handled commercially is due, not to intrinsic changes—for the flesh of fish has a slow intrinsic rate of deterioration—but to the post-mortem invasion of bacteria, some present when the fish is caught, others acquired during the process of gutting, handling and storing. This observation immediately opened up a line of practical experiment. Two stream trawlers were chartered during the summer and autumn of 1928, and were fitted with various devices designed to ensure more cleanly handling and more effective storage in ice than obtains in ordinary commercial practice”. At the Torry Station research is also undertaken on effects of freezing on fish and changes which occur in tissues following cold storage. It was found that the ill-effects of changes in the texture, flavour and appearance of fish can be reduced by a combination of quick freezing and storage at low temperature. As a result of the work at this Station it has been established that haddock, fresh from the sea quickly frozen in brine at a temperature of 5°F., and subsequently stored at the same temperature or lower lost nothing in appearance or palatability, even after six weeks and furthermore proved highly suitable for smoke-

curing. Similar work in connection with other species of fish is also being carried out. Other lines of research in progress at the Station embrace work on smoke-curing of fish, investigations into methods of preserving fish, handling, and packing for transport.

90. In view of the above and the urgent research requirements of the fish industry in connection with the processing of fish, we recommend that pending the establishment of the proposed Central Fishery Research Institute, the Government of India should send as soon as possible a sufficient number of State scholars to the Torry Research Station, Aberdeen, for training. On their return this trained personnel may be attached to the Fisheries Departments of Madras, Bombay, Travancore, and other Provinces and States, for initiating and carrying out detailed researches on the preservation and processing of fish. Our conviction is that without such basic research no real improvement in the existing methods of curing is possible.

X. Shark Liver Oil Industry

91. We propose in the following paragraphs to consider the position in regard to a very important industry which has recently been established in connection with the manufacture of Shark Liver Oil in the country. Shark liver oil as indeed all fish oils are rich in vitamins A and D. In view of these properties they are of importance not only in connection with the nutritional requirements of the people, but as substitutes for Cod and Halibut liver oils which, owing to the prevailing war conditions, are no longer available. Mr. K. V. Giri of the Department of Biochemistry, Indian Institute of Science, Bangalore, in a recent paper in *Science and Culture* (Vol. X, No. 7, Jan. 1945, pp. 275—281) has given a resumé of the work done in India and other countries on the vitamins A and D contents of fish liver and body oils.

92. In India the manufacture of medicinal fish-liver oil was started in Cochin about 1852. In 1854 owing to the limitations of space in British Cochin the centre of manufacture was shifted to Calicut, and manufacture was placed under the direct supervision of the Civil Surgeon of Malabar. In 1871 the Madras Government resolved to discontinue manufacture owing to the heavier cost of the indigenous oil as compared to that of the imported Cod Liver Oil. A short note of the history of the fish-oil industry in India was included by Surgeon Major Francis Day in his Report on the Sea Fish and Fisheries of India and Burma (1873).

93. Since 1934 the Madras Fisheries Department began to interest itself in the manufacture of Shark Liver Oil on an extensive scale. In 1941, 40,129 lbs. of oil were manufactured while in 1943-44 the amount rose to 62,206 lbs. In Bombay the production rose from 500 gallons in 1940-41 to 2000 gallons in 1943-44. Information regarding the quantities produced in Travancors, Sind and other parts of the country is not available. The Madras and Bombay Fisheries Departments have evolved detailed techniques for the preparation of Shark liver oil, but no information is available regarding the methods followed in other parts of the country.

94. In 1940 Dr. W. R. Aykroyd, Director of Nutrition Research, Coonoor, in a detailed note urged the necessity of developing the production of Shark liver oil in India as a substitute for Cod liver oil, more particularly for combating diseases like keratomalacia due to vitamin A deficiency. In his note he remarked: "Hospitals, dispensaries, and infant welfare centres all over the country are clamouring for a cod liver oil substitute. There would be little difficulty in disposing of the oil in quantity at reasonable price. Another point is that there may be a large demand in England for vitamin A concentrates, now that European cod liver oil fisheries can no longer operate. Vitamin A concentrates are also needed for 'synthetic cod liver oil' and 'vitaminising' margarine. It is conceivable that potent fish liver oil produced in India might command a high price in England, if the war continue for some time." In regard to the methods of manufacture he added, "Oil produced by these relatively crude methods would be of great value for therapeutic purposes. It

would, of course, be better if all samples put on the market were to have their Vitamin A potency tested and be brought to some uniform standard. An oil with specified vitamin content is greatly to be preferred because then the physician knows what dose is to be given."

95. As a result of the interest aroused by the Imperial Council of Agricultural Research the Fishery Departments of all maritime Provinces and States have developed fishing for sharks and allied fishes on a large scale, and arranged for the extraction of liver oil. Owing to the relatively simple technique its production not only are official agencies of Fishery Departments engaged in the manufacture of oil, but extraction is also carried out by the fishermen as a cottage industry in Madras, Bombay, Sind, Travancore and Baroda. The crude products prepared from the livers of various species of sharks and allied fishes is collected by the Fishery Departments of Madras, Bombay etc., and after dehydration and clarification is blended with some vegetable oil for standardizing its vitamin A content. In the case of Travancore, however, only unblended oil is supplied. So far as we are aware no official standards for the manufacture or blending of the Shark liver oil have been laid down by any competent authority in India, but various industrial concerns are placing on the market different proprietary preparations in the form of blended oil or concentrates. We were informed at Bombay that some of those preparations were, on analyses, found to consist mainly of groundnut or some similar cheap vegetable oil with only traces of Shark liver oil.

96. In the interests of public health and if the Indian Shark Liver oil industry is to survive the competition it will have to face from highly organized Cod and Halibut liver oil industries of Europe in the post-war period, it is essential that detailed research should be carried out for improving the methods of extraction, purification and standardization, and for the preparation of concentrates. In this connection we append (Appendix II) a memorandum on the purification, and manufacture of concentrates from the shark liver oil and river fish oil prepared by Dr. M. K. Basu of the Board of Scientific and Industrial Research for the consideration of the authorities. Further, we recommend that definite standards for therapeutic products of Shark liver oil for human consumption whether pure, blended or in the form of concentrates be laid down by some official agency, such as the Nutrition Research Laboratories, Conoor or the Biochemical Standardization Laboratory, Calcutta. The Drugs Act of 1940 provides the necessary legislative powers for dealing with adulteration of drugs and therapeutical products, and once the standards have been laid down it should be possible for the Provincial Governments to issue necessary notifications under Section 33 of the Act for the examination and control of products placed for sale on the market. The question is of so great urgency that we strongly recommend that early action be taken along the lines suggested above.

XI. Subsidiary Fishery Industries

97 We are convinced that the development of subsidiary industries for the production of fish meal, fish manure, fish oil, fish glue, isinglass etc. by utilization of fish wastes and offal, and fish not suitable for human consumption is essential not only for providing additional employment and income to the poor fishermen, but for ensuring the utilization of the valuable resources—which are now wasted—to the best advantage. The Madras Fisheries Department carried out very valuable pioneer work in this connection and was successful in starting a number of important industries. Lack of enterprise, capital, suitable machinery, intensive research and sustained propaganda, however, appear to have been responsible for none of these industries being developed and established on a commercial scale. While the establishment and success of these and other industries, both as cottage industries and as commercial enterprises, is not possible without a properly equipped and staffed Central Research and Training Institute, we would urge the necessity of all steps being taken by the Fishery Departments to encourage, foster and develop such industries throughout the country.

XII. Conclusion

98. A careful consideration of the present position and varied needs of the fish industry has convinced us that no piece-meal and haphazard programmes of development would be of any use for placing this backward industry on a firm footing. We, therefore, strongly recommend that a comprehensive long range programme be adopted and put into operation at as early a date as possible, and that, as in the case of other projects of the Government of India, relegated consideration to a post-war period.

XIII. Summary of Recommendations

99. As a result of a careful review of the present position of the fisheries and fish trade in India we are convinced that material increase in fish production or the development of the extensive and varied fishery resources of the country is not possible unless a comprehensive programme based on an all-India policy of survey of fishery areas, initiation and coordination of research, conservation, development and exploitation of fisheries, improving the socio-economic position of fishermen, providing more efficient and modern crafts and tackle, and organizing the fish trade on proper lines is adopted (paras. 3, 9 and 10). For placing the very important but neglected fish industry of India on a firm footing and developing it, we have recommended that the Government of India should provide the necessary funds, staff and machinery for affording both direct and indirect assistance and take early steps to implement the recommendations made in the Memorandum on Post-War Development of Indian Fisheries (paras. 20 and 21).

100. In regard to Inland Fisheries, we have discussed the urgent necessity of conserving and increasing the fish populations of rivers and streams, and have suggested the formation of a Central Water Board consisting of engineers, fishery experts, and administrators for dealing with the urgent and multifarious problems of conservation (para 32). In connection with the development of fisheries in impounded or enclosed areas of waters our recommendations are detailed in para. 36, while the measures for the protection of brood and young fish are discussed in para 38. The development of suitable fishing techniques for exploiting deep water fisheries is only possible through extensive experimental work and our recommendations in this connection are summarized in para. 39. In connection with the Water Hyacinth Problem, we have recommended the appointment of special Commission of Enquiry for investigating the position and suggesting ways and means for its early eradication. The attention of the Government of Bengal should be directed to the reported deterioration of the rich fisheries in the Gangetic Delta through silting of river mouths and channels, and for taking early steps for their improvement (para. 40).

101. The adequate development and exploitation of the marine fisheries is only possible through the location of suitable fishing grounds by detailed surveys and research, assessing the suitability of different types of fishing crafts and tackle to Indian conditions through experimental work, and provision of proper transport and harbour facilities. The adoption of power boats for sea fishing must be encouraged by the grant of subsidies and loans (paras. 44, 45).

102. As the development of the fishing industry is dependent on the socio-economic position of the fishermen, we have discussed this question in some detail in paras 47—52. We have made a definite recommendation for suitable measures being taken for removing the handicaps of the fishermen and for providing facilities for fishing operations (para 51). We have also suggested that amelioration of the fishermen will be best achieved by organizing cooperative sales societies of fishermen.

103. The position in regard to the fishing crafts and tackle is discussed in paras 59—64. For providing the essential requirements of the fishermen under the prevailing abnormal conditions, we have recommended that arrangements should be made for bulk purchase and sale at controlled rates of various articles

through official agency. Supplies of timber, iron, steel etc., for meeting the urgent needs of the fishing industry should be released, while supply of power engines from fishing boats should be subsidized by Government.

104. Assembly, transport, distribution, marketing and prices are discussed in paras 65—79, and we have recommended that a special survey be undertaken to find the minimum number of ice factories required for each area. Necessary steps should be taken for importing plant and machinery, and facilities provided for their erection and working. In the absence of data we have not found it possible to make specific recommendations regarding cold storage requirements of different areas (para. 72). Our recommendations for providing communication facilities for the transport of fish by carrier launches, road and rail are found in paras 73 and 74, while in connection with the provision of harbours facilities for the fish trade we have recommended the appointment of a special Commission. Our suggestions for reducing the costs of distribution of fish will be found in para. 79.

105. Over 50 per cent. of the sea fish production of the country is cured by rather primitive and unhygienic methods. The defects of the methods employed are detailed in para 81, and the lines along with improvements are possible are indicated in para 86. An urgent need of the industry is the supply of sufficient quantities of salt of as pure a quality as possible at cheap rates (para. 88). Detailed research work is essential for effecting improvements in the processing of fish, and pending the establishment of the proposed Central Fishery Research Institute, we have recommended that a number of scholars be sent to the Torry Research Station, Aberdeen, for training in improved methods of processing fish.

106. The position of recently started Shark Liver Oil industry is discussed in paras. 91—96. For placing this industry on a permanent footing we have recommended that research should be undertaken for improving methods of extraction and for preparation of concentrates. We also consider it essential that some official agency should lay down definite standards for therapeutic products of this oil.

107. Finally we have suggested that subsidiary industries connected with the manufacture of fish meals, fish manure etc., should be started for providing additional employment and income for the fishermen (para 97).

The Committee desire to place on record their appreciation of the valuable services rendered by their Secretary, Dr. Bains Prashad, O.B.E. His special knowledge of the industry and the unflagging zeal shown by him have been of great assistance in the work of the Committee, and rendered it possible for them to complete the Report within such a short period.

Fazal I. Rahimfoola, (Chairman).

Khurshaid Ali Khan.

B. K. Dubash.

J. C. Biswas.

Pir Mohammad.

A. Karmally.

C. C. John.

S. Naimal Hasan.

A. Khaleeli.

Bains Prashad (Member, Secretary).

New Delhi, 18th January. 1945.

APPENDIX I.

QUESTIONNAIRE

(Only such questions regarding which you possess information may be answered.)

1. What is the estimate of fish production during each of the last 5 years in each of the following classes of fisheries: (a) marine, (b) estuarine, and (c) in rivers, tanks and other freshwater areas?

2. Can you give estimates of supply of fish from each class of fisheries to the principal consuming centres? Of the fresh and cured fish supplies (a) what percentage is sent out of the Provinces/State, (b) what is taken over by the Military and (c) what is left for local civilian consumption?

3. What proportion of the supplies of fish is consumed in the fresh state, and what is preserved by drying, salting etc.? What additional facilities, e.g., water supply, salt, drying platforms, curing vats, etc., are required for curing fish, and improving the products to a reasonably wholesome quality?

4. To what extent in your opinion should the supplies of both fresh and cured fish be increased to meet the present demand? What measures have been taken for the development of various classes of fisheries and for stopping up the production of fish?

5. Mention the prevailing fish prices—both wholesale and retail—in each season since 1937, in the main markets. If possible the prices for various important varieties of fish in the local markets for internal consumption and for export to other areas may be separately indicated.

6. In what directions have the trade and economic condition of fishermen been affected in the past five years? To what extent have fishermen given up fishing and gone over to other employments and for what reasons?

7. Are the available supplies of fishing crafts and gear, such as yarn for nets, ropes, coal tar, fishing hooks, stakes, etc. sufficient for the needs of the fishing community? If not, please indicate what increases are needed, and what immediate assistance should be rendered for improving the present position. In reference to these goods information regarding the increase in prices, if any since 1937, may also be supplied.

8. What additional facilities, such as ice, salt, packing materials, transport, etc., are required for the preservation and transport of fish within the Province/State, and for export to the main consuming centres in other Provinces or States to avoid deterioration during transport?

9. Have any subsidiary fishery industries, such as preparation of Shark Liver oil, fish meal, fish manures, etc., been established in the Province/State, and what is their present position?

10. Is there any department in-charge of fishery work in the Province/State? If so, details may kindly be supplied regarding the strength of its technical staff, annual budget and its programme of work.

11. Have you any other measures to suggest for improving the fishery industry, and for increasing the production of fish in such provinces and states about which you possess information? Measures for increasing the fish supplies on a short-term basis and for placing the fishery industry on a permanent footing may please be indicated separately.

APPENDIX II

Non-Technical Note on the purification and manufacture of concentrates from the Shark Liver Oil and river fish oil

Till before the outbreak of the war, a quantity of 164,924 lbs. of Codliver Oil was imported to this country. As this import was practically stopped as soon as the war broke out, vigorous searches were made for a substitute. And it was found that the oil obtained from the shark liver or from the body of the river fish was much stronger in vitamin (A & D) potency than the Codliver Oil.

A good market could not be found for the oil obtained from the liver of the shark or from the body of the river fish, as it is very difficult to digest and long continued use of the oil even in very small doses has a tendency to produce indigestion and other troubles of the liver and intestines. Hence, some sort of purification and concentration of the oil has been absolutely necessary.

As a result of experiments carried out in the laboratories of the Scientific and Industrial Research, this difficulty in administering the oil has been completely overcome, by a process of purification, which eliminates the fatty acids and stearine from the oil. The purified oil is quite easily digested and it keeps for a much larger period than the crude oil. Concentrates with very high potency of vitamins (A & D) have been also prepared from the purified oil by a simple treatment with chemicals and solvents easily available now in the country.

From the by-products obtained in the process of purification of the oil, a good quantity of wax is obtained which can easily form a separate cottage industry. Cholesterol, another important articles of medicine, is obtained from the by-products in fairly good quantity. And by a special bio-chemical process, a substance having vitamin D activity has been prepared from cholesterol, which can also form a very profitable business. Vitamin D activity of this substance was tested in the Research Laboratories at Coonoor, and it was found to be 50 per cent. of the imported stuff.

Process of preparation

From the crude oil, a good quantity of solid materials is first eliminated by simple mechanical means. The process of purification and the preparation of vitamin A & D concentrates now consists essentially in the removal of fatty acids and stearine from the oil, and in the extraction of active principles from the purified oil. For the process of purification, simple mechanical methods were developed at a controlled low temperature. And for further concentration, vitamin (A & D) were separated with the help of a solvent like Alcohol.

