REPORT OF THE

COMMITTEE ON FISHERIES

IN MADRAS

1929

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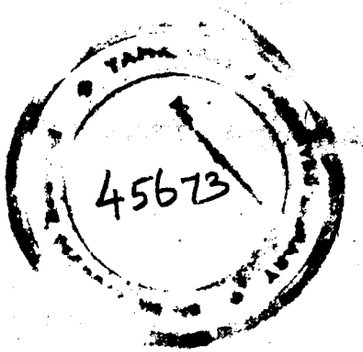

Government of Madras

DEVELOPMENT DEPARTMENT

G.O. No. 1342, 5th August 1929

Fisheries—Committee—Report—Published.

Order—No. 1342, Development, dated 5th August 1929.

The Government direct that the Report of the Committee on Fisheries in Madras shall be published.

2. In publishing this report the Government desire to express their cordial thanks to the President and members of the Committee and to the Secretary to the Committee for their report which will receive early examination and consideration.

(By order of the Government, Ministry of Development)

A. McG. C. Tampoe,
Secretary to Government.

To the Director of Fisheries.
" the Registrar of Co-operative Societies.
" the Director of Public Instruction.
" the Public Department.
" the Director of Industries.
" the Director of Public Health.
" the Local Self-Government (Public Health) Department.
" the Law (Education) Department.
" the Accountant-General.
" the Commissioner of Labour.
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" the President of the Committee on Fisheries.
" the Secretary to the Committee.
" the Members of the Committee.

Press.

REPORT OF THE COMMITTEE ON FISHERIES IN MADRAS—1929.

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REPORT OF THE COMMITTEE ON FISHERIES IN MADRAS—1929.

INTRODUCTION.

The Government of Madras in G.O. Mis. No. 1038, Development, dated 20th June 1928, constituted a Committee to consider the aims of the Fisheries Department, to review the progress so far made and to make recommendations for its future.

The Committee consisted of the following:—

Chairman.

1. M.R.Ry. Rao Bahadur Sir K. Venkata Reddi Nayudu Garu, *Kt.*

Members.

2. M.R.Ry. Diwan Bahadur Kumaraswami Reddi Avargal, B.A., B.L., M.L.C.
3. Dr. F. H. Gravely, Superintendent, Government Museum.
4. Khan Bahadur S. K. Abdul Razack Sahib Bahadur, M.L.C.
5. M.R.Ry. S. Arpudaswami Udayar Avargal, M.L.C.
6. M.R.Ry. P. V. Manicka Nayakar Avargal, B.E., Retired Superintending Engineer.
7. R. S. Nayudu, Esquire, Bar.-at-Law, Municipal Chairman, Madura.
8. A. McG. C. Tampoe, Esquire, I.C.S., M.L.C.

The Chairman, Sir K. V. Reddi, having been appointed Member of the League of Nations, left Madras for Europe on 30th July 1928, and returned towards the end of November 1928. Subsequently, he was appointed Agent to the Governor-General in South Africa. He therefore resigned his Chairmanship and M.R.Ry. Diwan Bahadur Kumaraswami Reddi Avargal was appointed Chairman.

Dr. B. Sundara Raj, Director of Fisheries, having been granted leave out of India for eight months from 2nd July 1928, was co-opted as member for about a month to assist the Committee in its enquiries on the West Coast.

2. The following were the terms of reference:—

(1) to examine the objects with which the department was inaugurated;

(2) to review the progress made in its several sections and the lines of development of the department and to make recommendations;

(3) in particular, and without prejudice to the enquiry under the foregoing general heads

(*i*) to examine and report on the work of the Fisheries Cannery at Chaliyam; and make recommendations for its future work if it is considered necessary to retain it;

(*ii*) to review the work of the Tanur Station and the problems for the solution of which it needs to be retained in the future;

(*iii*) to examine the policy and programme of scientific research and suggest recommendations for the efficient conduct of research devoted to the attainment of practical ends;

(*iv*) to examine the progress of education among the fishermen community since the department took over the control of this education and report whether, without impairing the efficiency of the special type of education needed for the community, its control may be transferred to the Educational Department;

(*v*) similarly, to examine the progress and results of the working of the co-operative movement amongst the community and suggest measures for better organization of the movement so as to secure its full advantages to the community; should responsibility for the spread of the movement rest with the Fisheries Department or could it be entrusted to the Co-operative Department?

(*vi*) to examine the need for the several vessels (including boats) in the possession of the department and suggest whether any economy could be effected either by reducing their number or by reducing the expenditure on their maintenance;

(*vii*) to examine the policy in regard to Inland Pisciculture and make recommendations as to the future plan of operations for the improvement of inland fisheries with reference to the efficacy of stocking operations hitherto conducted;

(*viii*) to examine the present organization and working of the fish-curing yards and make recommendations for cheapening the cost of maintaining the yards and devising a more efficient method of supply of salt with a view to effecting a reduction in the issue price of salt to the curers;

(*ix*) to examine the operations connected with pearl and chank fisheries and suggest measures for their economical working—is it possible to use mechanical appliances—dredging for instance—to collect oysters dispensing with the method of diving now adopted?

(*x*) to examine the working of deep-sea fishing with the help of the newly purchased trawler and report on its efficacy and usefulness;

(*xi*) to examine the organization of staff in the various grades and make recommendations, if any, as to its revision.

3. A questionnaire was issued on 22nd June 1928 to leading official and non-official gentlemen interested in fisheries or actually engaged in the fishing industry. The questionnaire is printed in

Appendix I. Their written evidence was first scrutinized and the gentlemen required to give oral evidence before the Committee were subsequently selected. A list of witnesses examined by the Committee is printed in Appendix II. The Committee commenced its sittings at Madras on 9th July 1928. Besides Madras, the Committee examined witnesses at Calicut, Ongole, Cocanada, Vizagapatam and Mandapam. They also visited the following institutions, sites, etc.:—

The Fisheries Training Institute at Calicut.
The Fisheries Station and the Public Fish-curing Yard at Tanur.
The Research Laboratory at West Hill.
The Fish Cannery and the Fisheries School at Chaliyam.
The Fisheries Office and Fish-curing Yards, the sites for an Aquarium and a Fisheries Training Institute at Vizagapatam.
The Research Laboratory at Krusadai Island, Pamban, and the proposed site for the Aquarium at Rameswaram.
The Trawler *Lady Goschen*.

The Committee took every opportunity to acquaint themselves with the social and economic condition of the fishermen and general state of the fishing industry on the East and West Coasts.

4. In the report that ensues, all the points of reference have been carefully considered by the Committee in the light of evidence, both written and oral, submitted to it and its inspection of the Fishery institutions and condition of the industry in the Presidency.

CHAPTER I.

AIMS AND HISTORY OF THE DEPARTMENT.

SECTION I.—ORIGIN AND AIMS OF THE FISHERIES DEPARTMENT.

5. From before 1870 onwards, Mr. H. S. Thomas, a Madras Civilian, and Dr. Day of the Madras Medical Service, subsequently Inspector-General of Fisheries in India, had urged the importance of developing the fishery resources of India as an important source of food-supply. Sir F. A. Nicholson in an official note of 1899 on the desirability of developing the Agricultural Department, proposed that a Bureau of Fisheries should be established as an important branch of that Department. On 19th January 1905, he submitted general proposals for the development of the fisheries of the Presidency and Government in May 1905, deputed Sir. F. A. Nicholson for a period of two years to investigate the fishery industry in the Madras Presidency and study the fishing methods and practice in Europe.

6. Sir F. A. Nicholson visited fishing villages on the East and West Coasts and made a tour of ten weeks in Japan in 1906 and a further tour in Europe, America and Japan in 1907. In his

reports he brought together a large fund of information on the economic and industrial sides of the industry, prevalent fishing and curing methods, apparatus, customs, the relation of labour to capital, of fishermen to curers and of curers to the trade, the fish-curing yards, etc., the progress of fishery work and its development especially by Government institutions in Japan and the West.

7. In April 1907, the Government accepted Sir F. A. Nicholson's proposals for the initiation of a small Bureau of Fisheries for Madras for the following reasons:—

(1) every civilised country possessed a Fishery Department;

(2) the fishing industry is of third importance in the country;

(3) the primitive and inefficient condition of the fishing industry in Madras without capital, initiative or knowledge rendered special attention of Government all the more necessary; and sanctioned the following permanent staff:—

1 Honorary Director.
1 Assistant on Rs. 175—5—200.
2 Sub-Assistants on Rs. 50—5—75 each.
1 Clerk and Typist on Rs. 30.
3 Clerks on Rs. 20 each.
4 Peons on Rs. 8 each.

8. The immediate work of the Bureau was to be—

(*a*) experiments at a marine experimental station on capture and preservation of fish and the development of by-industries and an inland hatchery for carp which he proposed to establish;

(*b*) to make tours of observations and enquiry along the Coast and Inland;

(*c*) to compile all the information gathered; and

(*d*) to attend to the clerical and account work connected with (*a*), (*b*) and (*c*).

9. On 28th February 1907, Sir F. A. Nicholson proposed—

(1) the establishment of an experimental sea fisheries station at Tellicherry on the West Coast;

(2) the acquisition of ponds in Madras for carp culture by his assistant, Mr. V. V. Ramanan; and

(3) the deputation of three students to Japan for training in catching, curing and pisciculture, to provide the expert staff required at the sea fisheries station and at the carp hatchery.

Government in April 1907, approved of his proposals (1) and (2) and vetoed (3) as the students in the short time at their disposal would be unable to obtain sufficient knowledge of the Japanese language to enable them to profit by the instruction given. Proposals (1) and (2), the station at Tellicherry and the carp culture experiment at Madras, also did not materialize. At this stage, a departure was made from the original plan of gradually training Indians in deep-sea fishing and fresh water pisciculture as they involve highly technical operations for which facilities were entirely

wanting in India. In addition to himself as Honorary Director, Sir F. A. Nicholson found that two European Assistants, one for Marine and one for Inland fresh water were needed. These, he decided, must be fishery experts who will deal with and supervise the details of work, will conduct the necessary enquiries, will translate into definite methods and experiments the policy and lines of action sanctioned by the Directetor. European experts were therefore selected and appointed, Mr. H. C. Wilson in 1907 for inland fisheries and Mr. James Hornell in 1908 for marine fisheries. The work of the department as it developed subsequently in various directions is reviewed below under appropriate heads.

SECTION II.—MARINE FISHERIES.

The first suggestion for improving the indigenous fishing boats and gear is contained in paragraph 188 of Sir Frederick Nicholson's note on "Fisheries in Japan." Here he stated "it will be the earliest business of the station (Fishery experimental station which he then proposed to establish at Ennur) to build or cause to be built on its designs, small (5 to 10-ton) sea-going fishing boats (sailers) suitable to local requirements within the means of many local fishermen, safe, roomy and comfortable enough to shelter a crew for a week or more, and to house their catches in saltholds or in wells or in live chests. For, the future of the trade is with the catching; and while it is true that, in the absence of an organized fresh fish trade, larger catches will have to be marketed as cured fish, yet the development of the whole industry, and with it the food and manure-supply of the country, rests with the improvement in the catching and storing power of the boats, in their ability to stay out at sea, to seek out and follow up the shoals, to exploit the deeper waters and to trawl over the shallower ones, to operate fleets of drift nets and miles of long lines, and to keep their catches in such condition, whether in wells or salt holds, as shall make them marketable goods even weeks after capture. In Japan, the improvement of boats for deep-sea and distant fishing is a constant anxiety and subject of experiment, and our experimental station should take the lead in demonstrating the best build and rig, and the cost; measures for assisting fishermen—if necessary—to build such boats can follow on the demonstration."

Madras Fisheries, Bul. No. II, para. 188.

In 1908, he reported as follows:—"Except *possibly* for one experimental trawler drifter (and inspection and research boat) I hope to work from the bottom, by very gradually improving local and indigenous boats and methods. In the matter of *catching*, it is a question for discussion whether Government will plunge direct into large enterprise, such as that of fitting out a trawler-drifter for a quantitative exploration of the waters outside of

Madras Fisheries, Bul. No. I, p. 72, para. 7.

Madras Fisheries, Bul. No. I, p. 75, para. 12.

Madras and for the introduction at once of the most modern methods in view to assist private enterprise to undertake such measures."

"On the one hand, we know nothing of the possible productivity of those waters, nor is it probable, at present, that private enterprise will risk capital in a commercial venture upon modern lines without some idea of the chances of success. On the other hand, is it not better *not* to attempt too much or take too large strides at first? Will it not be well to work slowly upwards through the small sailing boat and indigenous fishermen by steady evolution rather than to attempt or even suggest a revolution in fishery methods by even the experimental introduction of the latest Western apparatus? . . . In Madras we have a vast existing industry worked for centuries in the most primitive fashion by a large population of ignorant, but industrious men, and we cannot ignore them and their interest, welfare and industrial conditions; we cannot jump at once from the catamaran to the steam trawler."

Madras Fisheries Bul. No. I, p. 84.

"My own idea of Madras needs and methods is, that we do not at present need or want steam, save for particular cases; that to jump from the catamaran to the steamer is impossible and unwise if possible, and that our true method is to proceed by the ordinary and historical process of slow development." . . . "I proceed to indicate the probable lines of immediate policy and of immediate practical action, especially at the experimental station, by showing—(1) that steam . . . is a recent Western development necessitated . . . by . . . a strong effective demand, high prices, and elaborate organization, a wealthy distributing trade, rapid communications . . . etc.; (2) that even in the West the sailer holds its own, where fishing grounds are comparatively near at hand, and coal comparatively dear; (3) that in Madras Presidency waters the condition demanding or permitting steam for actual catching do not in general exist, and that sailers will fill the need; steam or power boats in catching are only needed for special purposes, such as the supply of high-priced goods and, possibly, fish for canning; (4) that improved sailers to supplement the present fishing boats are, however, an essential in the development of Madras Fisheries, . . .; (5) that larger boats would readily exploit the fishing grounds (within 100 fathoms), seeing that these grounds lie alongside . . . in a comparatively narrow belt . . . less than 20 miles on the East Coast and less than 40 miles on the West Coast, . . .; (6) that the swift carrier is, if not an essential, a most powerful instrument, in the production and placing on the market of sound edible goods at moderate price."

Madras Fisheries, Bul. No. I, p. 85, para. 4.

In 1907 two cruises in search of trawling grounds were undertaken by Messrs. Hornell and Cribb when in the employ of the Ceylon Pearl Fishery Company with the company's trawler

Violet, in the course of which an extensive trawling ground of five thousand square miles opposite to Cape Comorin and other smaller banks adjoining Tanjore Coast were discovered.

In 1908, the Ennur Experimental Station was opened with a view *inter alia* to experiment with large boats and powerful nets in catching fish. No experiments were however done at Ennur. The experiments were transferred to Cannanore. Two boats, one a sailing vessel, *Sutherland* (named after the Chairman of the Scottish Board by whose courtesy it was designed) of 12 tons and the other a 15 h.p. motor vessel *Turbinella* of 25 tons built of Arklow design, were constructed and fishing experiments beyond the usual range of the local boats were conducted till 1910–11. The *Sutherland*, though it caught a much larger quantity of fish than local vessels, was found too slow for the light winds of the East Coast. The experiments showed that these boats were too big for small work, but not big enough for large work. Moreover it was found impossible to obtain a crew, which, on their own initiative and without expert supervision, would work and modify their methods as occasion required, in unknown and hitherto untried conditions in purely experimental work, necessarily somewhat different from their own.

European Master-fisherman.—Hence it was proposed, and Government sanctioned the proposal, to obtain a practical instructor from the East of Scotland who would experiment mainly in drift nets and line fishing and in the exploitation of coastal fisheries in areas hitherto untouched, yet probably well within the 100-fathom limit. In 1912–14 no advance was made. In 1914 two excellent men were selected for appointment as Master-fisherman and Mate, but the outbreak of War cut short the negotiations, as both men were trained mine sweepers and were taken by the Admiralty. The motor boat *Turbinella* was required at Tuticorin for use as a survey and dredging boat in connexion with pearl and chank fisheries and was sent there. She conducted a few fishing experiments at Tuticorin and attracted attention by the unusual catching powers of her nets (set of nets obtained from England). These nets, though small and insufficient, caught a fair quantity of "seer." The local fishermen at Tuticorin borrowed these nets on a quarter share basis, but owing to the smallness of their boats were not able to use them effectively.

Simultaneously with the construction of the aforesaid two boats, chartered Ratnagiri sailing boats from the Bombay Presidency were also employed. These are simple drifters of from 6 to 8 tons and fished in waters from 8 to 12 fathoms outside the usual limits of Malabar canoes. They brought in large quantities of medium seer, small seer (*varian*), pomfret, dorab (*valai*), small sharks, etc. 1,500 lb. for one night's work was the largest catch. These boats enabled Sir Frederick Nicholson to ascertain—(1) the character of the fish available in the above zone; (2) the ability of

existing boats to catch such fish with the existing appliances; (3) the quantities, value and profits of catches of such boats; (4) the possibility of keeping fish fresh till they reach the shore. The quantities captured were as follows:—" In 48 nights of the two months—they did not fish when the moon is near the full—the two boats caught and delivered about 38,000 lb. of fish, by far the larger part being prime; this excludes fish taken by the crews for food and fish rejected as tainted: one boat moreover only fished for 38 nights. Hence each boat caught on an average at the rate of ten tons for the two months: the value, as paid by a local fish-curer and continued by me, was about Rs. 1,600 or Rs. 800 per boat with six men, *plus* the fish used as food, etc. No hire was paid for the boats, but I agreed to take and they to give their catches at the settled rates which were some 20 to 25 per cent below beach rates."

Madras Fisheries, Bul. No X. p. 12.

Sir Frederick Nicholson concluded that Ratnagiri boats were, for West Coast waters and weather, well adapted for deep-sea fishing all through the fishing season. They were cheap, good sailers and managed a large fleet of drift nets; those on trial had however insufficient room for gutting operations still less for storing, so that they could not keep the sea for several days; the larger ones which stay out for a week should suit better and would subsequently be tried. Until motor boats are introduced, these larger Ratnagiri boats should serve fishing purposes especially with a motor carrier.

In 1914 the Assistant Director was deputed to Ratnagiri (Bombay Presidency) to persuade the fishermen to come to South Malabar with their drifters (*Machuwas*) with a view to demonstrate to the local fishermen their efficiency but without success. The Ratnagiri deep-sea boats refused to be hired owing to the improved fishery conditions in Bombay. Pending the introduction of the motor boats and an European Master-fisherman, the Government sanctioned in 1915–16, the purchase of two Ratnagiri boats with nets for experiments at a cost not exceeding Rs. 2,000 for use with Malabar trained crew (1) to explore to some extent the deeper waters up to the 100-fathom limit; (2) to obtain a supply of larger sorts of fish for the cannery and curing yards; (3) to pay special attention to the whereabouts of shoal fish (sardine, mackerel, etc.) when not found in shoal; (4) to experiment in the better treatment, temporary preservation, etc., of fish on board; (5) to engage in other miscellaneous duties, such as those of carriers. From 1916—20 the experiments with Ratnagiri *Machuwas* continued with varying success. The experiment had however to be abandoned finally in 1922, as in the case of the *Sutherland* previously, because the crew did not work properly and secured only very poor catches of fish.

One more experiment at introducing well-known and effective implements from one locality to another was made. From 1917 to 1921 experiments were tried to demonstrate the possibility of using the bigger Malabar canoes and nets on the East Coast, at Madras and Negapatam. The superiority of the Malabar canoes and nets over the fishing craft (catamarans) of the East Coast was at best doubtful, and owing to the innate conservatism of the East Coast fishermen they refused to adopt these methods except on conditions which could not be accepted. These experiments were finally abandoned.

A Fisheries Inspection Boat.

From the very beginning (1908) Sir Frederick Nicholson considered " the provision of a boat for inspection, experiment, and research necessary " and stated " if we are to learn anything about deep-sea conditions and the habits of fish, especially migratory, and be able, therefore, to indicate probable developments in catching . . . an inspection boat is necessary to live on the sea at shoaling time, and to ascertain the existence, movements, etc., of shoals, so as to direct and stimulate deep-sea work . . . Again, a boat is wanted for experimental trawling and dredging; the question whether trawling can possibly pay . . . is absolutely unanswerable at present, and trials round the Coast are essential; it is far *easier*, especially for experimental purposes, to do this with a power boat than with a sailer . . . Again, it is necessary to ascertain the productive capacity of the sea outside the 100-fathom limits and the possibility of remunerative drift net fishing; a vast number of our fishes are surface or mid-water swimmers, especially shoalers, and for catching this with drift or purse nets, the depth of the sea is, of course, immaterial, *if* the fish are there. Similarly, we want to know something of the fish food (*plankton*) capacity of our waters and this can only be tested at sea . . . Finally, the inspection boat is required for experimental use as a carrier . . . I shall therefore eventually have to propose a power boat as a necessary part of our equipment . . ."

Madras Fisheries, Bul. No. 1, p. 117, para. 43

Madras Fisheries, Bul. No. 1, p. 118, para. 43

" The *Margarita* (the pearl fishery inspection steamer) is not a very satisfactory paddle boat, is hardly suitable " (for trawling and drifting experiment) " and seldom available just when required . . . Eventually, therefore, I hope, that Government will provide a . . . boat . . . fitted with auxiliary power and with all the necessary appliances for experimental fishing and the preserving of fish, such as trawls and other nets, dredges, fishhold, ice-room, net and warp rooms and usual mechanical aids to hauling heavy nets and lines, together with accommodation for the experimenter or observer . . . I enquired of many firms in Great Britain on my recent visit and also

Madras Fisheries, Bul. No. 1, p. 132

consulted the Irish and Scottish Official authorities and if Government choose to incur the expense, a very useful full-rigged boat with a "Dan" or other kerosene engine as auxiliary, and suitable for all fishery work, could be obtained fully fitted for about £2,000."

Madras Fisheries, Bul No. I, p. 133.

Madras Fisheries, Bul. No. I, p. 139.

The purchase of an inspection boat was deferred and the *Margarita* was utilized for inspection and experimental trawling during the year. In 1908 Mr. Hornell conducted a preliminary trawling cruise along the Malabar Coast and the Laccadive Islands with S.S. *Margarita*. His conclusions were that stream trawling would not be remunerative within the 30-fathom line, where the bottom consists of mud. But a zone roughly 25 miles wide, of grey sand beyond this line which extends from Cochin to Coondapoor may prove profitable. The *Margarita* was too small and feeble a boat and otherwise quite unsuitable for experimental trawling and inspection and concluded that a trial with a better equipped vessel should be made. S.S. *Margarita* was sold in 1909 for Rs. 12,000 and enquiries were made for the construction of a new inspection schooner of the best class suitable for all classes of Indian fishery work to take the place of the *Margarita*. Orders were finally placed with Messrs. Burn & Co., Calcutta, in 1912. The schooner *Lady Nicholson* with the following specifications was supplied by them in October 1913:—

Reports 3 and 4 of the Madras Fisheries, Bul. No. IV of 1908.

Tonnage	... ...	150 tons.
Speed	... ...	8·14 knots.
Indicated horse-power	... ...	75 to 95 B.H.P.
Length	... ...	107 feet.
Breadth	... ...	24 "
Draft. Forward	... ...	8 "
Draft. Aft	... ...	7 "
Oil fuel consumption	... ...	11·06 gallons.
Cost	...	Rs. 99,731.

Larger Research Vessel (Trawler).—In March 1914, owing to the difficulty of procuring a vessel from the Royal Indian Marine for the annual inspection of the Laccadive Islands, the Government considered the advisability of purchasing a vessel which would be suitable for the inspection and would for the rest of the year be at the disposal of the Fisheries Department. They believed that it was impossible for that department to provide a suitable vessel from its present fleet and that the addition of a steamer larger than the *Lady Nicholson* would be desirable in the interests of the department.

The suggestion was accepted by Sir Frederick Nicholson, as such a steamer would enable the department to determine with certainty the position and character *not merely of our trawling grounds, but the more important question of the richness or otherwise of the whole of our deep waters in fish generally*, together with the best seasons, the classes of fish available and the best means for capturing them. From the experience gained till 1914, the

Honorary Director agreed with Government that a better and more powerful steam vessel with proper gear and more accommodation than originally asked for by him in 1908 was necessary to carry out the researches of the department. The vessel was intended for the exploration of trawl banks and for trial fishing with drift nets and long lines for surface or midwater fish. It was pointed out that the trawling experiments so far done by the Ceylon trawlers were very brief and superficial. A prolonged investigation and a hundred times as much work was probably necessary before any conclusions could be drawn with certainty upon our potential deep-sea fisheries. The mere capture of fish was only one point for enquiry among many others including the important ones of preserving the catches, bringing them to port and the vital one of the market, prices and profits obtainable. For the preservation of fish, a refrigerating plant and holds were required. All these questions he stated could only be settled by thorough and skilled experiments under proper superintendence by an experienced and expert staff for which the specially fitted boat was necessary. He conceded that it was unlikely that the Indian fishing industry would jump at a bound from the catamaran or canoe to the steam trawler and that the value of catches in the present state of the industry and market might not recoup the investment on a large boat of this description. It was suggested that the boat was not to serve as a model or example for commercial work, but was solely intended and is a necessity *to enable the department to make the researches upon which future marine* fishery developments may be founded. The knowledge required was what the fishable contents of the whole of our seas or at every season and at various depths not merely up to, but beyond 100-fathoms and these facts can only be ascertained by means of—(1) a powerful steamer properly equipped with every class of fishing and exploring gear (trawls, drift nets, long lines, hand lines for using boats, dredges, etc.), capable of working in all seas and in all ordinary weather and provided with proper accommodation for the technical staff; (2) an intelligent and trustworthy sea-going staff (Master-fisherman, Mate and Engineer) accustomed to such boats and capable of using the gear to the best advantage; and (3) a staff for superintending, observing and recording the data obtained.

According to the Honorary Director it was for this purely exploratory work that the new research steamer was wanted. It alone would enable the department thoroughly to examine the seas and give definite answers to businessmen who would reap where the department has sown. The big steamer was not desired for industrial work, but for exploration and research without which the deep-sea industry cannot develop.

Sir Frederick Nicholson, Mr. Hornell and Commander Huddleston met in conference at Coonoor on 14th May 1914 and drew up specifications for an efficient research steamer at an approximate

cost of £8,500. The type of vessel recommended by them was a large modern twinscrew steam trawler. But Government decided to postpone the construction of the vessel till after the War.

In 1919 Mr. Hornell revived the proposal, but complicated it by suggesting that the ship should undertake trawling on commercial lines and stated that a profit of Rs. 70,000 could be made. The Government appointed another Committee to consider the question with reference to the following :—

(1) The uses to which the proposed steamer should be put;

(2) in the event of an attempt being made to establish trawling as a commercial industry, the manner in which such difficulties as the supply of ice, unloading at the port, terminal coal storage and transport by rail could be overcome ;

(3) whether a subsidiary steamer should be provided for carrying catches to port, for bringing ice, etc. ;

(4) plans and specifications of the proposed steamer or steamers, the fuel to be used, place of construction and the question whether tenders should be called for;

(5) estimates of the initial and recurring cost of the steamer and of the scheme proposed by the Committee ;

(6) the department to be primarily responsible for the maintenance of the steamer or steamers ;

(7) the distribution of charges among the departments which would use the steamer ; whether the initial and recurring charges on account of the steamer should be debited to the estimates of one department in the first instance, other departments paying for the use of the steamer when required at so much a day ; in that event, the rate to be charged was to be estimated.

The Committee recommended that the question of using the steamer for commercial trawling should be abandoned as impracticable. Their main reasons were—

(*a*) "The fact that, to make such work successful and remunerative, a most elaborate and expensive system of organization and distribution is inevitable, and must comprise the erection of cold storage depôts and of ice-making plants and probably the establishment of retail sale depôts. The whole of this organization is considered necessary to success by Lord Leverhulme even in England in the scheme he has elaborated for the disposal of the catches of the fleet of trawlers that he is basing upon Stornoway ; in India where the fish-trade is still in a primitive and unorganized condition the need for such distributing organization is infinitely more imperative."

(*b*) "The difficulties of landing fish and taking ice aboard at the only two ports convenient to the chief trawl grounds off Cape Comorin. At Tuticorin a vessel drawing 11 feet cannot use the harbour, and at Cochin, while a steamer of this draft can get in in good weather, this, I believe, would be dangerous with a heavy swell on and impracticable in the monsoon."

(*c*) "The absence of any shipping demand for fish at any Madras port, except a comparatively small one at Madras. Had we a port in any way comparable with Colombo, the difficulty of disposing of our catches would be small. The demand from the big passenger liners touching at Colombo would be sufficient to account for all the fish that one trawler could bring to port. But to use Colombo as a base of operations can hardly be contemplated so long as Ceylon is under a different administration from Madras."

(*d*) "Finally, and most cogent reason of all, the fact that as the steamer would be utilized for a considerable portion of each year for other purposes than commercial trawling (e.g., inspection of the Laccadives, special fishery investigations other than trawling, etc.), and that for a couple of years at least she would be employed on trawl ground survey extending from South Kanara on the West to Ganjam on the East, no regularity could be possible in the delivery of fish, and no one port could be made her trawl headquarters during this period. This alone would prevent any exploitation in a commercial manner, as the creation of cold storage and ice plants would be an indefensible procedure unless regular and large supplies of fish can be guaranteed."

They considered that till harbours and cold stores became available, commercial trawling was bound to be most severely handicapped and the attempt, if made, would be almost certain to land Government in heavy loss. They recommended therefore that the effort should be limited to the more modest one of surveying the grounds which are more or less suitable, testing by means of actual trawling their fish resources and charting the area where valuable food-fish abound in payable quantities. They recommended the provision of a scientific staff afloat capable of accurately recording the whole of the necessary data as to the catches made, the physical character of the bottom worked over, the temperature and salinity of the sea at different depths and the composition of the minute floating fish-food (*plankton*) of the sea. This last is an extremely important matter, for plankton is the ultimate source of the food-supply of the larger fishes and in it are found the eggs and larvæ of these fishes. "Unless all this be accurately recorded" they stated "we shall largely be wasting our time and money. Imperfect data are almost sure to lead to wrong conclusions and it *is of supreme importance that the data obtained be complete and accurate*. Otherwise it would be better to leave the matter alone. To obtain such data we must have a steamer large enough to use full-sized commercial trawls . . . We must trawl for fish . . . and the catch must be sorted into species, and these must be identified completely and accurately, and their sizes and weights and quality recorded, if we are to provide data of any real value to commercial firms who contemplate going in for trawling as a business proposition."

They therefore suggested the following uses for the inspection trawler :—

(*a*) "Survey of the sea-bottom and the fish found there . . . from inshore to 100-fathom line.

(*b*) General off-shore fishery investigations other than trawling, e.g., the migration of food fishes . . . , the extension of fishing operations into off-shore waters for shoaling and surface fish, plankton and general oceanographic research.

(*c*) The annual inspection of the Laccadive Islands.

(*d*) Lighthouse inspection."

They estimated its cost at £30,000, but the Naval Architects estimated the cost at £109,000 in the year 1920. As the cost was prohibitive, the Government abandoned the proposal to construct or purchase a trawler.

When the purchase of a trawler was abandoned, Mr. Hornell recommended and Government sanctioned the purchase of a Danish motor cutter equipped with Danish seines with a view to test the suitability of this method of fishing in Indian coastal waters.

Danish Cutter and Seine Nets.—Mr. Hornell visited Denmark in 1920 and found that the methods of fishing found in Denmark were the ones which would serve his purposes in the development of the coastal fisheries of Madras. He reported as follows:—"The Danes have devoted their energies to the thorough exploitation of Home waters within at least 100 miles from port . . . wonderful progress had been achieved . . . quite a number of freezing works, cold storage installations and canneries were springing up, with miles of new docks and quays where mud flats and sand banks existed not six years ago. This it is that encourages me to press for development of methods and apparatus that have been found so eminently successful under related conditions in Denmark. The cost of a new (Danish seine) net is Rs. 375 to 450. Fairly smooth bottom is necessary for good results and such we have in plenty on both our Madras coasts. Among the advantages possessed by this net are—(1) the fact that it does not damage or crush the fish caught, as does the trawl too often ; (2) the capital required . . . is not one-tenth of that required for a . . . steam trawler ; (3) use by boats of a size small enough to enter the harbours where seven to eight feet of water is all that is available and (4) low upkeep and running cost compared with a steamer ; four hands are enough to man one of these motor cutters." Instead of a Danish cutter recommended by Mr. Hornell a powerful sea-going launch *Sea Scout* available with Messrs. Thornycroft, 48′ 6″ long, 9′ beam 3′ draft with a three-ton fishhold and 30 horse-power motor engine, a hauling winch and rope coiler to be worked off the engine, was finally purchased by Government for £2,250 in 1922.

Mr. Allan (Assistant Director, Marine) died on 22nd September 1922 and negotiations were made for the engagement of an English Master-fisherman. Captain Cribb with long North Sea experience and a knowledge of Eastern tropical fisheries in India and Ceylon, extending to China and Japan where he introduced and established the trawling industry, was finally selected. The *Sea Scout* arrived in India in October 1923 and Captain Cribb attempted fishing off Cochin. The launch however proved a great disappointment from the start, both in design and equipment for fishing with a Danish seine net. Her high-speed engines could not work the seine winch. She was altogether too light to work the heavy nets and offered no accommodation or comforts to the European Master-fisherman. The experiments had to be terminated in March 1924. The failure of the experiments was solely due to the defects of the launch and not to any inherent unsuitability of the Indian coastal waters for the use of the Danish seine. The expenditure incurred on the experiments apart from the cost of the launch was Rs. 12,072. A motor cutter with its heavy-duty semi-diesel engine alone could work the Danish seine satisfactorily. Proposals for the purchase of a Danish cutter were then made, but were negatived by Government.

With the bifurcation of the old Salt and Abkari Departments from 1st April 1924, all the public fish-curing yards were transferred to the Fisheries Department. Government in April 1924, asked the Director of Fisheries to submit a report on the feasibility of making the fish-curing yards self-supporting. The main item of expenditure in the fish-curing yard budget was Rs. 1,99,000 (1924–25) for the purchase and transport of salt. In the absence of salt factories on the West Coast all the required salt (210,000 maunds on an average) were annually transported in sailing craft by a contractor. As by sea transport salt invariably failed to reach the yards in time, on an average, about 60,000 maunds of salt used to be sent by rail from the East Coast. The delay and inconvenience and loss of salt in sea transport by sailing vessels were considerable. The loss of revenue by depletion of salt in yards was appreciable and the cost of the subsidiary transport on the West Coast from ports and railway stations to fish-curing yards was disproportionately high. The Director, therefore, recommended the purchase of a second-hand steam trawler then available at £2,000 or less, both for inspection and research and for towage of salt to fish-curing yards on the West Coast and calculated the resultant monetary benefit to Government in the fish-curing yard budget after meeting all charges at half a lakh of rupees. In 1924 the Government however vetoed the scheme and terminated Captain Cribb's engagement.

But in 1925 the proposals were revived by His Excellency the Governor and the trawler was ordered. In 1922 when a full-sized trawler could not be purchased owing to high cost, Mr. Hornell advocated the introduction of the Danish seine net and motor

cutter as the most economic and suitable means for the development of the Madras Coastal Fisheries. The advantages of a seine net over the trawl are mainly financial in nature. The cutter-rigged seine net boats are much smaller than trawlers requiring far less in outlay and upkeep. But in India we have yet to test the suitability of all the available modern methods of fishing and the Danish seine net was only one of such methods. The proposal is novel and entirely in the experimental stage, where economy in working is not the main consideration, but should yield place to unfettered experiment till the most suitable methods are determined. An European Master-fisherman was indispensable for the success of the experiments and he would need conveniences, likewise the scientific officers on board. Previous experience with the smaller boats *Margarita, Sutherland* and *Lady Nicholson* had proved that a large seaworthy boat capable of standing monsoon weather and affording facilities and comforts to officers and experts was essential for marine fishery research and marine fishery development and that the absence of such a vessel and expert staff was largely responsible for the failure of the department to introduce improvements in fishing tackle, gear and methods employed by Madras fishermen. A trawler, it was felt by virtue of its size and sea-worthiness, would furnish the necessary facilities for deep-sea work. Unlike a Danish cutter or small drifter which could employ only a Danish seine or a drift net, a trawler could trawl, conduct the seine net fishing with the aid of a small auxiliary motor boat and test the possibilities of all other types of fishing gear, including a wide range of drift nets, the American purse net and others, besides serving the other purposes of the department (transport of salt, inspection of pearl banks, pearl fishery duties, etc). A trawler was therefore chosen as the best all-round fishery vessel for pioneer work in Madras waters. It was also decided to re-entertain Captain Cribb as Assistant Director (Marine).

Accordingly a second-hand Admiralty Trawler T.R. 8 was purchased and re-conditioned at a cost of £5,699 and she arrived in India on the 21st April 1926 in charge of Captain Cribb who was re-entertained for a term of three years from 13th March 1926. Her total cost, including the cost of voyage to India, was Rs. 1,04,450.

In view of the projected pearl fisheries early in 1926, the High Commissioner was told that the vessel might be sent to reach Tuticorin by the middle of February 1926, so that she might be used for pearl fishery work, only such alterations being carried out to the vessel as were absolutely necessary in Captain Cribb's opinion to make her fit to undertake the journey from England to India. The intention was that the remaining alterations necessary for the vessel should be executed in India. The vessel was inspected before purchase by the Naval Architects attached to the India Office and Mr. Bracken and Captain Cribb approved of the purchase.

The alterations and additions that were to be executed in India were—

(*a*) better ventilated cabins for the crew;

(*b*) a laboratory on board for research work;

(*c*) suitable accommodation for inspecting officers;

(*d*) a refrigerator and cold store on board.

It has now been decided to entrust the work to the Royal Indian Marine Dockyard authorities, Bombay, and necessary provision of funds has been made in the estimates for 1929–30. The vessel has therefore been till now without adequate equipment for fishing experiments and research.

Work done by the Trawler during the three years ending 1928–29.—The vessel arrived from England on 21st April 1926 at Tuticorin, but as her fishing gear was not supplied with her, it was not possible to start work in deep-sea fishing immediately. She also needed cleaning, painting, etc., after her long voyage. The fishing gear was received from England in November 1926 and considerable difficulty was experienced in recruiting a suitable crew.

On 18th December 1926, on her maiden voyage to the West Coast, boiler troubles started by one tube splitting. This was repaired and she conducted experiments in deep-sea fishing off Calicut, but the engine crew struck work and left the vessel. On 24th May they rejoined and further experimental work was done in the night of the 24th. On the 28th January 1927, on her way back to Tuticorin, a few more boiler tubes burst and she arrived at Tuticorin disabled. She could neither be used for the pearl fishery which was then about to begin, nor conduct deep-sea fishing experiments. The vessel was therefore sent to Colombo for the survey of the boiler by a competent authority. The Lloyds Surveyor examined the boiler on 16th February 1927, and condemned all the tubes as unsafe. He certified that all the boiler tubes required renewal. The boiler was accordingly repaired at a cost of Rs. 7,719. The surveyor was of opinion that the deterioration of the boiler tubes was due to the excessive rusting during the period the vessel was laid up at Inverness from the time she was built till she was sold. But this opinion was not accepted by the Naval Architects attached to the India office. After the repairs to the boiler were carried out, the vessel joined the pearl fishery on 26th March 1927, and continued to work in the fishery till 30th April 1927. After the close of the fishery, the trawler went to Colombo for her usual docking and coaling on 7th May 1927, when the question of alterations and additions was examined and an estimate was obtained from Messrs. Hutson & Co., Colombo.

She was brought to Madras on 16th May 1927, as the S.-W. Monsoon had commenced and as Tuticorin did not provide a safe anchorage for her. In the experiments in deep-sea fishing conducted off Calicut and Manapad, the trawl gear supplied with the vessel was found to be of very inferior quality, the otter boards would not sink in water and the nets were poor.

The trawler was in Madras Harbour from the middle of May to the 13th September 1927. The vessel was brought to Madras to carry on deep-sea fishing experiments and to examine further and estimate the alterations and additions to her. No fishing experiments, however, could be undertaken till 14th September 1927, as most of the crew resigned soon after the vessel arrived at Madras and as there was difficulty in securing the services of suitable men and the otter boards and nets required repairs and renewal. Two new otter boards had to be ordered at the Industrial Engineer's Workshops at Madras, and these were delivered by the Industrial Engineer on 12th September 1927. From 14th to 25th September 1927, the trawler did half a dozen experimental cruises off Madras, but these had to be closed as the inexperienced engine room crew were unable to raise sufficient steam pressure to work the trawl nets. All the catches were poor owing to the rocky nature of the sea-bottom in places explored.

The crew had to be discharged finally and a new crew was obtained from Ceylon and Tuticorin. Between 26th September and 14th October 1927, the Trawler was slipped at Madras and minor repairs to the engine were carried out at Messrs. Binny's Workshops. On the advent of the N.-E. Monsoon the vessel left for Tuticorin on 22nd October 1927, arriving there on 31st October 1927. From this date up to 26th April 1928, the vessel was engaged in exploring trawl grounds off Tuticorin and Cape Comorin systematically and transporting salt at intervals. A detailed report on the results of the trawling experiments has been drawn up and will be shortly submitted to Government. During this period she was also engaged for a period of ten days in dredging operations with a view to finding out whether pearl oysters existed beyond the 11-fathom line, up to which alone naked diving is possible. During May the vessel was slipped in Colombo and the data collected regarding depth, nature of bottom, etc., were charted at Krusadai Island station and dredging and trawling were continued north of Tuticorin and off Trichendur. She left for Bombay in the last week of June 1928, for inspection by the Royal Indian Marine Dockyard authorities with a view to the preparation of estimates for alterations and additions to her. On her return to Tuticorin in November 1928, she conducted trawling experiments off Calicut and Mangalore from 17th November to 10th December and from 26th December to 30th December 1928. From 7th January to 1st week of March 1929, she was engaged in the inspection of Laccadives. After return from the Laccadive Islands, she conducted

experimental trawling off the following places during the periods noted against each:—

Off Cape Comorin ..	9th March to 20th March 1929.
Off Tuticorin	20th March to 2nd April 1929.
Off Calicut	6th April to 14th April 1929.
Off Tiruchendur and Manapad.	3rd May to 13th May 1929.

Reports on the above experiments as well as those conducted off Calicut and Mangalore in November last with connected charts are under preparation.

The statement below gives details of experimental hauls made and fish caught and sold:—

Date	Place of fishing.	No. of hauls.	Quantity caught.	How disposed of.	Amount for which sold.
					Rs A. P.
24- 1-1927 ..	Off Calicut ..	3	About 1 ton.	Sold fresh ..	82 0 0
3- 4-1927 ..	Off Manapad ..	1	175 fish	Do. ..	24 7 3
14- 9-1927 and 15- 9-1927; 22- 9-1927 and 23- 9-1927	Off Madras ...	6	835 lb. ..	Do. ..	67 1 11
30-10-1927 to 26- 4-1928	Off Manapad, Cape Comorin and Calicut.	60	27,683 lb.	2,036 lb. sold fresh and the rest cured.	420 0 4
17-11-1928 to 10-12-1928; 26-12-1928 to 30-12-1928	Off Calicut and Mangalore.	50	22,812 lb.	Fish partly cured and partly sold fresh.	240 15 0
9- 3-1929 to 20- 3-1929	Off Cape Comorin	17	9,257 ..	Cured	116 0 0
30- 3-1929 to 2- 4-1929	Off Tuticorin ..	5	1,987 ..	Sold fresh ..	52 0 0
6- 4-1929 to 24- 4-1929	Off Calicut ..	13	10,929 ..	Do. ..	268 14 0
3- 5-1929 to 13- 5-1929	Off Cape Comorin, Trichendur and Manapad.	29	7,477 ..	Cured	94 7 0

The trawling grounds and their fisheries are being studied systematically in all their aspects. The fish caught are sorted, identified and listed with weights, and measurements. An examination of their stomach contents, gonads and so forth by dissection has not been possible in the absence of a laboratory and qualified staff on board. For the same reason water samples collected and plankton and other collections made could not be simultaneously examined or studied. But the more important specimens out of the collections have been examined and named at Madras. The data relating to bearings, depth, wind and weather have been noted, but have not been correlated or studied.

The subjoined statement shows how the vessel was employed from 21st April 1926 to 28th May 1929:—

—	From 21st April 1926 to 30th June 1926.	From 1st July 1926 to 30th June 1927	From 1st July 1927 to 30th June 1928.	From 1st July 1928 to 28th May 1929.
	Number of days.	Number of days.	Number of days.	Number of days.
Deep-sea fishing and research ..	..	3	39	64
Towing salt schooners from Tuticorin to West Coast	..	5	21	..
Pearl fishery	..	23	16½	..
Repairs	..	57	68	131
Return journeys	..	5	21	48
In port	71	272	200½	55
Laccadive Islands inspection ..	..	..	..	34

The Motor vessels of the Fisheries Department.

Statement showing the amount and value of fuel consumed and wages of crew during the twelve months ending August 1928 and also the number of hours of work done.

Vessels.	Number of hours engine ran.	Kerosene.	Value.	Petrol.	Value.	Lubricating oil.	Value.	Cost of crew.	Total.	Average cost of fuel per hour.	Average speed per gallon of oil fuel.
	Hrs. Mins.	Gals. Bots.	Rs. A. P.	Gals. Bots	Rs. A. P.	Gals. Bots.	Rs. A. P	Rs. A. P.	Rs. A. P.	Rs. A. P.	
Lady Nicholson * ..	214 15	1,485 0	1,276 2 9	100 0	140 10 0	57 3	136 9 0	4,719 10 0	6,272 15 9	7 4 0	7·0 Knots.
Sea Scout † ..	917 0	1,920 0	1,650 0 0	97 3	137 1 9	64 1	152 6 4	228 9 0	2,168 1 1	2 2 0	3·2 ,,
Leverett † ..	1,210 30	2,143 3	1,842 1 1	94 1	132 6 9	109 5	260 13 8	1,364 5 0	3,599 10 6	1 14 0	3·5 ,,
Pearl	484 0	360 4	309 15 2	..	..	43 4¼	103 12 11	820 15 0	1,234 11 1	0 14 0	6·0 ,,
Sutherland ..	*Not engaged for any work as she is completely disabled.*					..	..	690 12 0	690 12 0	..	..

* The engine of *Lady Nicholson* is auxiliary to sail and *not* the main source of power except when there is no wind.
† The number of hours noted here does not include the time the vessel was standing by at sea with idle engines while observations were being made.

SECTION III.—INLAND FISHERIES.

Sir Frederick Nicholson in his note on Fisheries in Japan, paragraphs 196—212, suggested certain inland piscicultural methods (carp culture, hatcheries, etc.) as capable of being copied from Japan. "Japan," he stated, "suggests certain cheap and immediately possible methods, open to the poorest man who owns a patch of water, to every village which has a tank or ponds, to the owners of many thousands of acres of paddy-fields, and to the controllers of thousands of acres of fresh water reservoirs and canals." As regards fish production, carp in Germany attained a weight of 3 lb. in three years; in the warmer parts of the United States, 9 lb. in two years; while in China, carp attained 4 lb. in the first year and 25 lb. to 30 lb. at maturity in five years. Mr. H. S. Thomas's experiment in the Vallam pond of 4 or 5 acres proved that, after stocking at a cost of Rs. 2 the fry of local carp yielded 4,000 lb. weight of fish annually after the first 12 months, without any artificial feeding of fish or care bestowed on the ponds. Sir Frederick Nicholson therefore recommended experiments in culture in fish farms and hatcheries and stocking of tanks, canals, ponds and even paddyfields and wells from fry bred in hatcheries and ponds at suitable centres. The first farm he proposed should be at Kanigiri reservoir, near Nellore and the second one on the Kurnool-Cuddapah canal at Kurnool.

Madras Fisheries Bull. No. I, page 59.

Mr. H. C. Wilson with practical experience in fish culture was appointed Piscicultural Expert in November 1907, on Rs. 500—50—750 in lieu of the Assistant on Rs. 175—5—200 to study inland fisheries, to experiment with the culture of carp and other fresh water fish and train Indian students in pisciculture.

The principal operations in inland pisciculture which have been undertaken by the Department are as follows:—

(1) The Nilgiri Trout Fisheries, and the conservancy of the Bhavani and Moyar Rivers.

(2) The establishment of fish farms at suitable centres for fish breeding and rearing of fry for distribution annually to tanks and channels to reinforce their natural stock of fish.

(3) The anti-malarial operations connected with the rearing and distribution of larvicidal fish in malarial areas.

(4) The gradual acquisition of the fisheries of irrigation tanks and other inland waters, on payment of compensation to local bodies, with a view to stocking them annually with improved varieties of food-fish and thereby augmenting the fish-supply.

(5) Experiments to devise methods and implements for fishing perennial deep water tanks throughout the year as such methods are wholly wanting and the fish from such sources are entirely lost to the fisherman and the consumer.

(6) Other piscicultural schemes, such as Hilsa breeding.

(1) The Nilgiri Trout Fisheries and the conservancy of the Bhavani and Moyar Rivers.

The first work Mr. Wilson did was in connexion with the establishment of Trout on the Nilgiris. Prior to his efforts these waters were barren of fish life except for some carp and small minnows. In 1909–10 Mr. Wilson constructed a trout hatchery at Avalanche for the rearing of trout, obtained a consignment of trout (*S. Iridius*) from New Zealand, successfully hatched the eggs and stocked all suitable streams on the Nilgiris. The trout fishery was thrown open to anglers about the end of August 1911 and subsequently every year.

Subsequent to 1909–10 Mr. Wilson's activity extended to the waters of the plains and in consequence he had to be away from the Nilgiris for considerable time. His continued absence from the Hills necessitated the transfer of the immediate control of the Nilgiri fishery staff to the Collector of the Nilgiris.

(2) The establishment of fish farms at suitable centres for fish breeding and rearing of fry for distribution annually to tanks and channels to reinforce their natural stock of fish.

Sunkesula Fish Farm.

Mr. Wilson next devoted attention to the waters on the plains. Kurnool being one of the driest inland districts, but possessing the Kurnool-Cuddapah canal of 200 miles in length and the perennial rivers Tungabadra and Kistna, was chosen as the most suitable one for starting operations. After a survey of the Kurnool district waters and the Kurnool-Cuddapah canal, Mr. Wilson proposed in June 1907, the establishment of a fish farm as per suggestion of Sir Frederick Nicholson in his note on the Fisheries of Japan, at Sunkesula anicut, whence the Kurnool-Cuddapah canal commences. The farm was intended for breeding and rearing suitable fish fry for stocking the canal and connected tanks, as a station for experiments on fish culture and for research on piscicultural problems of the locality.

The Government approved of the scheme and sanctioned a capital expenditure of Rs. 13,150 and a running expenditure of Rs. 3,794. The farm was designed on the model of the best trout farms in England and is the first fish farm to be established in India. The Sunkesula farm was brought into working order in 1911. The supply of water is obtained from the Tungabadra river above the anicut by pumping. The gross area of the farm is 20 acres out of which roughly 11 acres of water were divided into 19 ponds, the largest of which was about four acres. The area actually under water at present will be about three acres divided into 12 ponds.

In 1918 the difficulty in obtaining water reached a climax when unprecedented troubles were experienced in obtaining an adequate supply even for the few small ponds which were then utilized. In view of this and because of the restricted area of the ponds available and the high cost entailed by the pumping operations necessary to keep the ponds properly supplied with fresh water during the hot weather, the question of transferring the fish farm to another site where operations could be carried on more extensively and economically, was considered and sites were finally selected at Mahanandi and Praema, near Nandyal. A scheme for locating the farm at Mahanandi was drawn up, but owing to religious opposition by the Mahanandi temple authorities it had to be abandoned. The alternative site at Praema with much smaller springs where there were already two small ponds for larvicides, was then carefully examined and four additional ponds for food-fish were constructed at Praema at a capital cost of Rs. 5,350. The ponds came into use from the end of June 1927. Gourami and Etroplus breeders were transferred from the Sunkesula fish farm to the Praema farm thus relieving to some extent the congestion felt for years at Sunkesula. The spring at Praema is a small one and any considerable increase in ponds here is not feasible. The whole of the operations at Sunkesula cannot be transferred to Praema. The pumping engine at Sunkesula had become old and Government in March 1928, sanctioned the purchase of an oil engine at an aggregate cost of Rs. 4,500.

Experiments and Results—Murrel.—The earliest experiments conducted in the farm were in murrel breeding. Though the eggs of the murrel are the easiest to collect and hatch, after a stage they are exceedingly difficult to rear owing to the special live food they require. To turn murrel fry into a natural shallow swamp with abundant vegetation, insect larvæ and crustacea has been found to be the best method of cultivating this fish. Accordingly an extensive swampy waste (the Edurur swamp) about six miles from Sunkesula required neither for cultivation nor for the culture of other food-fish was reserved as a nursery and feeding ground for murrel. The young hatched and turned out in the swamp are annually fished and stored in ponds for a regular supply of live murrel to the Kurnool market at seasons of the year when fresh fish are not available in that inland town.

Etroplus suratensis.—Etroplus suratensis, a valuable food fish of Madras backwaters, non-indigenous to inland tanks, except near the Coast, was selected for observation and study in 1916 by Mr. Wilson. They were introduced into the Sunkesula fish farm in 1916–17. The fact that it is a nest builder and chooses submerged rocks for attaching eggs not being known, the earliest experiments to breed the fish proved abortive. It was only after the breeding habits of the fish had been studied by the present Director suitable nests were provided and the prolific breeding of

the fish in the farm followed. The culture of this valuable addition to the fresh water food-fishes of the Presidency on an extensive scale through the medium of fish farms for stocking tanks and rivers, has now been finally accomplished.

Gourami.—Gourami, well known the world over as the best fresh water food-fish, was the next exotic variety introduced for acclimatization and cultivation in the fish farms for introduction into tanks, lakes and rivers. One hundred and twenty-five live specimens were transported from Java in April–May 1916 and 95 specimens from Mauritius in the same year. A few Gourami from these consignments were sent to the Sunkesula farm. They bred in 1917–18 and the resultant fry were transferred to specially prepared ponds at Ippur. The fish continues to breed freely twice a year. These fish are specially adapted for pisciculture, but no experiments at intensive cultivation have been made, due to the limited accommodation available in the Sunkesula fish farm.

In 1920 a series of experiments were undertaken to decide the best form of artificial food for Gourami in the fish farms and the experiment proved the unquestioned superiority of gingelly oil-cakes to other kinds of oil-cakes. Further experiments made in 1926 went to show that Gourami feed voraciously on certain common garden shrubs while it does not feed on others. A collection has been made of these shrubs and the plants have been identified.

Tench.—The *tench* is a much better food-fish than the carp and grows well on the Nilgiris where it was introduced years ago from England. In June 1914, the Government approved of a scheme submitted by Mr. Wilson for the introduction of the tench from the cold waters of the Nilgiris into the warm waters of the plains. The object of the scheme was to introduce, breed and distribute throughout the rivers, tanks and canals of the Presidency this new and valuable fish. The first experiment to acclimatize tench into the waters of the plains of the Presidency was made by bringing a consignment to Hosur on the Mysore plateau in February 1913 and placing the fish in Jeejur and Mattigiri tanks. In February 1914, a further consignment of tench was brought down from the Nilgiris and placed in ponds in the Sunkesula farm. In September 1921, after seven years the fish bred for the first time indicating the success of the acclimatization experiment. Unfortunately the fish and their offspring were lost in 1923. A fresh batch was again introduced in 1923. These bred in 1926 and are thriving well. But owing to the cramped space available in the farm, both this and the *English carp* are accommodated in a single pond. They will shortly be transferred to the fish farm at Praema where conditions are more favourable for their growth and breeding.

English carp.—English carp introduced years ago into the Ootacamund lake and thriving there, were introduced into the farm

along with *tench* for acclimatization. These fish have not bred so far though they have grown and are in fine condition.

Carp, Labeo and Barbus.—Preliminary experiments in rearing species of indigenous *Carp*, *Labeo* and *Barbus* conducted at the farm were not a success.

Live Fish Market at Kurnool.—In inland towns and districts, fish supply at the best time is scanty and at others almost entirely *nil*. But the population are mostly fish-eaters and will buy any reasonable quantity at good prices. Tanks and rivers are never fished when they are full and deep. The fishermen wait till tanks get quite low and then within a few hours or days catch all the available fish. This often places on the local market quantities of fish far above demand and causes glut and decay. Both fishermen and consumers suffer in consequence. The former never realizes the full value for his fish nor does he obtain continuous employment. The latter is deprived of this important article of food practically throughout the year and when fish are actually available, often gets it in a semi-putrid condition owing to glut and delayed sales. To remedy these evils, Mr. Wilson proposed in 1912, that a live fish market should be tried by the department at Kurnool. The market site was close to the Kurnool-Cuddapah canal and consisted of shallow ponds supplied with running water from a channel. The fish were to be sent down the canal to the market from the Sunkesula fish farm in live cars, *i.e.*, cages with holes to allow a free flow of the canal water through them. The fish arriving alive at the market were to be kept alive in the market tank, till required for sale. The advantages of this system of marketing over existing practice were—

(1) it would provide a more even supply of fish to the market than was the case;

(2) fish would be supplied alive in an absolutely fresh and wholesome condition to the consumer instead of as often stale and semi-putrid;

(3) fish would be sold only as required, those not sold remaining alive till wanted;

(4) such supply will regularize scarcity prices which alternate with low prices in the market;

(5) the experiment was to be an object-lesson of the first importance in the breeding and marketing of fish.

The proposals for the construction of a live market at Kurnool were sanctioned for a period of two years in April 1913. The capital expenditure was Rs. 525 and the running expenditure Rs. 250. The market was opened in Kurnool in 1914 and live fish obtained from the farm were sold to the public at 3 annas per pound. Owing to difficulties in management, the live fish

market was closed in 1915. But it was reopened from July 1917 to January 1918, a season when fish is scarce in Kurnool and was run this time by a contractor who was supplied with 884 lb. of murrel from the farm. Two ponds for storing live fish pending sale were constructed at Kurnool. That the idea succeeded is shown by the fact that the contract for 1919–20 was let at rates nearly double those paid in 1918–19, thus indicating increasing appreciation by the public of the convenience of getting fish at times when usually none are available. The value of murrel, carp and other fish sold from 1918–19 was as follows:—

Year.	Value.
	RS.
1918–19	208
1919–20	334
1920–21	206
1921–22	338
1922–23	500
1923–24	145
1924–25	325
1925–26	123

The Edurur swamp which used to provide a nursery for growing murrel for the market at Kurnool is now heavily silted up and murrel culture in this swamp has therefore been abandoned. Suitable perennial water-springs at Kalva within 20 miles of Kurnool on the Yerramalais have been surveyed and a scheme for the construction of ponds for market culture of fresh water fish to take the place of Edurur is under consideration.

Ippur Fish Farm.

In paragraph 210 of Sir Frederick Nicholson's note on Fisheries in Japan, he had proposed a fish farm for utilising the Kanigiri and other reservoirs under the Sangam Works in the Nellore district. Mr. Wilson after an exhaustive survey of the Nellore district waters from 1908 to 1914 finally selected a site in the Ippur Kamini tank for the establishment of a fish farm. The Government sanctioned the Ippur fish farm at an estimated capital cost of Rs. 26,000 and annual running charges of Rs. 2,400. The fishery rights in the Ippur Kamini and Puduparti tanks which came within the operation of the scheme were taken over by Government from the Nellore District Board. This farm was established for the following purposes:—

(1) to breed larvicides in large numbers and distribute throughout the Presidency and further afield, if necessary, for the destruction of mosquito-larvæ and prevention of malaria;

(2) to breed the most highly esteemed and valuable fish, such as *Gourami*, *Etroplus*, *Tench*, etc., for stocking irrigation tanks and for market purposes;

(3) to hatch the eggs of Hilsa artificially and distribute the fry or fertilized eggs in rivers, both on the East and the West Coasts, where they have free access to the sea.

The farm was completed in January 1917 and has been working since. The farm was damaged by cyclone in November 1927 and repaired at a cost of Rs. 474.

Water-supply.—The farm is dependant on the Surveypalli reservoir, a deep and perennial tank which receives its supply from the Pennar river at Nellore. Occasionally, however, the supply fails and the farm is then subject to the grave risk of drying up. A well constructed proved brackish and does not serve the purpose. There was serious dearth of water in the Surveypalli reservoir for four years ending 1923–24 hampering the work of the farm.

Experiments and Results—Mullets.—The presence of stray specimens of large mullets in fresh water near the sea in the Nellore district in 1918–19 led to the experiment of cultivating in fresh water tanks the fry of selected species, abundantly available in backwaters and estuaries everywhere. Growth experiments at the farm have proved that mullets grow rapidly in tanks. The conditioning of mullet fry and their transport however presented difficulties as large numbers died in this process. But experiments proved that, if the fry are conditioned in running water in the very creeks or streams where they were taken, there was no appreciable mortality. As a result of these experiments mullet fry have been extensively employed by the department since 1920 in stocking tanks and channels in Nellore and Chingleput districts.

Etroplus suratensis.—In 1919, two hundred *Etroplus suratensis* were introduced into one of the ponds in the fish farm. The fish bred and multiplied rapidly. From 1921 onwards, the fry from the farm have been annually distributed to the irrigation tanks under the control of the department in the Nellore district. The annual introduction of this new food-fish to the Nellore district waters from the Ippur fish farm is now an established practice.

Gourami.—Two of the ponds were stocked with *Gourami* in 1916–17 and it took about six years for them to breed. This unsatisfactory result was attributed by Mr. Hornell to the large area of the ponds. To remedy this defect, the *Gourami* pond was remodelled in 1927. The experiments proposed for deciding the factors that had interfered with the normal breeding of the fish at Ippur hitherto have to be conducted.

Fish Farm at Madras.

The need for a fish farm at headquarters was long felt by Mr. Wilson. He took over from the Military Department the ponds in the Old Gunpowder Factory, Perambur, and remodelled it at a capital cost of Rs. 1,000. The running cost sanctioned for

the farm was Rs. 400. There are only three ponds in the compound: one, a small fresh water pond of 10,416 square feet and two long ponds of brackish water.

The objects of the scheme were—

(1) to acclimatize certain salt water fish to fresh water, and

(2) to breed larvicides and sporting fish for stocking purposes.

The fresh water tank requires to be replenished with tap water from the Municipal main during the hot weather which is both expensive and inconvenient.

Experiments and Results—Etroplus suratensis.—The first experiments with the backwater perch *Etroplus* now extensively used by the Fisheries Department for stocking, were conducted at this farm in 1916. *Megalops cyprinoids*, a sporting species and a large number of larvicidal fish were also introduced into the farm, but the limited space in the ponds precluded further experiments with sporting fish which are of a predaceous nature. Many tanks in the neighbourhood are annually stocked with the acclimatized *Etroplus* from this farm. The limited area of the ponds has restricted operations and often supplies for the Fort Moat and rivers are annually indented on, for stocking tanks of the Chingleput district.

Gourami.—The consignments of *Gourami* obtained from Mauritius and Java, were kept in the fresh water pond as a resting-place (after their long journey) before their distribution to other fish farms. The small stock of *Gourami* left in this pond breeds regularly and is one of the places where *Gourami* thrives well.

Proposed Transfer of the Farm to Chetput.—Recently the Military authorities desired that the land and building used by the department at Perambur should be paid for. The limited water area and costly water-supply were additional reasons for which it was considered desirable to shift operations to another more suitable site. Proposals were made in 1921 for the acquisition of the extensive borrow pits in the abandoned Government Brickfields at Chetput some of which hold permanent water. The Public Works Department refused to consider these proposals as they entertained hopes of sand-filling the pits and selling the lands as house sites for a handsome price. The Health Department also at that time objected to the permanent retention of these ditches. The proposal for a fish farm was however revived in 1927, as the depreciation of house property in Madras combined with the high cost of sand-filling beyond the expectations of the Public Works Department resulted in Government finally abandoning the scheme for selling the sites. The Director of Public Health also withdrew his objection to the retention of the ditches as fish-ponds. The Government in October 1927, approved of the transfer and plans

and estimates amounting to Rs. 21,000 for remodelling the pits in the Brickfields into fish-ponds have been submitted to Government on 10th December 1927. The extensive water area available at Chetput compared with Perambur will enable the department to carry on cultural operations on an efficient and enlarged scale adequate to the present needs of the department.

(3) The anti-malarial operations connected with the rearing and distribution of larvicidal fish in malarial areas.

In 1912–13 at the instance of the Health Department Mr. Wilson made a series of investigations at the Sunkesula fish farm with South Indian species of larvicidal fish to ascertain the best ones for the control of malaria. The effectiveness of fish breeding to destroy mosquito larvæ in tanks, ponds and wells was demonstrated by him to the medical profession, local bodies and the public and a practical paper giving detailed instructions about kinds of fish larvicides suitable for fresh, salt and brackish waters and the manner of employing them was read by him at the "All-India Malarial Conference" held in Madras.

These anti-malarial operations form a considerable and valuable part of the department's work and consist of three separate phases, *viz.*:—

(*a*) the breeding and distribution of mosquito larvicidal fishes to municipalities and other public bodies;

(*b*) the periodical stocking of pools in specially malarious localities with larvicidal fish;

(*c*) the conversion of mosquito infested sheets of water into fish-breeding ponds which also serve the purpose of fish distribution centres for the stocking of irrigation tanks with young fish.

(*a*) The department is able to supply specially selected larvicides in large numbers at a nominal cost of Rs. 20 per thousand. The Madras Corporation in 1915, the Cannanore Municipality in 1916 and the Bellary Municipality in 1917 applied to this department for help and advice in stocking their ponds and wells with larvicidal fish. Several thousands of larvicidal fish were supplied from the Ippur fish farm and Perambur to Municipalities and local bodies till 1923–24 when the demand for them from local bodies for stocking purposes practically ceased. In spite of the earnest recommendation of Government, municipalities and other local authorities have not as yet availed themselves adequately of the facilities for obtaining a good strain of larvicides from the department. They appear either careless in the matter or depend upon local supplies of what too often are species of very inferior larvicidal quality or even enemies of larvicides. In response to a request from the Malaria Board received through Government the matter was investigated by the department and a

complete report was submitted to Government. The investigations in Madras and in other places went to prove that the failure of the larvicidal operations conducted by local bodies without reference to the Fisheries Department was chiefly due to the procuring of unsuitable fish locally.

(*b*) The second form of operation is more directly in the power of the department to organize and consequently greater progress has been made in this method of fighting malaria. Inadequacy of staff and want of funds alone seem to have restricted operations. Up to now mosquito breeding water holes, ponds and streams in several localities in the Cuddapah district and in the whole of the Nallamalai region in the Kurnool district have been treated annually with hundreds of thousands of larvæ eating fish. Appreciable decrease in the incidence of malaria is reported by Forest Officers from the Nallamalais.

(*c*) The third line of attack on malarious waters is perhaps even more important. Two schemes have already been completed, *viz.*, the conversion of the Fort Moats at Chingleput and Vellore into fish farms. In both the cases until the operations were commenced, these moats formed stagnant pools, overgrown with dense pond vegetation and supremely suitable as harbourage to mosquito larvæ. As a consequence malaria was endemic within both the Forts, an extremely serious condition seeing that a large Reformatory for boys is located within the Chingleput Fort whilst a Police Training School is similarly located within that of Vellore. The moats have now ceased to harbour mosquito larvæ and have concurrently become fish-breeding ponds whence supplies of fry are available for stocking a large number of tanks in the districts of Chingleput and Nellore.

Vellore Fort Moat Fish Farm.

In December 1916, the Sanitary Commissioner to the Government of Madras reported that, if the Vellore Fort Moat could not be kept free of weeds and stocked with larvicidal fish it ought to be drained. The draining of the moat was then found to be a difficult and expensive proposal as a large area of the moat is 9 feet below the level of the drainage channel and about $3\frac{1}{4}$ million cubic feet of water could only be removed by pumping. Sir Frederick Nicholson therefore proposed in September 1918, the alternative scheme of converting the moat into a fish farm. The farm was to fulfil the dual function—(1) to breed larvicidal fish to prevent mosquito nuisance and malaria in the Fort and (2) to propagate the non-predaceous food-fish for distribution to irrigation tanks in the neighbourhood. The primary object however was the control of malaria within the Fort. The proposals of Sir Frederick Nicholson were approved by Government and a sum of Rs. 16,200 being the capital expenditure was sanctioned. The farm commenced work in 1923. Later some improvements to supply channel

were executed at a cost of Rs. 340. The moat now receives an adequate supply of water and incidentally benefits the town as it ensures a permanent supply of water in wells throughout the town.

Experiments and Results—Etroplus suratensis.—One thousand Etroplus were introduced into one of the four sections of the moat in 1922–23. They grew and multiplied rapidly. The public of Vellore accustomed to the coarse and bony tank fish have learnt to relish *Etroplus* so highly that, when this section of the moat was fished recently, they purchased the young ones alive for introduction into their wells and ponds.

Gourami.—The farm was stocked with *Gourami* in 1923–24. The fish bred successfully in 1926–27. Nearly a dozen nests were recently observed in the *Gourami* section. The heavy growth of water lilies whose leaves are eaten by this fish provides good feeding.

Mullets.—In the last week of January 1923, *mullet* fry three inches in length were introduced into the Vellore Fort Moat. In the last week of March 1924—after 14 months—they were found to have attained a length of one foot. This experiment has demonstrated that a suitable variety of *mullet* fry thrive in fresh water and grow to marketable size in about a year, even so far interior as Vellore. In Egypt an extensive trade in the cultivation of *mullets* obtained as fry from estuaries and backwaters has developed within recent years. The fry being abundant along the Coast afford necessary material for stocking tanks in the sea-board of the Presidency.

The moat has been heavily stocked with larvicides with beneficial results.

With a view to demonstrate to the public the profits in tank stocking and breeding of fish on a commercial scale, an experiment with the north Indian carp (*catla*) was carried out in one of the sections of the moat during 1926–27. Four hundred and fifty *catla* fry obtained in the Godavari River were stocked in one of the sections of the moat in September 1926. The total cost of capture and transport, including supervision charges, was only Rs. 85. In the course of eight months the fish had grown to a length of two feet. The fish in this section of the moat were sold for Rs. 800.

Chingleput Fort Moat Farm.

A scheme to combat malaria in the Reformatory School at Chingleput by draining the moat into the adjoining river by means of a channel costing Rs. 12,590 was drawn up by the authorities of the Reformatory School. Subsequently a combined anti-malarial and piscicultural scheme costing only Rs. 7,500 (capital charges) and Rs. 800 (running charges) prepared by the Fisheries Department was accepted by the Government. In 1921 the Government

sanctioned a revised Public Works Department's estimate amounting to Rs. 16,330. The purpose of the scheme was as at Vellore to be the prevention of malaria by larvicides and the culture of food-fish for tank stocking. Owing to constructional defects, the farm could not be worked. The Public Works Department have prepared an estimate at a cost of Rs. 1,680 to rectify the defects. Meantime the moat is kept free of mosquitos with a large stock of larvicides and there has been practically no malaria in the Reformatory School.

Experiments and Results—Mullets.—To find out the rate of growth of mullet fry, a small experiment was conducted in the Chingleput moat. Towards the end of January 1928, 2,000 mullet fry two to three inches long caught in the Adyar backwater were placed in one section of the moat. When in April 1928, on account of the failure of rain the water in the moat went very low and the fish had to be caught, the mullets were not only found living having acclimatized themselves to fresh water, but were found to have grown to a length of nearly seven inches. Under more favourable conditions the fish should show still better growth. This experiment will be repeated and an attempt made to find out the maximum growth of *mullets* in the Chingleput waters.

With a view to demonstrate the handsome returns from pond culture to the interested public of Chingleput, a small experiment with *Catla* was conducted. One hundred and fifty fingerlings from Godavari were stocked in the Northern section of the moat in August 1926. By April 1927, the fish had attained a length of $1\frac{1}{2}$ feet to the surprise of the local fishermen and fish merchants and the fishery of this section of the moat fetched Rs. 150 in the auction sale. The cost of stocking and proportionate supervision charges for the experiment amounted only to about Rs. 25.

(4) Gradual acquisition of the fisheries of irrigation tanks and other inland waters on payment of compensation to local bodies with a view to annually stock them with improved food-fish and thereby augmenting the fish-food supply.

In 1864 the Madras Government gave over the fishery rentals—then Rs. 80,000 only—to local boards following the precedent of Bengal probably to provide a convenient source of revenue to augment their then scanty funds.

After the formation of a technical Department of Fisheries, the first inland fish farm was established at Sunkesula in 1909–11. Mr. Wilson submitted proposals for the acquisition of the fisheries of the Daroji tank in the Bellary district and the Cumbum tank in the Kurnool district. The proposals were sanctioned in October 1910. In view of the fact that the development of the fisheries in these tanks involved expenditure from provincial revenues and that the supervision of the experiment must be in the hands of

the expert officers of the Fisheries Department, the Government directed that a fixed assignment be paid to the District Boards of Bellary and Kurnool districts respectively. In the same year the fisheries of the Barur tank in the Salem district were taken over.

In June 1912, Mr. Wilson, the Pisciculturai Expert, reported that the rentals from fisheries in the Cauvery and the Coleroon were likely to increase as a result of the Hilsa operations in the lower reaches of these rivers and of the conservancy operations in the upper reaches of the Bhavani and the Moyar. Sir Frederick Nicholson in August 1913 pointed out to Government that the amounts of rentals were rising with each successive fishery lease and were likely to rise still higher in view of the operations of the Fisheries Department. He therefore proposed that the Government should have control of these fisheries as well as of their rentals. He added that since the grant of these rentals by Government to local bodies was a pure gift on the part of Government and since the district boards had no concern whatever either in the upkeep of the rivers or the conservancy of the fisheries, there could be no injury to these funds in resuming the grant on payment of compensation. He further added that, in any case, whatever they might be entitled to on account of the original grant they were not entitled to any unearned increment such as was then rapidly accruing, partly by the reason of the general economic rise, partly by the direct action of Government in the Fisheries Department and other departments. Government accepted the proposals and adopted the policy of gradually acquiring the fisheries of all the important tanks and rivers from local bodies as the Fisheries Department were able to deal with them.

(1) *River Fisheries.*—Government directed that the proceeds from the fisheries in the Cauvery and Coleroon rivers be credited to Provincial Revenues from 1914–15 and that the District Boards of South Arcot, Tanjore and Trichinopoly be paid fixed annual assignments of Rs. 2,795, Rs. 26,620 (*a*) and Rs. 5,578 respectively as compensation for the loss of the income that they had been enjoying till then from these fisheries.

Similarly in 1916, the Government directed that the fisheries in the Cauvery and its tributaries within the limits of the Salem and Coimbatore districts be credited to Provincial Revenues from 1916–17 and that the District Boards of Salem and Coimbatore be paid fixed annual assignments of Rs. 2,198 (*b*) and Rs. 2,360 (*c*) as compensation for the loss of the income which they had derived from these fisheries in the past.

In 1921, the Government sanctioned the transfer to the Fisheries Department of the control of the fisheries of the tanks and channels watered by the Cauvery and its tributaries in the Coimbatore district and directed that the District Board of Coimbatore be

(*a*) Subsequently reduced to Rs. 23,031.
(*b*) Subsequently reduced to Rs. 656
(*c*) Subsequently raised to Rs. 2,865.

paid a fixed annual assignment of Rs. 1,893 as compensation in respect of these fisheries.

In 1922 the Government sanctioned the provincialization of the fisheries of the Amaravati river within the Trichinopoly district and the North Rajan and Vadavar irrigation channel and other branches relating to the Lower Anicut system and directed that the District Boards of Trichinopoly and South Arcot be paid an annual assignment of Rs. 912 and 3,177 respectively as compensation for loss of fishery rentals.

Thus the total compensation now paid to the District Boards of South Arcot, Tanjore, Trichinopoly, Salem and Coimbatore on account of the loss of Cauvery and Coleroon fishery rentals is Rs. 40,906, while the average rental for the last five years ending 1927–28 from the same fisheries is Rs. 77,509. The average increase of rentals over the total compensation paid to district boards is Rs. 36,603, viz., about 89·5 per cent in five years.

(2) *Canal and Tank Fisheries.*—As the Kurnool-Cuddapah canal had partly been stocked in 1913 and as it was to be regularly stocked subsequently from the Sunkesula fish farm, Mr. Wilson submitted proposals for taking over the fisheries in the Kurnool-Cuddapah canal and the tanks connected with it from the District Boards of Kurnool and Cuddapah on payment of a fixed annual compensation. The Government accordingly directed that the proceeds from the fisheries in this canal and connected tanks be credited entirely to Provincial Revenues from 1913–14 onwards. The District Boards of Kurnool and Cuddapah are paid fixed annual assignments of Rs. 2,222-14-0 and Rs. 321 respectively as compensation. In 1914 the fisheries of three irrigation tanks in the Salem district which are fed by the same supply channel as the Barur tank were taken over on payment of a fixed assignment of Rs. 20 per annum. In 1916 the fisheries of three more tanks in the Kurnool district were acquired on payment of a fixed assignment of Rs. 16 per annum.

In 1916 proposals were made for taking over and improving the fisheries of 11 permanent water tanks in the districts of North Arcot, Chittoor, Anantapur, Nellore and Chingleput on payment of a fixed annual assignment as compensation for loss of fishery rents and these proposals were sanctioned by Government, the compensation fixed was as follows:—

	Rs.
North Arcot	3,789
Chittoor	200
Anantapur	117
Nellore	185
Chingleput	2,803
	7,094

It was in June 1919, however, that definite proposals for the acquisition and systematic stocking of all suitable tanks, district by district, was inaugurated. All the major tanks of the Chingleput and Nellore districts were accordingly surveyed and a scheme for developing their fisheries, by annual stocking with suitable fry from natural sources as well as fish farms, was formulated. The proposals for the acquisition and organization on a piscicultural basis of about 110 tanks found suitable in the Nellore district and 25 in the Chingleput district, were sanctioned by Government and the District Boards of Chingleput and Nellore were granted fixed annual assignments of Rs. 7,000 and Rs. 2,300 respectively as compensation for loss of fishery rentals.

Subsequently the Government approved the proposal to transfer to this department 13 more tanks in the Chingleput district and granted an additional compensation of Rs. 175 to the Chingleput District Board.

The Nellore and Chingleput tank stocking scheme is the first of its kind. The financial results of tank stocking in the Nellore and Chingleput districts for the five years ending 1926–27 are as follows:—

Chingleput tank stocking scheme.

—	1922–23.	1923–24	1924–25.	1925–26.	1926–27.	Total.
	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.
Receipts from Fisheries ..	5,708 5	7,262 10	5,436 5	8,779 2	7,542 8	34,728 1

Nellore tank stocking scheme.

—	1922–23.	1923–24.	1924–25.	1925–26.	1926–27.	Total.
	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.
Receipts from Fisheries ..	10,477 0	8,443 6	12,610 0	16,461 2	10,827 11	58,819 3

The receipts for the first five years from the tanks in both these districts exceeded expenditure by Rs. 6,181 in spite of insufficient rain in two out of five years and non-co-operation on the part of villagers and lessees in 1925–26. The increase of rents in the first five years that the scheme has worked over compensation is about 37 per cent.

Besides these, the fisheries of 14 new tanks in eight districts of the Presidency constructed by the Public Works Department since 1914 have come under the control of this department in accordance with the orders of Government that the fisheries of all new tanks and irrigation schemes constructed since 1914 should vest in Government.

(5) Experiments to devise methods and implements for fishing perennial deep water tanks throughout the year, as such methods are wholly wanting and the fish from such sources are entirely lost to the fisherman and the consumer.

The indigenous fishing methods in fresh water tanks are even more primitive than those employed in sea fishing. So long as a tank is deep and full the fishermen are unable to fish it and perennial water tanks are hardly ever fished. With regard to others the usual practice is to wait till the tank is about to dry up and then to catch all the fish in the tank by a general battue, or to reduce the level of water by deliberately draining it and then fishing the tank. The existing practice has the following disadvantages:—

(1) where conditions are favourable for the growth of a large head of fish as in perennial tanks, such fish are left uncaptured, so that the food-supply is a minimum and the rentals *nil;*

(2) the dumping of excessive quantities of fish above local demand for a few days on the market with the resultant depreciation in price, delay in sales and putrefaction of fish;

(3) the starvation of inland markets for practically the whole year of fresh fish from the tanks; and

(4) the possible waste of water which could be turned to advantage if not for agriculture, for piscicultural purposes.

To remedy these defects experiments were initiated at Chembarambakam tank in 1918, to devise methods for the continuous fishing of permanent water tanks with boats and nets. Certain methods of netting were tried with varying degrees of success. From these experiments it appeared that drag nets and seines are of most value when the water is sufficiently clear of weeds for their use and the bottom free from boulders; in the deep central portion gill nets gave good result when their mesh was suitable for the size of fish most abundant. The presence of weeds and boulders at Chembarambakam however militated against the continuance of the experiment. Proposals for the transfer of the experiments to the Kanigiri reservoir in Nellore were therefore sanctioned by Government. But, as the tank was found to have silted up considerably and to run dry annually, the experiment was not made.

Mopad Fish Farm.

A somewhat similar scheme was evolved for developing the fishery of the new irrigation reservoir at Mopad, Nellore district, in 1918. This great sheet of water formed by damming the river Manneru impounds a large body of permanent water. The objects of the scheme were—

(1) to breed the best food-fish so far ascertained by the department, in ponds below the bund of the reservoir;

(2) to transfer the resultant fry annually into the reservoir for growth and thereby demonstrate the commercial possibilities of fish culture;

(3) to experiment in fishing with boats, nets and other implements throughout the year, to thin out the stock in the reservoir and to ascertain the best methods of fishing deep and perennial tanks and demonstrate the same to local fishermen, and

(4) by the above operation to render this new reservoir a source of continuous food-fish supply to the neighbouring markets all the year round at fixed cheap price.

The scheme was sanctioned by Government at a capital cost of Rs. 27,860 and annual running charges of Rs. 2,500. The Government sanctioned a further sum of Rs. 2,600 for rectifying defects in the construction of the farm. The deep water tank experiments originally proposed to be conducted at Kanigiri are now carried on in the Mopad reservoir, where the necessary facilities exist. The cultural operations in the fish-ponds commenced in June 1927. The reservoir however has been fished since 1921–22 regularly year after year. The sale proceeds of fish realized were as follows:—

The increased receipts are due partly to stocking and partly to some improvements in methods of capture. The latter aspect is however capable of further development.

	Rs.
1921–22	126
1922–23	422
1923–24	758
1924–25	782
1925–26	721
1926–27	761
1927–28	1,029

Drift and gill nets were found to yield the best results on weedy sections of the lake in calm days. Realizing the efficiency of the new nets, the local fishermen have now made similar nets and are using them to poach fish in the lake at night. Though the men may be utilizing the knowledge acquired from the department, in a way detrimental to the department's immediate interests, it is nevertheless a matter for gratification that the department's demonstration has been effective.

The aim of providing a constant supply of fresh fish at cheap rates to the people in the neighbourhood has also been realized in a considerable measure in recent years, with the progress made in

fishing the tank regularly. The fish caught are regularly supplied all round the year, to the markets at Kanigiri and Udayagiri and sold locally at a fixed price.

(6) Other piscicultural schemes.

Hilsa breeding.—Hilsa is a large and highly esteemed fish of the herring family which ascends rivers as does the salmon, for breeding in fresh water. The Cauvery in the south and the Kistna and Godavari in the north, are the chief rivers in this Presidency which are visited during the south-west monsoon by shoals of breeding Hilsa. Extensive and valuable fisheries exist in these rivers. Consequent on Dr. Day's report on the disastrous effects of anicuts which obstruct the free ascent of fish to their natural breeding grounds and facilitate their capture and destruction by fishermen in enormous numbers, Government have been taking steps since 1869 to safeguard the Hilsa fisheries from possible extermination. The suggestion of Dr. Day to construct fish passes across anicuts was tried in his time at the Lower Anicut, but were found ineffective as Hilsa would not ascend them. In 1909 the question was revived by Sir Frederick Nicholson. After an exhaustive enquiry fish passes as a protective measure had to be finally abandoned. The proposal for the construction of a Hilsa hatchery at Lower Anicut on the Coleroon river as the only satisfactory solution of the problem was approved by Government. An expenditure of Rs. 3,910 to meet the capital cost and the running expenses was sanctioned in 1909–10.

The proposal was (1) to establish a hatchery at Lower Anicut (Coleroon) to strip fish, artificially fertilize and hatch the eggs and (2) to rear the fry in suitable growing ground before liberating them into the river. Mr. Wilson succeeded in fecundating a few eggs in earthen pots, but for some reason or other, the hatching of eggs in the hatchery since its construction in 1909 was not successful. In 1915 the present Director took charge of the experiments. By 1921 the details of the method of impregnating Hilsa eggs, their subsequent treatment and hatching on a large scale were all successfully worked out. The hatching of Hilsa eggs having been successfully accomplished, the equally difficult problem of rearing the fry till they are of sufficient size before liberating them into the river, remains to be solved. The fry, when hatched, are mouthless hardly 3 mm. long, float belly upwards when resting and swim at intervals by rapid corkscrew movements of the body. They are nearly as defenceless as eggs and if hatching operations are to achieve the maximum results in increasing fish, the fry should be nursed in sheltered waters till they grow to sufficient size to go to sea. There are no suitable rearing grounds at Lower Anicut. The Collair lake in the vicinity of the Kistna and the Godavari appeared to afford the necessary facilities for the work. Proposals for instituting further

experiments in the Collair lake were therefore submitted to Government in 1925 and a sum of Rs. 500 was sanctioned. A small experimental hatchery with one McDonald jar and an iron overhead tank was fitted up in the office of the Assistant Industrial Engineer, Bezwada, in 1926–27. There were ripe fish available almost daily that season, but the difficulty was to secure the fish before death. On the few occasions live female fish with exuding eggs were obtained, live males were not available. At the Lower Anicut as the fishery is controlled by a single lessee there are grater facilities in securing fish alive. Also the method of fishing at Lower Anicut by means of a hand net when the river is full and the drag net when the river is low, enables fish to be kept alive for some time after capture and there is every facility to select live fish, male and female, required for hatching operations. The fishing at the Bezwada Anicut is free to all and each fisherman fishes whenever and wherever he pleases and carries away what he catches without reference to others. Fishing is done by a gill net which is allowed to drift with the current and the fish are usually taken long after they have been strangled to death. Great difficulty was therefore experienced in securing ripe fish alive at Bezwada. However, a few fish were procured and their eggs were hatched in November 1927.

Hilsa is absent from West Coast rivers which appear admirably adapted for this anadromous fish being uninterrupted by anicuts, full of fish-food and having excellent breeding grounds. Further study of conditions in West Coast rivers is necessary, before the experiments in transplanting Hilsa to the West Coast is done with any chance of success.

SECTION IV.—FISHERY INDUSTRIES.

Sir Frederick Nicholson in his note on Fisheries in Japan proposed an experimental station for developing Marine Fisheries on the model of Japanese institutions. In paragraphs 186–194 he has defined the aims and lines of work, of which the following is an abstract:—

"The first suggestion relates to the early necessity for at least one sea fishery Experimental Station. The peculiar history and work of the Japanese Stations as described above, show their practical value; they are 'peculiar' in the sense that, unlike those of other countries, their origin and primary object is industrial; primarily they are not biological observatories, valuable though these are, *but they are places where the processes of the industry and the requirements of the trade are practically experimented upon and developed, e.g.*, in the building of better boats,

in the use of new nets and methods of capture, in the better curing and preserving of fish and in new modes of preservation, in introducing goods into the market whether by exhibition or otherwise, in various methods of pisciculture, and in educating the people in these processes, whether in practical schools or by advice and example. They serve secondarily, however, as places of experiment and research in special matters, and as centres of that enquiry and observation so essential where Government desires to improve an industry or a community by methods based on exact knowledge of conditions and facts. In like manner, we need experimental stations on these coasts as a means, in the first place, of ascertaining experimentally the boats and nets, the catching and curing methods and processes, etc., suitable to these waters and climates, and of estimating quantitatively the chances of extended fisheries; in the second place, of demonstrating and teaching those found to be of real practical value; and in the third place, of obtaining knowledge by close scientific observation of the character of the waters and of the habits and characteristics of their fauna and flora."

". . . the Madras fishing industry . . . leaves almost everything to be desired in the methods of capture, preservation and distribution . . . however backward the West Coast may be, it is, I consider, in advance of the East Coast in the matter of fisheries and since this important industry is waiting for development, and there is no one to begin it, Government must show the way; the Japanese Government, notwithstanding considerable private enterprise, have found it necessary to act in this way, viz., in establishing Experimental Stations, and I suggest that the Madras Government shall begin work by establishing as soon as circumstances permit a first station on the West Coast, probably at Tellicherry with the following initial objects:—

"First, it will be the earliest business of the station to build or cause to be built on its designs small (5 to 10-ton) seagoing fishing boats (sailers) suitable to local requirements within the means of many local fishermen, safe, roomy and comfortable enough to shelter a crew for a week or more, and to house their catches in saltholds or in wells or live chests . . . In Japan the improvement of boats for deep sea and distant fishing is a constant anxiety and subject of experiment and our experimental station should take the lead in demonstrating the best build and rig, and the cost; measures for assisting fishermen—if necessary—to build such boats can follow on the demonstration."

"The second object of the station will be the introduction and use, especially with the new boats, of new and better nets especially the *purse seine* for deep sea use on the shoals of sardine and mackerel . . . the use of the trawl is obviously indicated, and this net will also be tried. The long line . . . will also be adopted . . ."

" The third object of the station will be to experiment in bringing fish to shore or into the curing yard in better condition than at present, even when salt is not used on board; to learn and to teach the better treatment of the fish, alive or dead, so as to minimise the chances of taint before reaching the market or the curing yard . . ."

" The fourth . . . object of the station should be . . . to teach the method of rapid collection at sea and transport to shore."

" The fifth object is the better curing of the fish . . . much weight will therefore be given in the station to experiment and demonstration in curing process . . . and teach better practice especially in the methods of drying fish.

. . . We need new methods of curing and preservation for market, such as fish pickled wet in barrels . . . hard dried fish like the Norwegian stockfish . . . smoked fish . . . and red herrings for long keeping, or mild cured, like bloaters, to be kept for a few days only; preparations, such as shark flesh and other pastes of Japan or the dried cod meal of America; goods put up in cans for indefinite preservation and, if necessary, for export."

" Sixthly, as a special branch of fifth object, the canning industry should be developed . . ."

" The seventh immediate object of the station will be observational. The station will be utilized as a minor marine laboratory for studying questions of importance relating to the food-fishes of the Coast. We know practically nothing accurate at present of the habits, food, habitat, spawning periods and places, etc., of the various classes of fish or of the causes which bring the shoals to shore or keep them away; the nature, abundance or paucity of fish-food (*plankton*) in the waters is wholly unstudied, though important as a test or sign of the nature and abundance of fish life. An observational section will be able to utilize and control the statistics now furnished regarding the catches, appearance and disappearance, etc., of fish by the fish-curing yard returns . . ."

The proposal for the establishment of a sea-fisheries station at Tellicherry was abandoned as a private firm—The India Fisheries Company of London—had commenced operations on the West Coast and the whole work of the proposed experimental station was expected to be carried out on a large scale with abundant funds and experts by this Company. In June 1908, Sir Frederick Nicholson obtained sanction to a station at Ennur intended for the following purposes:—

(*i*) to experiment with large sailing boats and up-to-date fishing nets and implements to fish the deep sea as a supplement to inshore catamaran and canoe;

(*ii*) to experiment with the best methods of preserving and bringing fish fresh to shore and putting it cheaply on the market free from taint;

(*iii*) to experiment with a swift carrier boat with live chests and wells for collecting fish from fishing boats and landing them without delay;

(*iv*) to effect improvements in indigenous methods of cure and introduce improved methods, such as smoking, wet pickling, mealing, canning and refrigeration;

(*v*) to carry out observations on edible oysters and conduct experiments in oyster culture;

(*vi*) to carry on biological studies on fish and fisheries.

The bulk of the work done at the experimental stations subsequently established consisted mainly of industrial experiments, in curing, canning, oil and guano and refrigeration, etc., which are summarized below:—

A—Curing.

In 1908 an Experimental Station was opened at Ennur, near Madras, with a view *inter alia* to experiment in salting, curing and preservation of fish. The Ennur Station was located in the Public Works Rest-house. A Superintendent and Head Curer were appointed to supervise the work. During 1908 salting and smoking arrangements were made and the experiments carried out related to—(1) the observance of absolute cleanliness especially in the gutting shed and the thorough washing of fish and (2) the use of clean salt. The discoloured salt, which alone was procurable locally, was a stumbling block and this had to be dissolved, decanted and evaported to get a fairly white salt. The amount of salt required, the period of salting and the best method of drying were all matters under investigation, as also the method of salting by immersion in strong brine instead of the method of dry salting. Proper scaffolds and ' flakes ' were used for drying and these were found to be very efficacious and clean as compared with the indigenous method of laying on mats on the ground. Very few blow-flies attacked properly treated fish and even these were entirely kept away, either by using gauze coverings over the flakes or by a sprinkling of preservatives.

Smoking of the salted fish was also tried with success; the kilns used for smoking were simple and cheap and the products found general acceptance and favour. The chief kinds of fish used for smoking were Mackerel, Ribbon-fish, small-Seer, large-Seer in slices, one species of Horse Mackerel and Kora (Sciaena). Besides *hard* smoking which would keep the products good for some time, experiments in *light* salting and curing for early consumption were also tried.

Actual demonstrations with kilns and fish, and lasting about a fortnight each, were given on the West Coast (Cannanore and Tellicherry) and Waltair. Smoked fish were received with favour not only locally, but elsewhere in Northern India and the Punjab.

Miscellaneous other experiments.—A beginning was made in investigating the proper treatment of fresh (not cured) fish on the way to market or to the consumer, so as to ensure—(1) that it arrived at the market, especially inland, in good condition and (2) that the markets or areas served were considerably extended. This was perhaps the most difficult of problems in a country possessing a fully tropical climate ranging roughly from 70° F. to 100° F. with slight variations on either side and yet poor, both in the *material* assets which simplified the question in the West, such as wealth and high prices, cheap ice and coal, short journeys and rapid transport and also in the *moral* assets, such as business enterprise, technical knowledge, educated public taste and opinion, sanitary regulations and so forth. The problem was how to get wholesome, untainted fresh fish to market without ice, as a rule, at low cost, and in large quantity. It was, however, proved by numerous experiments that fish well cleaned and soaked for a few minutes in weak brine with a slight admixture of boric preservative would keep *perfectly* up to at least 24 hours *without the use of ice* even in March, especially if wrapped in special paper, such as vegetable parchment or butter paper.

The *Hislaire* process of preserving fish by sterilization was also tried, probably for the first time in India. Sir Frederick Nicholson bought a sterilizer and pastilles and experimented with it at Ennur; fresh fish treated were hung in the open air and continued without taint up to complete dryness, though they had received *no salt, ice or preservative whatsoever;* flies entirely abstained from touching them when wrapped in butter paper or vegetable parchment; the fish kept perfectly good for days.

The *Chlorine* process of steeping fish in electrolysed sea water, was also under successful experiment, the fluid was being supplied *gratis* by the courtesy of Messrs. Binny & Co. The preserving power of this fluid *per se* so long as the chlorine was evolved, has been completely demonstrated.

Cannanore Station.—A new station was sanctioned in August 1908 and it was opened in 1909–10 at Cannanore as Ennur was found unsuitable. Here several experiments were made in ordinary salting and drying, in smoking especially of the lighter classes, similar to kippers, bloaters and haddocks, in the cure of sardines as pilchards, which process had the advantage that by the rapidity and ease of curing, any desired quantity of sardines could be turned into good food. The products generally were found not only commercially acceptable in Ceylon, where there was a great

market for cured fish, but realized, in several cases considerably higher prices than ordinary local cured fish.

A parcel of dry saltfish samples—cod, haddock, ling, etc.—was obtained from England and was a revelation to curers in their appearance, flavour, etc.

The adoption of slow drying under shade, to avoid the discolouration from oil usually found in all locally cured fish, obtained considerable success.

Brining with saturated brine was found, for some purposes, superior to salt, the strength being kept up by loose salt; this gave a better surface to lightly smoked fish. Owing to the impurities of the salt from the saltpans, English salt had to be largely used for experiments.

A young man of some means from Travancore underwent training in the various operations.

1910–11.

Experiments in the preparation of dried saltfish of superior quality were continued. Further experiments in *washing salt* in a sieve, in a tub of semi-saturated brine to get rid of dust, mud, sand, small shells, etc., which made " the cleanest fish eat gritty " were made. The resultant salt was almost as good as British duty-paid salt as regards contents of sodium chloride. Other experiments tried were the following:—

Pickling, i.e., salting in barrels for sale as wet fish, was a method new to this country. Owing to the difficulty of getting proper barrels the experiment was not fully carried out. A quantity of seer, pomfret and mackerel was placed in open roughly lidden boxes and tubs in 1 to 3 salt as in western countries and these were perfectly good even after five months.

Old brine, obtained in salting superior fish, e.g., seer, pomfret, mackerel, etc., was largely used in brining sardines and other thin and small fish. The old brine was used either filtered through sand and charcoal or latterly boiled. An addition of one-third further salt brought the brine back to saturation.

Formal de hyde and Chlorine.—Though sterilizing fresh fish, gutted, split and washed proved to be a success, yet sterilizing good-sized whole fish when merely gutted was found to keep good only for short periods. Five or ten minutes steeping in strong brine made sterilization by the Hislaire process a certain success, while a very small addition of boric preservative to the brine was found to ensure preservation for several days.

Tanur Station.—As towards the close of 1910–11 the Government sanctioned the transference of the oil and guano operations from Cannanore to Tanur, the curing work also, to facilitate easy

supervision, was shifted in 1912 to the latter station which had more fishing boats than any other fishing centre in Malabar and landed a much greater weight of fish.

The following experiments were made at the Tanur Station:—

1911–12.

Light curing.—This was started in 1910–11. Parcels of fish, cleaned, brined or salted for 20 to 30 minutes, sufficiently dried and packed were repeatedly despatched by rail to Kodaikanal—three or four days in transit—and these were found to arrive in good condition. Such fish being only slightly salted had the advantage of having lost but little of their nutritive value and of their digestibility. When such fish were smoked for a few hours, their keeping capacity was much enhanced and to Europeans, at all events, the flavour greatly improved. Light salted fish were also fully dried without the least appearance of taint; this not only saved the time usually spent in salting, but kept the product far more nutritious and digestible.

By a similar method sardines were cured with great advantage; the whole, ungutted sardine, just as it came from the sea, was washed, thrown into saturated brine or mixed with dry salt 1 to 6 or 7 for only one or two hours and then sun-dried. The product was quite good, well flavoured and kept for months. It was the quickest, easiest and most productive of good food of any process yet adopted and enabled these fish to be dealt with by tons per hour and turned rapidly into sound but cheap food instead of being dried into inferior manure.

Artificial drying.—Successful experiments were made in artificial drying by using a low cumbustion stove and a hand-driven fan to secure drying when weather conditions were unfavourable.

Vacuum drying.—Experiments in drying fish by means of a vacuum plant were attempted, but owing to a defect which prevented obtaining a sufficiently high vacuum for evaporation at a low temperature, they were not proceeded with.

Pickling.—Experiments were continued. Both mackerel and sardines were successfully pickled, i.e., packed wet in airtight barrels with plenty of salt and kept moist; the fish could be sent out in the original barrels, drained and packed moist with a little extra salt in boxes or kerosine tins. The advantages of pickling as demonstrated were—

(1) its greater digestibility;

(2) its ready preservation for many months (if containers were airtight);

(3) the comparative ease with which the salt was removed by soaking, from the wet fish;

(4) the greater range of culinary possibilities;

(5) the fish, when out in barrels, were not liable to the attacks of insects, mildew, etc., a common trouble with dried fish especially when stored in bulk;

(6) wet curing is independent of weather.

The disadvantages were—

(1) the need for somewhat expensive containers (for poor people even if kerosine tins);

(2) the larger quantity of salt required;

(3) heavier cost of transport due to the weight of the packages of wet fish.

There was a notable visit of enquiry by an official deputation from Eastern Bengal and Assam to study these methods.

1912–13.

By the commencement of the year the Tanur Experimental Station had two curing sheds, dryers, smoking boxes, a flyproof shed for hanging lightly cured fish, various other curing plant and manure pits for offal.

Experiments in light curing on ungutted sardines were continued, but the chief experiment for the year was on *Pilchardizing* on the same lines as practised in Cornwall, viz., in placing the ungutted cat fish (Pilchards) in heavy salt in 1 to 3 for a week or two, removing them to barrels with loose staved bottoms and subjecting them to pressure; the result, after two or three days moderate but increasing pressure, was a firm solid mass of moist pickled fish, and a considerable quantity of good and pure oil almost entirely free from stearine, since the fish were pressed at normal temperature when the stearine remained solid and could not be pressed out of the tissues.

Though a very good oil was obtained by this method, yet, for various reasons, the cured fish did not keep properly.

1913–14.

During the year the experiment was repeated, but the pressure was still insufficient; the fish however kept well for months. Regular pilchard screws for applying pressure were obtained from Plymouth. Pilchardized fish on a commercial scale are largely exported to Italy where they are cooked with rice and vegetables.

Prawn curing.—The only method known to the general curer was that of simply strewing the prawns, wholly unsalted, on the beach to dry; the resulting produce was always badly tainted or of very strong odour. Moreover, as prawns were mostly caught in large quantities in the monsoon period, it was often difficult to dry them. Obviously it was necessary to cure the prawns by salting and to find some mode of drying them.

The new method adopted at Tanur was to boil the prawns in salt water, shell the prawns, salt or brine them for a few minutes only and semi-dry them. It was found that this method yielded a product suitable for the best tables and kept perfectly good for months. The special features with the semi-dried prawns were—(1) they retained the original prawn flavour; and (2) they were easy for cooking and for digestion. These products were tried scores of times with invariable success and great appreciation by consumers.

The fishing season was a failure; this, coupled with the absence of deep-sea boats, prevented the station from making any progress on the other lines. Further experiments in *artificial drying* were carried out in the small drier put up at the Tanur Station. Fish and prawns were dried in it frequently with success; but it was difficult to teach ignorant men the true methods of operating a drier even when worked with a simple slow combustion stove. The disposal of the cured products gave a great deal of work in the calculation of costs, in the consideration of the best methods of marketing and in ascertaining public tastes; four jails wrote for supplies of dried fish, but Salem and Vellore shortly dropped out; Trichinopoly and Coimbatore however continued to take supplies.

1914–15.

The year was extremely unfavourable; there were no shoals of cat fish, few large fish, extremely few mackerel and an extraordinary shortage of sardines. No new departures were made except in the construction of a new drier and in improving the semi-dried cure of prawns. These were well established as an excellent product for which there was a large demand. Five pounds of fresh prawns yielded one pound of shelled semi-dried prawns which kept for months and, when slightly soaked, formed an excellent substitute for fresh prawns.

A Sub-Assistant was sanctioned and one was appointed late in the year to take charge of the Tanur Station.

A student from Baroda and another from Travancore were admitted to training for official work in their own States and they did very well; a young man from South Kanara was also admitted as an unpaid student.

1915–16.

The year was absolutely disastrous as it was one of fish famine. Mackerel, sardines and cat fish were scarce; the larger fish feeding on the smaller ones were equally scanty. Hence ordinary operations were poor and only prawns gave fair results.

Pickled Mackerel.—The new experiment was tried in pickling mackerel, but these were too few for serious treatment. Mackerel, pickled with salt like Scotch and English pickled herrings and sold moist, were favourably received. Experiments in pickling

mackerel with vinegar (a strong antiseptic) and spices were started. The difficulty with this process was to get water-tight wooden containers or double lacquered kerosine tins.

1916–17.

This year was better than the previous one, but was not altogether favourable. Sardines were mostly small and lean as compared with ordinary years. The mackerel were unusually small and large fish scarce. Experiments with mackerel pickled moist with ordinary salt and pickled with condiments were developed. They were quite tasty when properly prepared and cooked.

The curing station was visited by His Excellency the Governor and the Indian Industrial Commission during the year.

1918–24.

The curing methods developed at Tanur having attained a fair standard, from 1918–19 to 1923–24 no important advance was made beyond demonstrating to the public the methods ascertained and pushing reforms in public fish-curing yards. The statement below gives the main facts relating to the work at Tanur during the years 1918–19 to 1923–24:—

Year.	Fish cured.	Amounts for which sold.	Remarks.
	LBS.	RS.	
1918–19 ..	90,269	3,878	Sardine though abundant was small.
1919–20 ..	127,476	5,918	Season poor, as regards larger kinds of fish. Sardines were available in plenty.
1920–21 ..	97,724	5,802	Sardines scarce, but mackerel were in fairly large quantities.
1921–22 ..	100,817	5,917	Sardines scarce, but the fishing was slightly better for mackerel and some of the larger kinds of fish.
1922–23 ..	249,293	Not separately given. Large supplies of cured fish to jails amounted to Rs. 5,401.	Fishing season favourable. Sardine and mackerel abundant, though large fish were scarce.
1923–24 ..	92,031	Not separately given ..	Season disappointing. Sardines and mackerels scarce.
1924–25 ..	83,843	Do. ..	Do. do.
1925–26 ..	83,284	Do. ..	Do. do.
1926–27 ..	78,764	Do. ..	Season poorest of the four years, including 1926-27.
1927–28 ..	81,675	Do. ..	Sardine scarce.

1924–25.

In July 1925, the Government ordered that the accounts of the Tanur Station should be maintained on commercial lines.

A new set of experiments was inaugurated in 1924 with a view to ascertaining how to prevent defects in cured fish under storage, such as "pink-eye," moulds, rusting and saline excrescence in dried prawns.

Pink-eye and rusting.—Sodium Benzoate and Bisulphide in the proportion of 1 : 20 of salt had a very favourable effect in preventing " pink-eye." Pickling mackerel in brine in closed barrels, free from light and air, prevented Pink-eye and rusting completely for months on end.

Saline excrescence in dried prawns.—The occurrence of salt excrescence was found to be connected with the length of time for which the prawns were cooked; by limiting the cooking to an absolute minimum, the defect was found not to appear for a considerable time.

At the request of the Director of Industries, Bihar and Orissa, the District Fishery Officer, Puri, was trained at the Tanur Station during the year in the curing of fish, specially prawns, which was one of the chief industries of the Chilka lake.

An important prawn fishery, worth several lakhs, is carried on in the Collair lake on the East Coast every summer after the first monsoon floods. With a view to augmenting the manufacture of semi-dried prawns for which there was always a high demand, and to extending and demonstrating prawn curing methods ascertained and practised at Tanur Station to the East Coast curers, experiments in semi-drying prawns in the Collair lake were conducted by the Inspector of Fisheries, Vizagapatam, on a small scale, at the instance of the Registrar of Co-operative Societies and they yielded good results.

1925–26.

The usual methods of cure were continued. Certain experiments to prevent salt excrescence in semi-dried prawns were carried out.

1926–27.

Three men were trained at Tanur, one a Chemistry graduate employed in the Malabar Soap and Candle Works in manufacturing fish oil. The members of the Thalayi Fish-curing Co-operative Society were instructed in the methods of light curing large seer.

Seeing there was a good demand for good quality mass-meen (Bonito) in Ceylon and the Far East about 84 lb. of mass-meen were made at Tanur (from Bonito and Tunny) as an experiment and the whole stock was sold locally and the consumers appreciated it highly.

The manufacture of Bonito will be one of the chief items of research and experiment at the fish-curing yard in Laccadive Islands recently sanctioned by Government.

Experiments in sterilization were renewed. Big galvanized tins were used as containers. A consignment of fish was sent to Vellore where the fish arrived in sound condition. The contents were sold and the tin returned; but the container was subsequently found unserviceable owing to the bolts getting rusty and developing leaks which could not be soldered. A suitable container is to be devised for future experiments.

Experiments in electrolysing salt water for preserving fresh fish were restarted. A small 5-amp. Graphode Electrolyser was purchased from Messrs. Mathers & Platt, London, and set up in the Marine Aquarium in March 1927. The electrolyser is the smallest in the market and yields only a gallon of solution with 1 per cent available chlorine in three hours. A few initial experiments were carried out with the preparation of sodium hypochlorite and in the preservation of fish; sodium hypochlorite has been successfully manufactured and the experiments in preservation of fish have shown that about 200 c.c. of fluid is sufficient to keep one pound of smaller variety of fish for over 30 hours. The faint smell of chlorine however is a drawback and various experiments were tried to eliminate it as well as to design containers to transport fish in sodium hypochlorite solution. The need of the services of an Engineer and Bio-chemist who could devote their undivided attention to the work is keenly felt. The modern tendency is to eliminate all preservatives and antiseptics (such as boric acid) even in infinitesimal quantities, in the preparation of foodstuffs (vide Report by the British Department Committee on preservatives and colouring matter, 1923). The principle has been scrupulously observed in all recent experiments at Tanur.

1927–28.

Experiments were made to determine the proper proportion of salt to be issued for curing shelled prawns and Mullan (Equula) in wet and dry weather and for mackerel under Ratnagiri cure in the public fish-curing yards. The proportions fixed were the following:—

	Wet weather.	Dry weather.
Shelled prawns	1 : 4	1 : 5
Mullan	1 : 6	1 : 8

Mackerels under Ratnagiri cure, 1 : 6, 1 : 12, 1 : 19 on the first, second and third days.

Improved types of cooking vats and gutting tables were designed and tried.

Special attention was directed to the reduction and standardisation of working costs by organizing labour. The coolies engaged on daily wages were dispensed with and contract rates for piecework were introduced resulting in a great amount of saving.

Fish-curing is an age-old industry in India, but the methods in use are generally primitive and susceptible of great improvement in regard to the flavour, appearance, cleanliness and keeping quality of the product. The chief indigenous method is to salt the fish, usually for one night, followed by sun-drying. Long and patient endeavour to ascertain improvements in methods that are inexpensive to adopt, has been made by the department particularly at its experimental station at Tanur. The Tanur Station has accomplished much in determining the correct proportion of salt for curing, improved methods of cure, including most of those adopted in England and America. Its products are far superior to those of the bazaar (*karuvad*). To introduce the improvements ascertained at Tanur into trade particularly in regard to cleanliness and sanitation, proper salting and drying, six Government fish-curing yards were transferred temporarily from the Salt Department to " Fisheries " in 1917. In 1924 all the yards in the Presidency were transferred to the control of this department. Progress in improvement in public fish-curing yards has been slow owing both to the innate and ignorant conservatism of the curers and to factious opposition. With patience these obstacles are being overcome. Now there is a notable improvement on the West Coast in the cleanliness of the products of these yards, but the produce is not yet up to the mark. The work in the East Coast yards commenced only four years ago and reforms there are even more difficult than on the West Coast, chiefly on account of the extreme poverty of the East Coast curers. A beginning however has been made.

B—Canning.

In August 1908, Government sanctioned canning experiments at a suitable West Coast Station. Sir Frederick Nicholson, while in England on deputation in 1909, purchased an autoclave for canning experiments. During 1910–11 a suitable building was rented at Cannanore and the plant was set up there. By the courtesy of Messrs. T. Stanes & Co. of Coimbatore, two artisans were trained at their Coffee Works in the making of cans. Stores, such as tin plates, oil, etc., were also obtained.

1911–12.

When the Cannanore Experimental Station was transferred to Tanur the Canning Branch was shifted to Calicut. The small canning plant was supplemented by several necessary accessories. Sardine tins of usual " quarter " and " half " size as well as round tins of any depth were made.

Mackerel, sardines and prawns and fish pastes generally of mackerel and sardines, were canned with encouraging results. In

some experiments the success was marked, but in others only partial. The failures were chiefly due to—

(*a*) the inferior oil obtainable in India;
(*b*) inexperience in condimental additions;
(*c*) inappropriate methods or period of salting, drying or cooking, and
(*d*) the inexperience of the soldering staff in hermetically and rapidly sealing tins full of oil, brine, etc.

It was realized that success in general canning could not at once be obtained in India with many new conditions to face and that several years of experiment would be needed before perfection could be obtained.

1912–13.

Three hundred and seventy-four experiments were conducted and these were mainly concerned with sardines in oil, plain sardines without oil, mackerel plain and marinated, and plain prawns, besides various minor lines, such as fish pastes. The technical success attained enabled Sir Frederick Nicholson to decide on certain standards for each class of product. Some samples that were sent to the public were received with favour.

On account of this success, Government permitted Sir Frederick Nicholson to obtain a superior can-making plant of a character determined by his enquiries in England in 1912. The factory was expected to become a place of instruction in canning where the so-called secrets of canning could be taught. Canning, properly conducted, was a method eminently suited to the tropics, especially for fish which so readily taint.

The question of the bitter controversy raised in England in 1912 over the Trade name " Sardines " was examined and Sir Frederick Nicholson decided on calling the Madras fish " Indian Sardines."

1913–14.

The experiments were further improved. As the plant was still the small experimental plant of 1912, only a few thousand cans were packed, chiefly of sardines (plain, curry or with oil), mackerel and whole prawns and in a small quantity prawn and smoked mackerel paste. The canning experiments numbered 700. Considerable advances were made in technical processes, especially in the use of oils obtained from England. One noteworthy feature of this year's experiment was that the first-class sardine oil made in the Government factory was found to be an excellent packing oil, and this opened out a large additional market for such oil and a method of cheapening canned fish.

The canned goods found a very appreciative market and the difficulty was not to sell the goods, but to supply the demand.

The new solderless plant from England arrived during the year and the new canning factory buildings were in the course of construction at Chaliyam which had the advantage of supplies from both the sea and the estuary while even the deep sea boats could come up to the factory gates. The cost of the site and the buildings was Rs. 14,845 and that of the plants, Rs. 11,092.

1914–15.

The manufacture this year was considerable, but the *recipés* used were practically those standardized in the previous year and, to judge by the demand, were highly appreciated.

About 30,000 cans of all sorts were packed during the year mainly of sardines (plain, cured and in oil) 13,020, of mackerel (plain and marinated) 8,676, whole prawns 2,905, prawn paste 4,806 and smoked mackerel paste 930. Twenty-nine thousand and one hundred cans were sold to the public during the year for Rs. 7,298 which worked up to Rs. 3 per dozen.

The new cannery at Chaliyam was put up; the new canning plant produced solid-drawn cans, the bodies of which were struck by a drawing press from the flat tin plates; the covers were secured to the body by " double seaming " with the interposition of a composition band which made an air-tight joint; this method produced a can free from solder; the can was struck as fast as the press could work and 50 perfect bodies were struck in five minutes.

It was proved during the year that sardines in oil were all the better for long storage; refined cotton-seed oil gave as good results as olive oil, while sardines in fine sardine-oil were generally preferred to any as being richer in flavour.

Experiments were tried with great success in preventing the slight discoloration of prawns when canned by treating the container in a special way.

Sir Frederick Nicholson while in England in 1914 attempted to persuade British firms to open canning branches in this Presidency, with a view to stimulate this industry. But the War spoiled the prospect.

1915–16.

An unprecedented scarcity of fish hampered canning operations and very few tins were packed. For lack of the true oil sardines (*Clupea longiceps* or Nalla Mathi) the 'Chala Mathi' (*C. fimbriata*) was tried, but proved to be fit only for third-class work, being lean, tasteless and very bony.

The new solderless plant was brought into operation, but had only scanty scope for its considerable capacity.

The necessity for protecting the inside of tins from the action of vinegar and of prawn flesh, etc., led to various experiments. " Double lacquering " inside of tins with a stove was found to be

fairly successful. This double stoving was troublesome and somewhat costly in fuel; hence experiments were made in sun-heating in a " Solar oven." In this the heat could not rise above 300° F., the maximum permissible for soldered tins, and the heat was obtained with no cost. But unfortunately this experiment was unsuited for the West Coast owing to a long south-west monsoon, frequent clouds and a moist atmosphere which absorbed and lowered direct heat.

Hundreds of orders were received literally from Kashmir to Ceylon, but there was little stock owing to the paucity of fish. So it was necessary to restrict the sales to within the Presidency.

Fisheries products were displayed at the Madras Exhibition this year. Several thousand tins were of double or more than double the ordinary size; these were tried, with a view to save tin plate and cheapen the price of the contents and to cater to the wants of big hotels, clubs, refreshment rooms, troops, etc.

Other fish (seer, pomfret, etc.) were also canned in some quantity and proved successful.

1916–17 and 1917–18.

Certain other experiments in the better preservation of canned prawns and in canning methods were attempted in these years as also some improvements to the " Solar Oven."

His Excellency the Governor and the Indian Industrial Commission visited the cannery.

1918–19.

Work was sadly hampered both by War conditions and the poor supply of fish; the stock of tin plates was exhausted and had to be purchased locally at a high price. Solder went up to about double the pre-war price and the proper packing oils were almost unobtainable. Notwithstanding these extraordinary items of cost, the sale price of goods was not raised above that of the previous year.

The sardines though very abundant this year were generally of miserable canning quality being lean, and, on this count, canning was for a time suspended. Mackerel were comparatively scarce and only 9,716 cans were packed notwithstanding all exertions and at the end of the year there was no stock left on hand. Prawns were also very scarce, and only 2,030 cans of whole prawns were packed and disposed of. During the year 80,267 tins of all sorts were manufactured; 62,095 tins were sold.

At a cost of Rs. 3,852 decent quarters for the staff were built on part of the land obtained from the Forest Department.

An experiment in canning sardines rather more salted than usual, in large tins in oil, was tried with success; a shopman could

open such a tin and sell canned sardines by the pound; as an experiment cans so packed and processed were subsequently opened and left open for many days without tainting.

The maximum temperature obtained by the " Solar Oven " was as high as 325° F. and cans were lacquered with it.

1919–20.

Mr. Hornell proposed to Government the appointment of a General Manager to take charge of the cannery as Sir Frederick Nicholson severed his connection with the department. One Mr. H. L. Prager, Inspector of Salt and Abkari Department, was appointed Business Manager and took charge of the cannery on 5th December 1919. Work was handicapped by repairs to some of the machinery. For want of cans, it was not possible to purchase all the fish available. To prevent a recurrence, an additional lid stamping Swan Neck Press and a set of duplicate dies were ordered from England.

Mullets, for the first time, were canned with success. Some consumers pronounced this to be equal to salmon; but, unfortunately, very few were available and those only at prohibitive prices.

A few tins of sardines, with the scales (which the consumers found a nuisance) removed, were canned and were found to be capable of improvement, but the operation was tedious and expensive and the fish liable to taint.

1920–21.

The year was a complete failure for sardine; but, on the other hand, mackerel was abundant. New experiments carried out this year were canning soles, mackerel in oil and mackerel put up as tamarind fish. To add to the difficulties the price of tin plates rose to an extraordinary degree. Besides, the quality of the tin plate was unsatisfactory due to the unsettled conditions of industrial life in England.

The reasons for the fall in sales of the cannery were—

(1) a glut of imported goods in the market;

(2) the disposal of large quantities of surplus stores of tinned fish by the Munitions Department, at low prices;

(3) the sweeping reduction in the number of English troops stationed in India, and

(4) the withdrawal, by the South Indian Railway Company, of the concession enjoyed during previous years of sending canned fish at half parcel rates, coupled with the recent enhancement of rates *plus* a surcharge.

The last of these causes proved most detrimental, for the freight bore a wholly disproportionate relation to the value of the goods. Efforts were made to give a wide publicity to canned goods by

means of samples in local exhibitions, advertisement, a new price list, new and attractive labels registered with the Madras Chamber of Commerce.

To achieve better results, Mr. Hornell suggested—

(1) the removal of the cannery to another place where sardines were more abundant, and

(2) the establishment of reliable selling agencies.

1921–22.

Mackerel were more numerous relatively to sardines which were again abnormally scarce. Prawns were scarce at Chaliyam and, to meet the local deficiency, semi-dried prawns from Tanur were this year successfully utilized for canning whole prawns and for paste.

Sales having declined, to reduce supervision charges, Mr. H. L. Prager, the Business Manager, was permitted to revert at the end of April 1922 and the Cannery was put in charge of a Sub-Assistant.

For various reasons the removal of the Cannery from the existing premises was urged again.

Next to sardine specialities, mackerel in oil came to be the most popular production and to improve the container, new dies were ordered. Samples of canned sardines sent to an expert in Great Britain elicited a favourable opinion.

1922–23.

The fishing season was fairly good, sardines were abundant, though small and deficient in oil. Mackerel and prawns were unusually scarce.

It was evident that some outlet should be found to dispose of the stock and Mr. Hornell proposed either the imposition of import tariff on the foreign canned goods or the concentration upon the creation of an export trade; the former, however, the Government did not view with favour.

1923–24.

Two new machines, a double seamer and a rubber gasket applying machine were received from England. Owing to defects in the dies and the rubber rings, the machines could not be put to use.

The sales by Messrs. McDowells, agents for the cannery goods, became unsatisfactory and their agency was terminated. A good many tins from their stock were found to have rusted and deteriorated and therefore to be in an unsaleable condition.

Canned goods were sent to the British Empire Exhibition and found a ready sale.

Burma and the Straits Settlements were ascertained to be probable markets for canned goods since they were importing large quantities from America. American shipments of sardines to the Straits Settlements showed an enormous increase in 1923.

In 1922	2,653,813 lb.
In 1923	6,053,497 „

The consul report also stated that there was in those years an unprecedented demand throughout Malaya for sardines from among the Europeans and the Chinese.

Government sanctioned the deputation of an agent, Mr. Alf. O. Ginivan, to introduce the department's goods into Malaya and canvass sales. Seeing that there was a demand for sardines in tomato sauce in the Straits, a sample consignment was prepared and sent to the agent, to ascertain possibilities.

Messrs. Bradley & Burch, Ltd., London, from whom the defective dies were obtained by the High Commissioner suggested local repairs.

The defective dies after trial by the Industrial Engineer were sent to the firm for repairs.

Owing to a large stock held in oil sardines and other lines Government decided that the Cannery should suspend manufacture of such goods, from 1st April 1925. The staff were accordingly reduced.

Mr. Ginivan left for the Straits on 6th November and returned on the 16th of December 1924. Except for a small order worth about Rs. 700, his deputation was a failure. He reported that there was a good market for cured products and not for canned goods owing to keen American competition.

The statement below shows the opening stock, number of tins manufactured, number sold and otherwise disposed of and the closing stock for ten years ending 1927–28:—

Year.	Opening Stock.	Manufactured.	Tins sold.	Tins written off.	Closing Stock.
1918–19 ..	19,511	80,267	62,095	..	37,683
1919–20 ..	37,683	59,586	40,729	4,229	52,311
1920–21 ..	52,311	67,524	35,092	2,591	82,152
1921–22 ..	82,152	70,510	31,243	4,761	116,658
1922–23 ..	116,658	79,873	48,285	..	148,246
1923–24 ..	148,246	74,113	27,331	15,602	179,426
1924–25 ..	179,426	42,677	33,886	10,808	177,409
1925–26 ..	177,409	(*a*) 417	26,762	6,449	144,619
1926–27 ..	144,759	..	11,497	2,216	131,046
1927–28 ..	131,046	(*b*) 3,228 ; (*c*) 3	107,156	23,959	* 3,162

(*a*) Sales returns; (*b*) Returned from England. (*c*) Excess in stock.

1925–26.

The two travelling salesmen on pay appointed by Government during the year for the disposal of canned goods failed to do appreciable business. So they were dispensed with and one Mr. Madhavan was appointed on a commission basis as sales agent.

The Fisheries Advisory Committee who were consulted regarding the future of the cannery recommended that Sir Frederick Nicholson should be consulted on the question. He made the following recommendations:—

(1) " Retain the cannery as an important activity and instrument of fisheries promoting food production and distribution and developing industry, trade and intelligence; in these objects it has as yet done only half its possible work.

(2) Concentrate on reduction of manufacturing cost—(*a*) by the closest attention to efficiency and economy and (*b*) by stopping the pecuniary leakage caused by spoilage and by undue expenditure on wastage.

(3) Reconsider the methods of sale.

(4) Offer the present lines and stock of goods at reduced prices so as to increase general sales, meet competition, get rid of accumulated stocks and advertise and push our produce.

(5) Widen the lines of production in the direction of cheaper goods for the masses.

(6) For these and other purposes, use the best management available.

(7) Change the location of the cannery to a more useful centre, even at some expense and loss since better supplies of raw material, publicity, ready supervision, technical help, the attraction of students and other benefits will thereby be assured and moreover the sale of the cannery, if desired, at some future time will in such location be profitable; if now sold or closed much real loss is inevitable.

(8) Develop its training capacity and make such training attractive and thorough."

He offered his services to run the cannery on return from England which the Government accepted. But later, on account of ill-health he was unable to undertake the work.

1926–27.

The defective die sent to England for repairs was received back from London.

An outright sale of the whole of the stock was effected in Burma at a reduced cost to compete with foreign goods.

Government wanted the Director of Fisheries to report on the future of the cannery. The Director proposed continuance on the following improved lines:—

(1) The assets should be revalued and the capital investment involved should be accurately determined for purposes of depreciation and interest.

(2) The cannery should manufacture tins of approved trade size already in the market.

(3) The management of the cannery and the Tanur research station should be combined with a view to reduce the overhead charges which at present amount to nearly 50 per cent. of the cost of manufacture.

(4) If possible a suitable by-industry should be undertaken to fill up idle time at the cannery.

(5) The purchase of its Europe stores should be exempt from the stores purchase rules and full liberty should be given for the purchase of machinery, tin-plate, etc., from the cheapest markets.

Scheme for Development of Trade.

Realizing from the experience of the previous year that, if the fish-curing industry and trade were to be seriously developed, *business knowledge and business organization* were necessary preliminaries, in 1909–10 the Personal Assistant, Mr. V. Govindan, was sent out on a tour of special enquiry and valuable first-hand information and facts regarding the existing markets and tastes in various localities were obtained. Sir Frederick Nicholson suggested to Government the need for State pioneership, as in the new catching and curing methods, in the matter of actually developing a trade and markets which did not then exist and would not exist till so developed. For this he proposed that it would be necessary for Government to take one or two particular localities, open a shop at each locality and keep it supplied with really good products. During 1910–11 also Sir Frederick Nicholson urged on the Government the necessity for exploiting the potential better class market if the industry and trade, as a whole, should develop and faulty methods and goods eliminated. He wanted that the development of the market must synchronise with the development of methods. In 1913–14 a stall was opened at the Moore Market (Madras) for the sale of the department's products. Another stall was opened in 1916–17 at Bangalore.

In 1924 efforts were made to popularize and push sales of goods manufactured by Government industrial undertakings. Mr. A. O. Ginivan was sent to the Federated Malay States to report on the state of the market and to effect sales of canned fish. It was evident from his report that there was a large market in Singapore for cured fish and that local curers were exploited by middlemen in Colombo who secured the lion's share of the profit

in the trade with the Federated Malay States. On conferring with all the fish merchants in the Presidency, it was found that they were eager to secure advantageous sales in the Federated Malay States, but desired the assistance of the department for the first few years. They agreed to co-operate and offered to pay the fare of the officer selected to go to Malaya for arranging sales of their goods. Government sanctioned the Director's proposal to send a capable clerk with sufficient knowledge of Tanur to Singapore. The scheme has not so far materialized owing to the following difficulties:—

(1) No direct lines of steamers exist from the West Coast to Malaya and arrangements are necessary to tranship goods at Colombo.

(2) Parties wanted the stuff on consignment basis. Banks offered to collect the proceeds, but refused to handle the goods.

(3) Shipping firms who offered to transport the goods as well as collect sale-proceeds demanded a high percentage of commission.

In 1925–26 Government appointed two travelling salesmen for the disposal of canned goods. These failed to do appreciable business as there was little scope for the disposal of the goods within the Presidency. The services of the two travelling salesmen for Tamil and Telugu districts were consequently terminated on 24th February 1926 and 27th March 1926, respectively. In April 1926, the Government sanctioned the appointment of one M. C. Madhavan as Sales Agent. Since he was unable to produce the necessary security, the agency could not be granted to him.

C—Oil and Guano.

Prior to the experimental work by the department, the amount of sardine oil produced on the West Coast was inconsiderable and of the worst possible quality. The usual method was to obtain the oil by putrefaction of a mass of sardines contained in a worn out and filthy dug-out canoe. It was also a wasteful process, for the proteid and other residue were thrown into the sea. Similarly, when fertilizer was made from sardines, the ancient and accepted procedure was to spread the sardines on the sand of the open beach and so dry them in the sun. This had two drawbacks—large quantities of valuable oil, of no manurial value, were wasted and the product became so highly impregnated with sand that analysis not infrequently showed the resultant mass to contain as much as 40 per cent of this useless adulterant.

In 1908 the Government approved of Sir Frederick Nicholson's proposal to obtain a small oil and fertilizer plant such as would be suitable for very small capitalists or even fisherfolk. This was intended to be worked in the Cannanore Experimental Station but pending examination of suitable plant by the Honorary Director in England the opening of the station was kept in abeyance. In the meanwhile, one private person, Mr. M. C. Choyi of Cannanore,

erected a small wooden press on the direct suggestion of the then Personal Assistant, Mr. V. Govindan. Mr. Govindan was interesting himself in designing and getting made cheap but effective presses for the purpose and Sir Frederick Nicholson hoped to second his efforts by enquiries in England.

During 1909–10 Mr. Choyi erected three presses and succeeded in placing marketable crude brown oil and guano of 8·3 per cent nitrogen and 7·95 per cent phosphoric acid on the market at remunerative rates.

Sir Frederick Nicholson attempted to devise methods of obtaining better qualities of oil and guano, to avoid waste of material and labour and to utilize waste matter. As a result of experiments he produced, instead of coarse brown oil, a fine yellow oil of good quality never before obtained on the coast and quite fit for use as an edible oil by the simplest method and plant. He also succeeded in getting the largest yield of oil from the guts then mostly wasted and which the local curers derided as oil producers. A main object of the station was the preparation of oil and fish guano from the oil sardines by a new system devised in 1908 by "Fisheries" on the example of the American farmers, and demonstration of the same to the public.

Under the new system the fish (or guts) were boiled in open pans over a fire and the boiled stuff was then pressed for oil. The pressed scrap was dried in the sun and formed guano. In this way the whole of the oil was obtained as a very valuable marketable product while the fish (tissues and bones) were reduced to a friable mass one-fifth of the weight of raw fish and readily assimilable as manure, while the process was absolutely inoffensive and free from sanitary objection. Many private persons took to these methods and during 1910–11 there were nine small factories in operation. In the experimental station efforts were made to separate the oil into two qualities, viz., fine yellow oil, which was the one skimmed from the surface of the boiling pan and ordinary brown oil obtained by pressing the boiled stuff. Fine yellow oil was, on test, found to be particularly good for leather and there were enquiries for it from firms in Hamburg, Australia, and elsewhere. A good deal was done not only in fostering the new methods, but also in ascertaining markets. The accurate data available from work at the station, as to the outturn and cost, showed that big profits could be obtained from improved methods and that the oil yield of sardines varied year by year as it was found that the fish differed largely in fat contents in different seasons, e.g., while in 1909 the very fattest were obtained in March, those of March 1910 were almost useless as oil producers.

From 1908 onwards Sir Frederick Nicholson advocated the wisdom of opening hundreds of petty factories, each costing a few hundred rupees, scattered all along the coast producing oil and

guano whenever possible, instead of large central factories, the success of which looked highly problematical especially in a tropical climate where fish could not be brought from even moderate distances without putrefaction.

The Agricultural Department approved highly of the new fish guano.

With a view to extending the market, specimens of fish oil used by 11 jute mills in Calcutta were obtained and it was found that they were very similar to Malabar ordinary brown oil but costlier.

It was wholly the action of Government that initiated the new industry of which the propaganda began in 1907, but more particularly in 1908 and it is gratifying to remember that the industry meant, *at its lowest*, the conservation and utilization of oil, hitherto wasted or rather *destroyed* in beach drying the oil sardine for manure, and that this conservation meant an economic benefit amounting to many lakhs of rupees in addition to many collateral benefits, such as the industrial and commercial stimulation afforded to the trade and the readiness and ease with which the new light weight guano unadulterated with sand could be transported to and assimilated by the crops of the country.

Towards the close of the year 1910–11, Government sanctioned further experiments in a somewhat enlarged and improved factory and the oil and guano work was shifted from Cannanore where fish were not very abundant and private guano factories were well started, to Tanur where fish was ordinarily far more abundant. Owing to the absence of sardine shoals and also to the delay in the arrival and setting up of the new and in the transfer of the old plant, little was done during 1911–12.

A powerful English press capable of taking charge of half a ton and a steam-driven centrifugal were set up; the latter was tried once and found effective in separating fluids from the solid. Steam was applied to boil the mass in the boiling vats, so as to obtain a prime, light coloured oil, and to reduce the boiling period. A small steam oil-boiling pan for sterlizing the oil and driving off any suspended water, a small and a large oil filter press and a steam oil refining pan working with an air-blast were also got ready.

Mr. Govindan continued his lectures and practical demonstrations (with a small portable plant) on the Coast. The number of private factories rose to 45; these factories were wisely limiting themselves to the production of crude brown oil to suit the nearest large market (the Jute Industry in Calcutta). The Tanur Station put up plants to secure only light coloured oil, to separate the oil and stearine by a filter press and to refine the oil, a special laboratory plant was obtained for experiments in deodorizing. Some of the best oil was supplied *gratis* to local medical men to test its therapeautic value.

1912–13.

At the commencement of the year the oil and guano plant at the Tanur Station included two steam boilers with two steam boiling pans of masonry and several of wood all heated by open steam, besides two copper pans for open fire, presses of various sorts, two filter presses and a variety of other accessories.

A small contract was accepted to supply 1,000 gallons of first-class yellow oil to the Government Leather Factory at Cawnpore. The steam vats were found to be invaluable for the extraction of this superior oil, since the action was rapid and the oil could not be scorched. Owing to the extraordinary local conditions very little oil was made at Tanur. Sardines were enormously abundant, but were almost destitute of fat. These gave good guano, but no oil worth mentioning.

The rush for the industry led to insufficient care in sanitary matters in private factories and on a reference by the Collector of South Kanara, Sir Frederick Nicholson examined a number of small factories and made suggestions for the proper conduct of operations, especially in the matter of leading the effluent waste water direct to the sea below high water-mark.

The following table shows the sudden rise in the West Coast export by sea of fish guano during the year 1912–13:—

1910-11.		1911-12.		1912-13.	
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
TONS.	RS.	TONS.	RS.	TONS.	RS.
188	13,618	267	17,866	1,872	1,54,910

The whole of the export was to Ceylon, but it was believed that part was re-shipped to Japan and elsewhere.

The absence of oil in the masses of sardines in 1912–13 led to a very heavy operation in drying sardines in the usual fashion on the beach. The wastefulness of this method in valuable constituents owing to the putrefactive loss of nitrogen, etc., could be gauged by the prices quoted by a large firm dealing in fish manure:—

	Rupees per ton bagged, f.o.r.
(1) Fish guano, guaranteed 8 to 9 per cent N and 7 to 8 per cent phosphoric acid	100
(2) Fish manure (beach-dried fish without guarantee)	40

No. 2 was the ordinary manure obtained by drying fish on the beach. Since five tons of fresh fish yielded 1 ton of guano or $1\frac{1}{4}$ tons of beach dried fish manure, the gain both in money and in nitrogen was obvious, while the whole of the oil (much or little) obtained in the manufacture of guano was an additional asset.

Owing to the absence of the oil in the fish, experiments in the methods of drying *lean* fish without boiling them were tried. Two methods were adopted, namely—(*a*) that of light and brief salting followed by sun-drying; (*b*) that of artificial drying. In both cases the object was to avoid the loss of several days of drying without salt on the beach where putrefaction, loss by soakage, birds, insects, etc., caused great loss of nitrogen and of actual material besides being a nuisance to the public. Great loss was often caused by rain on the drying material. It was found that one hour in salt was a sufficient protection.

1913–14.

The work was continued and improved; the percentage of first-class yellow oil obtained was larger than in 1912–13 and averaged above 50 per cent of the outturn. This oil was pronounced by an European buying firm as "Unique" by reason of its purity, colour and slight odour. The oil chemist attached to the department also gave a high technical value. The conditions of manufacture were again unfortunate as the shoals of fat sardines were not only few, but ceased at a very early date. However the quantity of fish guano exported by sea increased to 4,726 tons as against 1,872 in the previous year. The oil exports by sea were 1,511 tons of which above half went to Germany. The number of private factories increased to 211.

On requisition from the Collectors of Malabar and South Kanara several private factories were visited by the Honorary Director and the Assistant Director and a set of tentative rules liable to alteration on greater experience, was formulated to check the growing tendency on the part of the owners of the factories, to disregard sanitary rules which was proving a nuisance to the public.

1914–15.

The year was extremely unfavourable for sardine fishery and so very little was done. A new shed with two large boiling pans of a new model (one worked by steam) was built and arrangements improved for obtaining fine oil and preventing rancidity.

Samples of fine oil were sent to England for examination by hardening experts and to others for medical use, while the lower grades and stearine were made into soap. The Oil Chemist was employed on various analyses and experiments on fish-oil. The good effect of ordinary caustic lime on the effluent water in place of the expensive chloride of lime was partly demonstrated.

1915–16.

This year was absolutely disastrous to the industry being a year of fish-famine along the whole Coast; only twice in November, were sardines available for oil and guano work. Consequently there was hardly any oil and guano or fish manure on the Coast, and the prices for the minute quantity available, were very high. Only $2\frac{1}{2}$ tons of fish guano and a small quantity of oil were made at the Tanur Station and only half a ton of oil was available on the whole Coast from private factories which numbered then 250, to make up a forward contract for 10 tons of oil.

1916–17.

The sardine fishery this year was better than in the previous year and the manufacture of oil and guano was continued on improved lines; the products were of first-class quality. There was very little difference between skimmed and pressed oil while the guano on one occasion gave above 9 per cent nitrogen.

1918–19.

The sardines, though abundant, were lean, very small and poor in oil-content. About 106 tons of sardines were obtained at a cost of Rs. 613 and these yielded in oil and guano Rs. 2,173. The guano was sold at Rs. 81 per ton. The oil yield was only 4 per cent whereas the normal rate should be double this. During the year a great quantity of oil was supplied for the Munition Boards, mainly by purchase from the private factories, which reached 358 in number.

1919–20.

Sardines were plentiful and the operations resulted in a good sale in spite of the fact that the fish were much leaner than in previous years and the percentage of oil was consequently much less than usual not amounting to even 1 per cent. Two hundred and sixty tons of sardines costing Rs. 2,321 were treated and yielded 585 gallons of oil and $44\frac{1}{2}$ tons of guano, both of which realized Rs. 4,568, leaving a stock on hand valued at Rs. 656. The highest price realized for guano was Rs. 115 per ton *ex* factory, Tanur.

A considerable quantity of fish-oil of a superior grade was supplied to the munition factories and to private firms. Several consignments of guano were also purchased and supplied to co-operative societies and others.

Samples of fish-oil were sent to the Indian Institute of Science, Bangalore, for experiments with a view to finding out the simplest and the cheapest method of reducing the acidity.

The number of private factories increased from 358 to 563. It was estimated that 2,400 tons of guano valued at Rs. 100 per ton, f.o.r. were manufactured during the season; most of it was exported

to Japan, the value of oil manufactured on the coast was about Rs. 3,75,000. The insanitary condition of private factories was not remedied, but the rules for their inspection, etc., were framed and issued. Adulteration of guano with sand or mud was unfortunately a universal practice; in some samples 25 per cent of sand was detected.

During the year 24,557 gallons of various grades of fish-oil were purchased and supplied to the Board of Munitions. Most of it was of a superior grade and had to be specially manufactured besides at Tanur in a few factories where the manufacture could be supervised.

1920–21.

The operations were restricted owing to the dearth of sardines. Only 27·4 tons of fresh fish were purchased as against 260 tons in the previous year and 337 gallons of oil and 4·8 tons of guano were manufactured. The operations though very small were fairly remunerative; the cost of the fish was Rs. 406 while sales and stock in hand amounted to Rs. 603. The highest rate for guano was Rs. 120 per ton, f.o.r. Tanur. The few sardines were rich in their oil-contents, amounting to as much as 6·3 per cent in December 1920, as against 1·3 per cent in 1919.

A sample of superfine sardine oil was analysed by the Government Chemical Examiner and the result was as noted below:—

Specific gravity	0·927
Iodine value	161
Saponification value	196
Free fatty acid (as oleic acid)	0·5 per cent.
Colour	Yellow (pale).

The percentage of acidity was considerably lower than was allowed by the British Pharmacopœia for cod liver oil. Large samples were sent to the Tuberculosis Hospital for actual trial. The oil was also successfully employed in packing sardine in tins at the Cannery.

The set of rules framed for the guidance of the factory owners to check insanitation was approved in July 1920, and the local boards were empowered to enforce them. Government also sanctioned the appointment of an Inspector of oil and guano factories and a fitter, to instruct factory owners in the method of manufacture. A thorough inspection of all factories was made and advices to remedy the defects wherever noted, were also given. The number of private factories rose to 646, but on account of the scarcity of sardines very few worked and that too only for a short period. The total output over the whole Coast was estimated at 1,500 tons as against 2,400 tons in the previous year. On account of adulteration of the guano with sand in previous years, there was little demand for it and in some cases buyers actually preferred beach-dried sardine manure to guano and even paid higher prices

than for guano. Likewise the Malabar fish-oil earned a bad reputation in the Calcutta markets and the demand for the same was small. The department tried to bring the manufacturers to a sense of the injury caused to the entire industry by their lack of commercial morality.

1921–22.

The operations were again restricted, but on a few occasions large catches were made. The total weight of sardines dealt with at Tanur Station was 50·5 tons. From this, about 4½ tons of oil and 8½ tons of guano were obtained. Of the oil expressed 431 and 692 gallons were respectively graded as first and second-class. The highest price realized was Rs. 130 per ton for guano and Rs. 3 and Rs. 2 per gallon of first and second class oil.

The percentage of oil this year was particularly great reaching a maximum of 18·9 per cent about the middle of November; the general average for the year was 9 per cent. The report on the samples of oil sent to the Tuberculosis Institute to test its Vitamin A content last year, did not confirm the expectation previously entertained of the sardine oil becoming a useful and cheap substitute for cod liver oil. The Tanur oil was obtained by steaming the fish at a high temperature in an open boiler. It was felt that the mode of preparation adopted possibly caused the reduction in vitamin content.

During the year much consideration was given to the problem of devising an artificial dryer capable of dealing with large quantities of wet guano during rainy weather. Plans and estimates were obtained from a leading firm in England and from Dr. Marsden, Industrial Chemist and Dyeing Expert. Both had the objection of a high initial cost and running expenses in fuel. Eventually, taking into consideration the smallness of the capital at the command of the vast majority of the guano manufacturers and the state of the post-monsoon conditions, it was concluded that sun-drying under present conditions of manufacture on the West Coast could not be replaced economically by any artificial method.

A manual dealing with the manufacture of fish-oil and guano based largely on experiments and results obtained at Tanur, was completed by Sir Frederick Nicholson (and published as Report No. 3, Vol. XIII of Mad. Fish. Bull.); an honorarium of Rs. 1,000 was paid to the author.

The continued dearth of sardines reduced the number of private factories from 646 to 542 in 1921–22, out of which more than 300 took out licences as required by the new rules. In South Kanara, so scarce were the sardine shoals, that none of the factories conducted any operation. The total output for the whole Coast did not exceed 1,000 tons and the price per ton of guano was Rs. 130. The supply of oil was insufficient to meet the demand.

Officers of the department inspected all the factories in Malabar, those in South Kanara being shut up were not visited.

A demonstration plant was taken during the year, to some villages where this industry was not yet established and the method explained.

1922–23.

The season was favourable for sardines which were very abundant and the oil and guano factories prospered.

The total quantity of sardines treated at the Tanur Station was 417,053 lb. (186 tons) purchased at a cost of Rs. 1,459-5-6; the average price per ton was Rs. 8-4-3 as compared with Rs. 6-5-0 during 1921–22. There were 68,901 lb. (31 tons) of sardine offal resulting from the curing operations which was also converted into oil or guano.

The total output of guano was 84,720 lb. (38 tons), the price per ton f.o.r. Tanur was Rs. 95 as against Rs. 140 in the previous year. The proportion of oil varied from 2·2 to 7·7 per cent except in the case of a small batch on 385 lb. which yielded a phenomenally large percentage (19·7 per cent) on 7th November 1922. The outturn of superior grade oil was only 815 gallons, of which 300 gallons had an acidity below 1 per cent and the rest up to 2·5 per cent. Most of this oil was supplied to the Cannery. The second grade oil (pressed oil) about 1,350 gallons were sold to the Controller of Contracts, Simla.

A specially prepared oil was furnished to the Medical Officer (Major R. E. Wright) in charge of the Ophthalmic Hospital who had agreed to test it for therapeutic value.

Sardine shoals were abundant in the inshore waters along the whole coast, but they were lean and poor in oil-content. So, although many factories were at work this year and there was a great production of guano, the output of oil was comparatively small.

The estimated total production of guano throughout the Coast for the year, was 32,000 tons and that of oil 12,000 tons; the average price per ton of guano was Rs. 75 and of oil Rs. 100. Most of the guano was exported to Ceylon, but 2,000 tons were shipped direct to Japan; the oil was sent mostly to Calcutta. Towards the close of the season owing to demand from Europe, there was an improvement in the prices; and the price of guano went up to Rs. 125 a ton.

The number of private factories rose again to 647.

Municipalities and Taluk Boards levied Rs. 2 to Rs. 15 as licence fees on each factory.

There were three Sanitary Inspectors in South Kanara and two in Malabar employed by the taluk boards for the inspection of the private factories. The Fisheries Inspector and the fitter were retained for a further period of two years, from 18th November 1922. A systematic tour was made by these men, instructing and demonstrating to the factory owners how to prepare better grades of oil and guano.

1923–24.

Owing to the scarcity of sardines the operations were restricted, the total weight of sardine treated at Tanur was 185,260 lb. at a cost of Rs. 808 against 417,053 lb. at a cost of Rs. 1,459 during the previous year.

The output of guano was only 8,398 lb. and this was disposed of locally. The superior oil was supplied to the Cannery and to the Military and the lower grades of oil, stearine, etc., were sold to the soapery.

1924–25.

There was a scarcity of sardines and so there were operations at Tanur Station only on four days in the year. 41,851 lb. of sardines and 11,481 lb. of Podimeen were purchased and these yielded 313 gallons of oil, 297 lb. of guano and 10,348 lb. of fish meal.

Arrangements were made with the Director of the Imperial Institute, London, to have our sardine oil tested properly for the Vitamin content.

A small Laboratory was set up at the Tanur Station for analysing fish oil and manures and for various chemical and bio-chemical tests; private manufacturers were permitted to get their oil and guano analysed and certified on payment of a small fee.

A series of experiments in refining the fish oil and converting it into paint oil, etc., were started.

During the year 515 factories took out licences against 440 of the previous year. Very few factories however actually conducted operations owing to the failure of the sardine season. The guano was sold at Rs. 150 per ton, oil at Rs. 300 per ton and fish manure at Rs. 120. The total estimated quantity produced throughout the Coast was 4,000 tons of guano, 2,000 tons of fish oil and 1,000 tons of fish manure valued at Rs. 4,25,000, Rs. 4,16,000 and Rs. 1,00,000, respectively. The season proved disastrous to many, who were unable to fulfil contracts entered into in anticipation of a good season. The fish-curing yards of the Presidency were transferred to the control of the department and the special staff employed in inspecting factories were absorbed in the general staff of officers during the year. In consequence Fisheries Officers were not able to carry out any regular inspection of oil and guano factories since this year.

1925–26.

A poor sardine season resulted in sardine operations at the Tanur Station only on five days.

The total output amounted to 12,972 lb. of fish meal, 10,700 lb. of guano and 1,976 gallons of oil. The high percentage of oil, 11·4 per cent in sardines was a special feature of this year. Experiments in refining oil were also carried on and about 50 gallons of A-1 edible oil were prepared.

Sales during the year amounted to Rs. 12,443-6-1.

There were only 463 private factories during 1925–26; some of the factories did not work for want of sardines; the price of guano ranged between Rs. 60 and Rs. 110 per ton and fish oil between Rs. 125 and Rs. 200 per ton. Fish manure was sold at Rs. 70 per ton.

The estimated total output for the Coast this year was 9,850 tons of guano, 4,980 tons of fish oil and 1,000 tons of fish manure valued at Rs. 7,50,000, Rs. 8,50,000 and Rs. 70,000 respectively.

1926–27.

This year was the poorest in the four successive bad years.

At the Tanur Station 40·25 tons of sardines, etc., for the manufacture of oil, fish meal and manure and 320 gallons of crude oil for refining, were purchased. The price of fresh sardine was Rs. 23 per ton as against Rs. 13-10-0 in the previous year. There were heavy sardine operations only on two days; the total output was 3,292 lb. of guano and 248 gallons of fish oil. One thousand six hundred and seventy-one lb. of bone meal was also made during the year.

Samples of edible sardine oil were sent to Professor Drummond through the Imperial Institute, London, and Prof. Hjort of Christiania University for Vitamin test. Both reported that the Vitamin A content in Malabar Sardine oil was negligible, but Prof. Hjort stated that there were indications of another vitamin—possibly Vitamin D. In pursuance of the suggestion of Prof. Drummond, a trial was made to prepare oil solely from the sardine liver.

There were 504 licensed oil and guano factories, but most of them did not work owing to the failure of the sardine season. Sardines appeared in small shoals only for a few days in November and December.

The total output on the Coast was 2,100 tons of guano, 640 tons of fish oil and 2,100 tons of fish manure. The rate for guano varied between Rs. 70 and Rs. 180 per ton in South Kanara and Rs. 75 to Rs. 140 in Malabar. The price for oil varied from Rs. 150 to Rs. 300 per ton in both the districts.

1927–28.

Sardines were scarce and mackerel were caught in fair quantities.

72·72 tons of fish and bones were purchased for Rs. 1,412-3-6 or Rs. 19·4 per ton as against 40—25 tons at Rs. 23 per ton the previous year : the higher price being due to the fish being mackerel instead of sardines. The total output was 27,566 lb. of fish meal, 5,663 lb. of guano and milled fish, 423 gallons of oil and 1,383 lb. of bone meal.

Mackerel formed 50 per cent of the fish treated. The oil obtained from them came to 1·595 per cent of the raw weight of fish, the maximum being 2·46 per cent at the end of November, which is decidedly lower than that of sardines which gave 10 per cent in November and a maximum of 20 per cent in 1921–22.

The percentage of stearine in mackerel oil was nearly $\frac{2}{3}$ as against $\frac{1}{3}$ in sardine oil. Four hundred and seventy oil and guano factories were licensed during the year. Owing to the failure of the sardine fishery, only 156 factories worked.

Approximately 200 tons of fish oil, valued at Rs. 50,000, 850 tons of fish guano valued at Rs. 95,000 and 1,00,000 tons of fish manure valued at Rs. 10,00,000 were produced throughout the Coast.

Owing to the abundance of mackerel, attempts were made to extract oil and guano from this fish. The oil yield was very poor, but the guano and manure manufactured were found to have high manurial value, equal to, if not higher than, sardine guano. The price of guano rose from Rs. 80 to Rs. 200 and of oil from Rs. 175 to Rs. 350 per ton loose *ex* factory.

D—Refrigeration.

Beyond a distance of 20 to 25 miles from the sea coast reached by runners, fresh sea fish does not reach the markets in the interior as the climate and lack of speedy communication prevent transport. A large potential market for fresh fish, exists in the interior and the only set-back to the trade has been lack of efficient means of transport, want of ice and cold storage facilities or other suitable preservatives. Fish refrigeration has therefore been a subject of early enquiry by the department. Sir Frederick Nicholson when in England in 1912, studied methods other than light curing for keeping fish fresh; two of which were specially noticed that year by the trade, (1) the method of conservation by Co_2 (Carbonic acid), did not seem practicable in this country owing to the heavy cost of the plant, (2) the other method (Henderson's brine freezing) was shown to Sir Frederick Nicholson by the inventor and had great possibilities; he generously permitted the use of his process freely in India " for the good of the people " and subsequently communicated further improvements made by him. In this method

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of refrigeration the details differed largely from the ordinary freezing and packing in ice. It was tried in 1912–13 in an imperfect way—imperfect for want of correct plant—but the results were fairly satisfactory; the cost as carried out, was unduly high, since ice at six pies per pound had to be substituted for mechanical refrigeration, but the results showed that frozen fish could be despatched without ice and yet kept perfectly good even on the plains for three days. These experiments were continued in 1913–14 with much success, but were not carried out in their entirety, as the refrigerating plant was only received in March, too late for being set up during the season.

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While in England in 1914, Sir Frederick Nicholson made enquiries regarding the French Audiffren-Sangrun refrigerator; machines of this make were found installed in the Government House, Madras, and Pasteur Institute, Coonoor.

In 1915–16 fish frozen after the Henderson method was successfully prepared and experimentally distributed. The plant consisted of a small refrigerating plant and oil engine. In the brine tank, the fish previously cleaned and slowly cooled to about 35°F., to get rid of the animal heat, were plunged into clean sodium chloride brine at a temperature of from 10° to 15°F. The frozen fish when removed were packed in paper and a basket with 2 or 3 inches of paddy husk as insulation. In this way it travelled successfully for several hundreds of miles and up to two days in time, on many occasions, without a single failure. Experimentally the process was quite successful; commercially two things were requisite, viz., (1) an organized and continuous supply of really fresh fish of a quality worth the cost of refrigeration and railway parcel carriage; (2) a plant sufficiently large to deal with several cwts. at a time to cover overhead expenses.

In 1916–17 the Henderson method of freezing fish was successfully operated till the hot part of the engine cracked; it was not possible to replace this readily. It should be understood that the small experimental plant was intended to ascertain technical facts, and not to make a business profit for which plant and organisation on a large scale would be necessary.

In 1918–19 a pair of twin refrigerating tanks were constructed at Tanur, to experiment in sharp freezing and in chilling of cheap fish, *e.g.*, sardines.

In 1919–20 an experiment in the sharp freezing and chilling of fish was carried out, but it was not a commercial success, owing to the large quantity of ice required and its exorbitant price.

In 1924 proposals were made by the present Director to conduct further experiments on modern lines, but Government ordered the postponement of the experiments.

A South Kanara merchant, Mr. Soma, in view of the Government attitude, offered to take up fish refrigeration, if technical

assistance be given by the Director. Accordingly, on the advice of the department, he has purchased a small ice-making plant at a cost of £400 and has built an ice factory at Malpe. At present he packs the fish in ice, but wishes to experiment with the more modern methods of refrigeration.

E—Other Miscellaneous Experiments.

Manufacture of Fish Meal.—From enquiries in England and from a perusal of agricultural reports, it was realized that fish meal was largely used in Western countries as food for cattle, poultry, etc. In April 1913, a sample of lightly salted and dried lean sardines was sent to the College of Agriculture at Coimbatore. Experiments conducted there were successful, but the commercial success of the meal depended on the price of the dried fish which was very variable, owing to the great uncertainties of the sardine shoals.

As enquiries were made for fish meal for feeding cattle, pigs and dogs, the experiments were renewed in 1919–20 and samples prepared were favourably reported on.

In 1920–21 the preparation of the fish meal for poultry was continued and the demand for it was slowly increasing. Realising by this time that the manufacture of this product had come to the front rapidly in Western countries, notably in England and America, increased attention was given to it during the year. Both sardines and mackerel were utilized; the meal made from mackerel was whiter and contained a smaller proportion of fat, but it was more expensive to produce. Results of analysis of the fish meal by the Government Agricultural Chemist in January 1922, were as follows:—

	Mackerel meal.	Sardine meal.
Moisture	8·75	7·74
Ash	4·90	17·50
Crude Protein	77·44	59·29
Ether Extractive	8·80	13·45
Unestimated	0·11	2·02
	100 00	100·00

With improved pressing a considerable reduction in the percentage of oil was effected.

The Manager of the Government Cattle Farm at Chintaladevi on trial found the Tanur meal suitable for cattle.

In 1922–23 the manufacture was done on a much larger scale; the quantity of fish treated being 71,706 lb. (32 tons) of sardines and 1,200 lb. of horse mackerel and ribbon fish costing in all Rs. 342-13-0. This yielded about 10,300 lb. of fish meal. Its preparation involved much extra labour for want of proper plant and utensils; the greatest difficulty was found in drying the pressed cake. Powdering arrangements also were imperfect.

The meal was mainly sold to European owners of cattle farms, piggeries and to poultry breeders, as well as the Government cattle farm. The number of customers increased.

The quantity of fish meal prepared in 1923–24 was more than double that of the previous year, being 22,113 lb. There was a considerable increase in customers and sales. The United Provinces Poultry Association helped to sell about 1 ton; the Director of Agriculture, Travancore, took half a ton and the Carnatic Mills, Madras, took 3 cwts. a month.

Sardines and other fish were scarce in 1924–25 and only 10,348 lb. of fish meal were manufactured this year. Experiments at the Hosur cattle farm showed that small quantities, such as two ounces a day, had such bone building and fattening properties that a bull-calf and heifer fed on this meal grew up steadily, attained maturity and started breeding at the second year.

There were enquiries for fish meal from Europe; the orders promised were in hundreds of tons, but the output at the Tanur Station was far too small. Export trade will require installation of power-driven machinery. A sample consignment was sent to Burma and advertisements were inserted in Colombo and Singapore papers.

During 1925–26 fish-meal operations were continued and the output was 12,972½ lb. There were enquiries from Kenya and the sales in India and Burma increased.

In 1926–27 two other miscellaneous fish available in quantities at Tanur, "Chamban" and shrimp were successfully used for fish meal and found to produce good white fish meal.

Fish meal this year was made from scrap, formerly converted wholesale into guano. The enormous economic advantage of such utilization will be evident from the fact that while guano sells at about Rs. 80 a ton, the same quantity of fish meal sells at Rs. 250. But so far Tanur has not succeeded in reducing fat in sardine meal to the required minimum of 2 to 3 per cent. The methods for reduction of fat are—(1) mechanical pressure; and (2) use of solvents. Both require study by a qualified whole-time Fisheries Chemist.

In 1927–28 experiments in reducing fat to prevent rancidity and to increase its keeping quality were carried out. To test the effect of more efficient pressing, two experiments were conducted in hydraulic pressing this year. The results show, that by cooking and pressing the fresh fish, the reduction of fat content effected, though appreciable, is not sufficiently low to justify the high investment involved. In the case of fish which is not perfectly fresh, the fat can be reduced even to 1 per cent of the dry weight

of the cake, but this is effected by pressing out the major portion of the solid fleshy matter as "foots." This reduced the dry weight of the cake to 4·3 per cent of the wet weight as against 16 to 20 per cent in the ordinary process.

Two new fish meals introduced this year were prawn shell meal and shark meal. Both found favour with customers, the former for its cheapness (1 anna per pound) and the latter for its low fat content (5·24 per cent) and white colour.

Studies on remodelling of the manufacturing plant, to reduce coolie labour, fuel, etc., were made and the purchase of a small engine for powdering fish meal received consideration. The Industrial Engineer who was on deputation in America has studied the types of fish meal plants available in America at the request of the Fisheries Department. The devising of a suitable continuous process plant for the Indian sardine is a matter of great technical difficulty and the services of a skilled Fisheries Engineer were keenly felt. The Industrial Engineer and the Director with their very limited leisure have pushed the investigation as far as possible and a suitable plant is receiving consideration.

Utilization of Waste.—Experiments have been tried since 1909–10. Pits were dug at one end of the Tanur yard and lined with wood, mats, etc. These were gradually filled with offal from the gutted fish, the products of failed experiments, etc., with a modicum of ash from the Municipal incinerator and of quicklime. After several months a quantity of pit manure was available to be dried and bagged. This not only got rid of offal without nuisance, but with considerable gain. Sardine offal however had to be first boiled for oil before being consigned to the manure pit.

Soap.—The Oil Chemist appointed in December 1913 was employed on various analyses and experiments on fish oils and soaps both at the Indian Research Institute, Bangalore, and at the Agricultural College, Coimbatore. His work was however mainly on research connected with soap manufacture.

In 1914–15 the Agricultural authorities wanted the soap for insecticidal work, and the Military demanded a good harness soap; the Chemist succeeded in making a soap which was found highly insecticidal for bugs, coconut borers and mangohoppers, but innocuous to plant-life. Henceforward for planters' requirements two soaps, a pure fish-oil soap and a fish-oil rosin soap were made.

In 1915–16 fish oil insecticidal soaps were made to the amount of about 28 tons, of which nearly 25 tons were sold; the greater proportion was a soap containing rosin which the planters preferred to plain soaps; these soaps were very favourably reported on by the Government Entomologist for use against "mango-hopper."

In 1916–17 only 12 tons of fish oil were converted into soap and sold when there was a decrease in demand due to diminution of insect pests on consumers' estates.

The soapery and the Oil Chemist were transferred to the control of the Industries Department in 1917–18.

Vinegar.—In 1915–16, while trying experiments at Tanur in the preparation of pickled mackerel with vinegar, Sir Frederick Nicholson felt the need for cheap, but strong, vinegar. The vinegar available locally was too weak and British vinegar far too costly. Hence he attempted to manufacture his own vinegar; the "quick process" was adopted, the alcoholic base being rectified spirit with various feeding additions.

A small generator was locally devised and made some 62 gallons of very pure aromatic vinegar at below the cost of local vinegar but of double the strength. But it was subsequently realised that the hot climate of the plains was against success and so Sir Frederick Nicholson suggested continuance of the experiment in the breweries at Ootacamund.

Fish glue.—In 1915–16 at Tanur an attempt was made to make fish glue from various waste parts of the fish cured in the yards, but, owing to various reasons, sufficient attention could not be paid to this line of research. Meantime the Industries Department took up the research, but gave it up as an uneconomical proposition.

SECTION V.—PEARL AND CHANK FISHERIES.

The aim of this section of the department is the organisation and development, on scientific lines, of the ancient chank and pearl fisheries which are Government monopolies, with a view both to ensure the prosperity of the fishermen who engage in these fisheries, to the exclusion of the middlemen, and to safeguarding the revenues to the State.

The chank fisheries of Madras are worked off the six southern maritime districts on the East Coast. The important ones are those of Tinnevelly and Ramnad. The former yields from 1½ to 2 lakhs of shells per annum, the latter; leased for 15 years from 1913–14 for the sum of Rs. 60,000 from the Raja of Ramnad usually produced from 2 to 2½ lakhs of shells a year. But the lease of the Ramnad chank fisheries from the Raja of Ramnad ended with June 1928. The smaller fisheries of Tanjore, South Arcot, Chingleput and Nellore are leased to contractors.

All the important pearl banks lie off the Tinnevelly and Ramnad Coasts. From causes still obscure, the pearl banks are seldom productive. While chank fisheries are annual, the pearl fisheries are intermittent.

These monopolies of the Crown have been handed down from the ancient Hindu Kings. From the beginning of the 19th century these fisheries have been administered by the British.

From 1801–1877 the chank fisheries were leased out to two cotton merchants of Tuticorin, Mr. Cocq and Mr. Barter, who undertook the entire oraganisation and conduct of the fisheries. Difficulties with the renters and the belief that direct management of the fishery would result both in increased profits to Government and improvement in the condition under which the divers worked, led the authorities to abandon the renting system in 1876. Thenceforward the Port Officer of Tuticorin was Superintendent of these fisheries and organised and worked them departmentally. The anticipations of Government were justified. Against the annual rent of Rs. 7,566 realised during the 33 years prior to the resumption in 1876, Rs. 10,521, very nearly one and a half times the revenue, was realized from the chank fisheries during the subsequent 33 years up to 1908–09.

After the British assumed control of the pearl banks in 1796, 14 pearl fisheries have been held up to 1908.

Mr. H. S. Thomas, in paragraph 96 of his report on the pearl and chank fisheries in 1884, recommended that, if Government should ever contemplate constituting a Fisheries Department, these fisheries should be combined with it and given the benefit of scientific supervision. As it was, these fisheries were under a very busy officer (Port Officer) with a daily increasing business to supervise a distant duty, totally foreign to his primary duties and one for which he, in all probability, had no previous training and possibly no taste. The administration of the fisheries under these conditions was found to be unsatisfactory. In the interest of the Government revenue and of the fishing population of the Coast they were transferred to the Fisheries Department in the year 1909.

I—Pearl Fishery.

After the transfer of the Pearl Fisheries to the Fisheries Department, Mr. Hornell conducted a small pearl fishery off Tondi in 1914. It was however in 1922–23 that pearl oysters appeared in great abundance on the majority of banks off the Tinnevelly Coast. Two inspections were made in the Spring and Autumn of 1923–24 and the oysters were found growing rapidly in size and weight. The oysters on some of the banks were found crushed by the stone anchors employed by fishermen. The banks were patrolled by the fishing vessels. An exhaustive inspection of pearl banks in 1924–25 showed that oysters on some of the banks had

reached their maximum size. In the year 1925 Government framed rules under section 6 of the Indian Fisheries Act of 1897, prohibiting fishing on the pearl banks and penalizing poaching and theft of oysters and pearls.

From 1926 to 1928 five pearl fisheries, attended with unprecedented success, were held as shown below:—

	Gross income.
	Rs.
Spring of 1926	2,25,455
Autumn of 1926	51,387
Spring of 1927	2,54,497
Autumn of 1927	1,95,039
Spring of 1928	2,02,575
	9,08,953

The maximum revenue from pearl fisheries in any year during the last 100 years was in 1927–28. Taking the productive cycle of years 1926—28, the gross revenue was Rs. 9,08,953, a higher aggregate, than for any previous period of three consecutive pearling years, for which we have a record.

Notwithstanding the premature closure of the fisheries on account of cholera, administrative difficulties caused by factions among Parawars, the long-standing prejudice among pearl merchants that Indian fisheries are inferior to those of Ceylon and other damaging factors, the fisheries yielded a substantial revenue and completely restored the reputation of the ancient Tinnevelly fisheries. The fishery camp was placed at Silavathurai and the camp arrangements were superior in point of sanitation, water-supply, etc., to any fisheries held in Ceylon or India. Also during these years a successful effort was made to run a pearl fishery in the Autumn for the first time in the history of Indian pearl fisheries. Oysters have now totally disappeared and there is very little prospect of another fishery during the next few years.

II—Chank Fisheries.

The sub-joined statement shows the number of full-sized chanks fished in the Tinnevelly district and the gross revenue realised by the sale of these chanks for 20 years ending 1928–29, during which the fishery was administered by the Fisheries Department and 20 years prior to 1908–09. The figures show

that the chank fisheries have been organized on a sound basis and the transfer has been fully justified:—

Tinnevelly Chank Fisheries.

Season.	Number of full-sized chanks fished.	Rate per 1,000.	Gross revenue realized.	
		RS. A. P.	RS.	
1889-90	55,639	84 6 11	4,698	Average per year Rs. 15,986. Under the control of the Port Officer.
1890-91	313,726	79 8 0	27,326	
1891-92	} 316,354 {	45 0 0	..	
1892-93		51 0 0	15,185	
1893-94	86,474	57 8 0	4,972	
1894-95	204,593	62 4 10	12,869	
1895-96	185,641	81 6 3	15,109	
1896-97	209,801	77 6 3	16,237	
1897-98	187,641	81 8 0	15,393	
1898-99	147,900	87 15 9	13,013	
1899-1900	118,648	112 11 0	13,370	
1900-01	205,671	113 1 0	23,254	
1901-02	336,908	83 10 9	28,190	
1902-03	102,817	63 0 0	6,477	
1903-04	135,067	154 13 4	20,913	
1904-05	118,634	121 0 6	14,358	
1905-06	86,725	104 6 11	9,057	
1906-07	118,580	167 4 7	19,837	
1907-08	163,671	99 8 8	16,292	
1908-09	272,841	99 9 7	27,175	
1909-10	304,275	121 9 9	37,003	Average per year Rs. 37,956. Under the control of the Fisheries Department.
1910-11	281,330	110 0 0	30,946	
1911-12	166,144	110 0 0	18,276	
1912-13	136,542	110 0 0	15,020	
1913-14	235,205	121 0 0	28,460	
1914-15	129,437	121 0 0	15,662	
1915-16	295,043	121 0 0	35,700	
1916-17	166,841	121 0 0	20,188	
1917-18	127,153	121 0 0	15,386	
1918-19	145,285	325 0 0	47,218	
1919-20	158,941	325 0 0	51,656	
1920-21	109,434	325 0 0	35,566	
1922-23	69,970	210 0 0	14,694	
1923-24	311,826	210 0 0	65,483	
1924-25	276,486	230 0 0	63,592	
1925-26	97,051	230 0 0	22,322	
1926-27	46,588	350 0 0	16,306	
1927-28	54,046	350 0 0	18,916	
1928-29	93,172	400 0 0	37,289	
	423,623 (Total up to 26th May 1929 when the fishery closed.)	400 0 0	1,69,419	

The highest number of chanks ever fished in the Tinnevelly district in any season and the maximum revenue realised from the sale of chanks in any year were in 1928–29. The average annual revenue from the Tinnevelly chanks during the 20 years ending 1928–29 is Rs. 37,955, while the average annual revenue during the 20 years previous to 1909–10 is only Rs. 15,986. A scheme to develop the chank fisheries of Tanjore has received the sanction of Government this year and will be proceeded with shortly.

The departmental working of the pearl and chank fisheries has benefited the divers, chank workers and merchants and the present condition of the industry is satisfactory and prosperous. The divers are no longer under perpetual debt to capitalist "*mudalalis*," but are independent wage-earning labourers, to whom advances for boats and equipment are made by Government on easy terms. The consumers, the chank workers of Bengal, have been assigned the monopoly for the purchase of shells, on highly favourable terms, thus cutting out the middlemen who fleeced them almost to the point of extinction. The pearl fisheries have been retrieved from the evil repute into which they had fallen during the last 100 years or more and the Tuticorin fisheries have outshone those of Ceylon for the first time within the living memory of pearl merchants.

Beche-de-mer Fishery.

In 1914–15 several of the species of Holothuria best esteemed by the Chinese, in the preparation of their great delicacy of Beche-de-mer or trepang, were found in the course of the prosecution of the Ramnad chank fishery, to be abundant in Palk Bay. The proposal to start the working of this industry was submitted to Government and sanction was received from Government in 1915–16 to open an experimental Holothurian curing factory at Tirupalakudi where the problems of successful treatment might be investigated. The work of curing Beche-de-mer continued on a small scale till 1927–28 and with the decision of Government not to renew the Ramnad chank fishery lease, this industry which was carried on as an adjunct to that chank fishery, was also brought to a close.

The financial statement of receipts and expenditure is given below:—

Year.	Receipts.	Expenditure.
	RS.	RS.
1916-17	1,075	656
1917-18	658	688
1918-19	..	Not available.
1919-20	..	,,
1920-21	59	234
1921-22	439	398
1922-23	360	466
1923-24	896	610
1924-25	700	620
1925-26	471	467
1926-27	709	434
1927-28	..	969

This by industry was carried on, as the wages earned by divers at Tirupalakudi, were not sufficiently attractive and the collection of Holothuria in addition to chanks augmented their daily

earnings. Departmental efforts in this line have given an impetus to the local merchants and they have undertaken the curing on the same lines as was conducted by the department.

SECTION VI.—SOCIO-ECONOMIC WORK.

At the inception of the department, its first and chief object of investigation and effort, was naturally the development of Fisheries as a source of food. Very soon it became obvious that, in developing the fishing industry for the benefit of the consumer, an essential consideration, in the present condition of India, was the producer. Not merely does the development ultimately rest with him, under the peculiar caste system prevalent in India, but his welfare is just as important as that of the consumer. It was felt that it was not an absolutely new industry that was to be introduced, to which anyone in the country may and will resort, but the development of an ancient and indigenous one employing vast numbers of people forming an exclusive caste with immemorial interests and customs, who ought to develop in the same proportion as the industry, in status, intelligence, independence and wealth.

The first efforts of the department were necessarily of an informal and unsystematic character. From 1910 one of the Assistants of the Honorary Director of Fisheries, who was himself a member of the fishing community, began the work of impressing on the members of the community, by informal talks and private conversations, the necessity and benefits of co-operation in a Society in Mangalore and helped to develop it. An indigenous Temperance Society at Malpe in the South Kanara district, formed the starting point for temperance work in that district. A special fisheries school was also started in 1913 at Tanur. Gradually the number of co-operative societies, schools and temperance societies, started under the auspices of the department increased. But the work was still carried on with little or no method and on a humble scale. Between 1917 and 1919, Sir Frederick Nicholson submitted to Government comprehensive schemes to establish special fishermen schools at every important fishing centre, to start co-operative societies and conduct propaganda against habits of intemperance, of extravagance and prejudices that have stood in the way of the progress of the community. The proposals were, that Government permit the department to organize the development of the fisher-folk as a primary duty of a special department—(1) by the stimulation of co-operative societies on the basis found most advisable; (2) by utilising such societies when necessary, as channels for Government loans; (3) by training each year sucessive series of educated young men, to live among the people in their villages, in order to be the right hands of the department, in organizing co-operative, economic and social societies; in

inculcating thrift, temperance and self-help, in serving as advisers and arbiters in cases of difficulty; in inquiring into the condition, indebtedness, etc., of the villagers and assisting Government in combating or removing such indebtedness; in ascertaining the need and security for loans, in establishing schools and regulating the hours and subjects of study, to suit the convenience and requirements of fisher children.

Education.

All fisher boys above a certain tender age, work on the boats or are in attendance on the men on the beach. If the boats go to sea in the early morning, the boys will not be home till the afternoon or, if only in attendance on the beach, the boys will have to be there in the afternoon. If the boats are out all night, the boys coming back from the sea, will be too tired for the morning class and the others will be in attendance on the beach in the afternoon, hence most unusual and irregular hours will have to be adopted in the schools which the fisher children attend. The hours will vary according to the time of the month or according to the season, the class of fish available, etc. The course of studies in fishery schools should also be of a special kind in some respects, and should be closely connected with the industry, for they will have no back ground of reality for the children unless they have special application to the condition and circumstances of their lives, of their parents and to their immediate work. The object should be to make them better fishermen, more intelligent, more adaptive, capable of understanding and applying better methods of fishing and handling fish and better able to keep to themselves the major portion of the profits from the fishing industry which now go to outsiders. Living as they do in foul and loathsome surroundings and dealing in putrescible matter, they should possess special knowledge of hygiene and sanitation. Thrift and elementary social science should be taught, because of all classes they are the most unthrifty and intemperate.

Fisheries Training Institute.—As a first step towards the starting of special schools for fishermen on a large scale, the Government sanctioned in 1919 the opening of a Training Institute at Calicut, for the training of special schoolmasters. In addition to the curriculum followed in ordinary training schools, the pupil teachers receive at the Fisheries Training Institute special technical instruction in fisheries and fishery science in all its branches, comprising a history of the industry; a general account of the fish and fisheries of the world; some account of the little we yet know of South Indian food-fish, their habits, life history, food, abundance, economic importance, etc.; oceanography of the oceans generally and of the Arabian Sea and the Bay of Bengal in particular; an account of fishing craft and tackle, their origin and design including details of modern developments; a survey of fish industries, especially the principles and practice of fish-curing, canning, refrigeration, manufacture of fish oil, guano and

fish meal and other minor marine products; elements of navigation and seamanship, such as the use of the mariner's compass, barometer, signalling, steering and sailing boats, chart reading, taking cross bearings, testing depths and bottom, making and repairing canoes, sails, oars and other appurtenances, and the ordinary arts and crafts relating to fishing, such as spinning and net-making, the use of nets, lines, etc.; and elementary biology and nature study with emphasis on fish and animals of economic importance in the sea and fresh water. On the practical side, they are given actual training in working and sailing different kinds of boats, in making and repairing canoes, oars and other appurtenances, in spinning and net-making, in the use of nets, line, etc., in catching, and in curing and canning fish and the manufacture of fish oil; besides a series of practical exercises in improved methods of cure in the model shed provided for them in the Calicut fish curing yard. They are also taught the methods of organizing and managing fishermen co-operative societies, hygiene, sanitation and first aid.

Fishery schools.—Simultaneously with the starting of the Training Institute at Calicut in 1919, four day and four night schools were also sanctioned. In the fishery elementary schools for children of tender age, the object is not technical education, but adapting the whole course of general instruction in the 3 R's, nature study, etc., to their requirements, and correlating it to life in fishing villages and to the industry. So far 33 day schools and 4 night schools have been opened by the department. The education given is *free* and the poor children are supplied with books and slates *gratis*. Many of the teachers belong to the fishing community and their proportion is being steadily increased. The subjoined statement shows the number of day and night schools, the number of boys and girls reading in the schools and the number of teachers employed for the eight years ending with 1927–28. The expenditure on these schools is also given for a period of five years.

Year.	Number of schools.		Strength.		Number of teachers.	Expenditure.
	Day.	Night.	Boys.	Girls.		
						Rs.
1920-21	15	13	1,100	285	61	Separate figures not available.
1921-22	18	9	1,533	Separate figures of boys and girls not available.	59	
1922-23	26	..	1,761		53	14,927
1923-24	21	6	1,497	504	69	Figures not available.
1924-25	27	5	1,759	691	84	26,068
1925-26	27	6	1,681	613	83	28,419
1926-27	30	4	1,737	703	89	29,889
1927-28	33	4	1,572	868	107	42,885

Co-operation.—Probably there is no community or class in India which needs more and appreciates less the benefits of co-operation than the fishing classes of the Presidency. Though a large community they do not thrive as well as they might, because the profits of their calling are uncertain, and occasionally it happens that catches are very meagre for two or three years in succession. A good fishing season lasts for about nine months in a year and no fishing is carried on during the monsoon. The profits made in a good season would certainly be sufficient to carry the fisherman and his family over the non-fishing months, but by a long-standing habit, the fishermen do not save. During the fishing months, they spend all that they earn, and for the remaining months, they are content to borrow from the middlemen who, of course, appropriate in lieu of principal and interest, the lion's share of the next season's catch. The result is that the fishermen, in the course of very few years, have to surrender their boats and nets to the middlemen, whose servants they then become.

For these and other reasons, unusual difficulties are experienced in the formation and working of co-operative societies among fishermen. Very few of them possess any immovable property. Their entire worldly belongings of any value consist, in most cases of their boats and nets. As these are not recognised as assets, on the security of which banks could advance loans, the fishermen co-operative societies have found it impossible to raise loans, from the District and Urban Banks for the formation of their initial and working capital. Until as recently as 1926 every one of these societies had to provide their own working capital, by means of share capital accumulated by monthly contributions from the members. To a people naturally averse to thrifty and saving habits, the compulsory saving necessitated by this condition, has served as a deterrent to their combining into co-operative organisations. Further, as the fishermen are out for fishing in the sea most of the day and often till late at night the ordinary officers of the co-operative department, and even the un-official co-operative union, are unable to get into touch with them for the conduct of co-operative work among them, nor are they able, owing to the same reason, to maintain effective supervision over societies already formed. Officers of the co-operative department and Union supervisors are handicapped because they have to travel far from their normal field of work, to inspect fishermen co-operative societies whose members live on the seashore and who can be got at only very inconvenient hours. The inspecting officers have to wait indefinitely for fishermen who have gone to sea to come back and when they do come back they are so tired that they are seldom able to render any help to inspecting officers. Further, supervisors are generally of higher caste than fishermen and have no facilities for staying in a fishing village. Thus inspecting agents of the Co-operative Department have neither the inclination nor facilities for working the fishermen societies. Very little progress was

therefore made in co-operative work among fishermen till about the year 1914, when the officers of the Fisheries Department at the instance and in collaboration with the Co-operative Department began actively to interest themselves in the work. There has been a steady increase in the number of special societies for fishermen since then. The fishermen are ever ready to take out loans, but the loans are not repaid when due and the instalments accumulate. Some societies have already become defunct. For reasons stated the regular co-operative supervising and inspecting staff was unable to do anything to improve their condition. The fishery officers who were available in the years previous to 1917, were so few in number that they could make but little progress with the work that had to be done. From 1917, however, when the Fisheries Department took over a few of the fish-curing yards, and with them the staff of those yards, the officers in charge of these yards were utilized to help in the management of the societies and the collection of arrears, and conditions began to improve. From 1919 with the opening of fishery elementary schools the staff of these schools also helped in forming and supervising fishermen co-operative societies. When in 1924 the rest of the yards in the Presidency came under the control of the department, the agency for carrying out such work was greatly strengthened, with beneficial results on co-operative work among fishermen. The fishery officers in charge of the yards, who are always present in the village, are just the persons who will always know when large catches are landed there and by whom; for the arrival of fish has to be notified to the yard officers instantly, so that they might be in readiness to issue salt for curing before the fish turn bad. These officers also know the catches made in the neighbourhood, as they have been assigned the duty of collecting statistics of landings even beyond the limits of their village. In 1924–25, in consultation with the Assistant Registrar of Co-operative Societies, South Kanara, a system of group examiners was tried and 13 societies were brought under it. It was found that the group examiners had no sufficient influence to improve the condition of the societies. The Co-operative Societies in the Ponnani taluk appealed to the District Co-operative Bank, for the organization of a union for the better supervision of fishermen co-operative societies. The idea did not appeal to the bank, as the supervision funds collected from fishermen co-operative societies would not enable the District Co-operative Bank or a local union to pay a supervisor. It was conceded that fishermen societies cannot be improved unless there is more intensive supervision than that which a local or district co-operative union can afford. The only solution was therefore to entrust the work of supervision to the Fisheries Department. In recognition of the fact that fishery officers are in the best position to supervise co-operative work among fishermen, the Inspectors of Fisheries on the West Coast have been invested with powers to inspect the books of the societies, and recently the Assistant Director (Coast) has been invested with

powers under sections 17 (3), 35, 36 and 37 of the Co-operative Societies Act and under rules VIII-A and XIV of the rules framed under section 43 of the Act.

Several societies have already been rescued from a state of collapse and put on a satisfactory footing by the exertions of the fishery officers. Some societies continue to exist solely owing to the encouragement and supervision they have from these officers. The slightest relaxation of departmental supervision has produced neglect and mismanagement. On the other hand, some societies have reached such a strong position as to become independent of further departmental help of any kind.

The following statement shows the number of societies on the West Coast, number of members, amount of paid-up share capital, amount of loans disbursed, loans for prior debts and loans for industrial purposes for seven years ending 1927–28:—

Year.	Number of societies.	Membership		Paid-up share capital.	Loans disbursed.	Loans for prior debts.	Loans for industrial purposes.	Loans for other purposes.
		Male.	Female.	Rs	Rs.	Rs.	Rs.	Rs.
1921–22	60	3,128	453	81,702	2,53,303	44,615	99,634	21,608
1922–23	63	2,968	359	85,916	3,14,101	60,286	1,20,033	6,533
1923–24	57	2,697	335	81,670	3,11,392	75,429	91,662	10,802
1924–25	56	2,632	219	74,576	3,11,377	81,573	51,618	13,397
1925–26	55	2,673	280	75,392	2,34,668	48,343	64,686	7,597
1926–27	57	2,464	318	62,848	84,138	36,397	27,912	19,829
1927–28	56	2,361	219	58,686	83,309	41,591	23,322	18,306

Efforts were made to wean the fishermen from the thraldom of middlemen capitalists by granting loans on the securities of their boats and nets. In 1926, at the instance of the Fisheries Department, the Government started a new form of direct help to fishermen by giving two new societies formed for the purpose at Blangad and Palapatti in the Ponnani taluk, a loan of Rs. 1,500 each to buy fishing equipment on the condition that the working of these societies should be closely supervised by the Fisheries Department. This has helped to remove another outstanding difficulty, that of financing fishermen co-operative societies which possess no assets recognised by the banks. The security for the loan is the fishing boats and nets purchased with the loan. The Government have allowed the societies in question to repay the loan in small instalments from the profits made by them, by fishing conducted with these boats and nets. The two societies are working satisfactorily. The Blangad Society has repaid to date (8th May 1929) Rs. 1,000 and Palapatti Rs. 850 (29th May 1929) in spite of successive adverse fishing seasons.

Other socio-economic work.—The officers of the Fisheries Department are doing a great deal of social service among the fisherfolk. As officers issuing cheap salt for fish-curing, they

exercise great influence in the fishing villages. This influence, as well as reasoned advice, is being employed to wean the people from habits of intemperance, improvidence and extravagance. Organisation of temperance and literary associations, common good funds, habits of cleanliness, increased knowledge of the world, realisation of their slavish dependance on merchants and money-lenders and a desire to escape from it, feeling of self-respect, self and mutual help, all these have been constantly promoted by the officers of the Fisheries Department. Even social disputes have been settled. Small private quarrels, which ultimately develop into disastrous communal feuds, are settled promptly by the watchfulness of the Fisheries Officer, if one is available in the neighbourhood.

The staff available to do this work is, as already stated, *very small.* But nevertheless the results of their work have been marvellous. There is now a thorough awakening among the fishing classes, especially on the West Coast where the bulk of the work has been done, and the social and economic improvement among the fishermen, directly due to the work of the Fisheries Department, has been gratifying.

As a result of the spread of education among the fisherfolk on the West Coast and the keen interest taken by the departmental officers, there is appreciable improvement in temperance among the younger generation. The marked improvement even in remote villages is significant.

SECTION VII.—OTHER MINOR ACTIVITIES.

A—Oyster culture.

Edible oysters of two kinds thrive in most estuaries and backwaters on both the East and West Coasts of the Presidency and exceptionally also in the open sea. Though the quantity available is large, shell fish is very little consumed by the people, who are averse to such food. Except on the Malabar, Tinnevelly and Ramnad coasts, oyster is consumed only by the lower classes of the population and by Europeans and Anglo-Indians.

It has been found, as a result of experiments conducted, that edible oysters can be readily cultivated and that they thrive in India, even better than in European waters. Although local demand is small, there is a great demand for canned oysters and dried oysters for export. There are therefore economic possibilities for the fishery.

The cultivation of the edible oyster was first contemplated in 1907. But till 1910 only preliminary researches on the spawning season, the early stage and habits of the oyster could be done.

In 1910, however, some cultural methods on the lines of the Arcachon oyster fishery of France were started at Pulicat. It was only from 1921, that up-to-date experiments in conditioning oysters and sterilising them have been conducted and adopted. Since then oysters have been regularly marketed after hygienic treatment though on a small scale. Unfortunately a shell contractor who had taken the lease of the right of collecting shells denuded the most important beds in the Pulicat oyster farm, in 1922, in order to collect the shells and the farm has not yet recovered from this depredation. At other places along the Coast, shell contractors are clearing oyster beds of all shells and are even carting off the hard calcarious rock consisting of old comminuted oyster shells. If left unchecked, this may result in the destruction of the oyster fishery of these Coasts in the near future. Measures to reserve some of these beds against indiscriminate fishing and destruction by shell contractors have recently been adopted in a few localities near Madras.

The subjoined statement shows the number of oysters sold during the years ending 1919–20 to 1927–28.

Year.	Number of oysters sold.
1919–20	133,459
1920–21	167,000
1921–22	95,875
1922–23	184,350
1923–24	203,592
1924–25	256,810
1925–26	150,675
1926–27	269,875
1927–28	147,550

In 1926–29 embryological studies on the development of the oyster were conducted at Ennur and Pulicut. The experiments have revealed the percentages of salinity most favoured by oysters. This research has enabled the department to correct certain erroneous ideas that had been entertained in the past regarding the optimum salinities required by the edible oyster. While the oyster in England fattens and breeds when there is a rise in salinity, the Indian oyster seems to flourish only in low salinities. The freshes in rivers, far from damaging them, as was supposed before on the analogy of the European oyster, provides the most favourable conditions for spawning and development of the Indian oyster. The research has also thrown considerable light on the early stages and development of the Indian oyster. A paper on the results of this research is under preparation and will be published shortly in the Department's Bulletins.

B—Biological Specimen supply.

About 1910–11 Mr. Hornell sent some biological specimens obtained in the course of chank diving operations to various institutions and persons, such as the British Museum and Indian Museum.

In 1911–12 a scheme for the erection at Madras of a suitable Marine Aquarium and a Marine Biological Station was submitted to Government, one of the objects being the supply of biological specimens for educational institutions.

From 1912 to 1914 no further development occurred.

In 1914–15 supply of Biological specimens to educational and scientific institutions was commenced with the following staff sanctioned in August 1914, for work in the Pamban Pearl Farm:—

	Rs.
One senior operator	50—5—75
One lascar or peon	10

In 1915–16 a large series of Biological preparations suitable for teaching purposes in Colleges were exhibited in the Madras Exhibition. The specimens were sold to various Colleges. Type collections of Madras Crustaceans were also prepared and sold. Specimens for dissection were likewise sold during the Exhibition to several teaching institutions.

From 1917 to 1920 the supply of Zoological specimens progressed. In 1920 the appointment of a Marine Biologist was made and the supply section was placed under his control. A handbook entitled *The Common Molluscs of South India* was published by Mr. Hornell. In 1921–22 the Marine Biologist's post was abolished and the Biological supply section had to be transferred from Tuticorin to Ennur, to be placed under the direct supervision of the Director of Fisheries. In 1922–23 a suggestion was made to Government to move the Government of India to sanction a subsidy to this section which was more or less educational and was not therefore self-supporting. But this suggestion was not adopted by Government who ordered that the matter of making the section self-supporting should be examined by the Director.

In 1924–25 identification of marine biological specimens and formation of a reference collection at Ennur was started to help the assistant in charge and is being continued.

A price list of biological specimens was first published in 1919 by Mr. Hornell. This was revised and brought up to date in 1927. A special catalogue of specimens suitable for Secondary Schools was published in 1929.

The financial statement with regard to this section is given below:—

Year.	Receipts.			Expenditure.		
	Rs.	A.	P.	Rs.	A.	P.
1916–17	576	0	0	253	0	0
1917–18	735	11	0	302	11	11
1918–19	1,257	14	6	363	4	8
1919–20	.....			Not available.		
1920–21	3,131	11	0	2,974	15	9
1921–22	2,541	0	0	2,567	0	0
1922–23	4,698	0	0	5,379	0	0
1923–24	5,392	9	0	4,957	1	11
1924–25	1,391	5	0	3,971	0	0
1925–26	3,610	9	0	4,583	6	11
1926–27	3,988	11	0	5,622	6	1
1927–28	5,105	15	0	5,099	4	5

CHAPTER II.

ABSTRACT OF PORTIONS OF EVIDENCE.

SECTION 1.—AIMS OF THE DEPARTMENT.

Diwan Bahadur Arogyaswami Mudaliyar stated that "the aim of the department may be said to be three-fold ; to conserve and develop inland fisheries, to similarly conserve and develop the marine fisheries and to look after the interests of the fisher-folk." Within the limits possible, he thought that those aims had been achieved. He however pointed out that the organization of the department itself was defective and wrong and the department had not the right personnel. He was of opinion that for the main operations of the department technical experts should be recruited.

Mr. Gopala Menon, M.L.C., stated that the department was organized to conduct research work in its different aspects so as to augment the sea and inland fisheries, that various ways, means and devices were on the anvil during the time Sir Frederick Nicholson was in charge but that, after his retirement, the same enthusiasm did not appear to have been continued with the result that the achievements were hardly tangible. He was of opinion that the department should be manned by officers of good training in the line of their work to ensure expert knowledge. Success in research work for which the field was vast would add, he said, materially to economic welfare.

Mr. T. V. Subba Rao said that the object of the Fisheries Department was to develop the fishing industry, that is, to catch fish, to collect pearls, chanks, weeds, etc., and thus to make a decent revenue from the sea, to train fisher-folk in catching large quantities of fish by modern methods, to breed and rear fish in salt waters as well as in fresh waters, to produce pearls by scientific breeding as in Japan and to train fishermen as mariners and sailors.

Mr. J. L. P. Roche Victoria stated that the object was mainly to develop the fish-food supply of the Presidency, to improve the material and moral condition of the fishermen and to promote scientific research in fisheries. He was not aware that the attempts to increase the food-supply had borne any satisfactory results, but something had been done to improve the economic condition of the people on the West Coast, although nothing had been done in that direction on the East Coast. In his opinion, the reason for the failure to increase the food-supply was want of organized and systematic experiments in fishing and he suggested the following remedies :—

(1) The existing methods of fishing should be studied by experts, who should be practical men, and efforts made to improve them ; and

(2) In his opinion the main objects of the department should be to introduce model fishing methods in large towns under the charge of experts and demonstrate the use of improved fishing nets, etc. The work should be like that of the Agricultural Department which runs model farms for demonstration purposes. He would place the legitimate objects of the department in the following order :—

(1) demonstration of efficient methods of catching fish ;

(2) demonstration of improved methods of curing fish if possible by the exhibition of films imported from the West ;

(3) special efforts to inculcate thrift and co-operation and promote temperance ;

(4) special efforts to remove illiteracy, providing a school in each fishing village ;

(5) improvement of transport and communication facilities.

He was also of opinion that the main object of the Department should be first to improve the material condition of fisherfolk and develop the fishing industry.

Rao Bahadur J. A. Fernandez stated that the Department was inaugurated with the following main objects :—

(1) increasing the fish-food supply ;

(2) promotion of fishing industries ; and

(3) promotion of the material and moral welfare of the fisher-folk.

He did not think that any of the above objects had been achieved in a satisfactory measure except the oil industry on the West Coast. These poor results he attributed to lack of experts and adequate financial support and to absence of systematic and organized efforts. As a remedy he suggested the recruitment of experts engaged in the fishing industry in Europe on attractive terms and organization of socio-economic work on the East Coast as well. He was of opinion that the main object should be the promotion of the material and moral condition of the fisher-class and the other objects of increase of the food-supply and promotion of fishing industries should come next.

Mr. S. T. Moses stated that the main objects of the department should be scientific investigation, fishery development and socio-economic work among fisher communities. He was of opinion that the most important was scientific investigation. The development of the industries and the elevation of the people could go together. The practical results of investigations should be demonstrated. Effective propaganda regarding improved methods, etc., should form part of the education work.

Mr. Soma Marakala stated that it should be the bounden duty of the Fisheries Department to give a thorough elementary education to all the boys and girls belonging to the various sections of the fisher-class.

Mr. M. P. Krishnan stated that the Fisheries Department was inaugurated for the purpose of—(1) improving the dietary of fish among the people and thereby establishing an increased demand for fish as food ; (2) converting certain species of fish into fertilizers for agricultural purposes ; and (3) improving the general condition of the fisher-folk by chiefly relieving them of their poverty. He said that something was done in the matter of elementary education, and a tangible change effected as regards the method of curing fish which was formerly quite crude. He was of opinion that, on the whole, considering the amount spent for the maintenance of the department the benefit so far derived was very small. He attributed this to the following reasons :—(1) Want of sufficient instruction, theoretical or practical, to the real working classes ; (2) failure on the part of the department to take into confidence and patronize the leading men of the fishing community who could influence the illiterate classes to take up any new methods inaugurated ; (3) not affording facilities to the really working people to acquire boats and nets and other equipment with the result that they continued to be in the clutches of the money-lenders and middlemen. He suggested the following remedies :—

(1) lending money or materials to the working people under proper guarantee ;

(2) as regards fishing, practical demonstration on the West Coast of the indigenous methods in vogue at Malpe and Ratnagiri and the introduction elsewhere of the Malabar boats and nets in the place of catamarans ; and

(3) either reducing the price of salt or permitting people to use salt-earth as before, sufficient demonstration being given in the latter case to use it in a cleaner manner.

Mr. R. Suryanarayana Rao stated that the aims of the department primarily were, or, at any rate, should be—

(1) to develop the fish industry as a source of food-supply, since fish is considered to contain certain elements which are necessary for the upkeep of the body ;

(2) to provide better and more remunerative occupation for the fisher-folk ;

(3) to prepare and popularize the use of products of fish that could not be converted into human food, such as oils, manure, etc. ; and

(4) to improve the moral and economic condition of the fishermen engaged in the fishing industry by undertaking welfare work.

He was of opinion that, if the objects mentioned above were to be achieved, considerations of net profit in the working of the department to which prominent attention was being given in the reviews of Government were out of place.

Mr. Saldanha stated that the main aim should be educative, combined with research.

According to Rao Bahadur V. Govindan the main object was to add to the food-supply of the country by tapping the marine and inland fisheries resources.

Mr. M. Viswanath stated that the department was started with the following objects :—

(1) to improve the supplies of fish-food in the country ;

(2) to demonstrate new methods of curing fish ;

(3) to exploit fish resources and to improve the socio-economic condition of the fisher-folk.

He regretted that none of the above objects had been achieved to any substantial extent so far as the West Coast was concerned except the introduction of fish-oil and guano factories and the starting of some schools for the children of the fisher-folk.

Mr. M. Othenan stated that the objects with which the Fisheries Department was inaugurated were—(*a*) the improvement of the fishing industry and (*b*) the improvement of the conditions of the people engaged in fishing. In his opinion the failures which were noticed in not introducing any new methods of catching or curing fish, were due to lack of technical knowledge on the part of the officers of the Department. To remedy this, he would suggest that technically qualified experts should be appointed to the department. As young men selected from the fishing communities would suit the purpose better than others, he suggested that all officers of the Department should, as far as possible, be men from fishing communities.

Mr. Karunakara Menon stated that the main objects were the supply of fish-food and scientific research and also socio-economic work among fishermen. He said that the object was not so much the increase of fish-food supply as the improvement of the quality thereof.

Mr. Raman Menon would put down the following as the main objects of the Department :—

(1) to introduce improved methods of fishing ;

(2) to improve methods of manufacture in existing fishing industries and to introduce new industries ; and

(3) to work for the socio-economic betterment of the fishing population.

He stated that the objects mentioned above were interdependent and should be realized simultaneously.

In reply to questions Nos. 1 to 7, Dr. Sundara Raj stated as follows :—

1. Half a century ago, Mr. H. S. Thomas and Dr. Day urged the importance of developing fisheries as an important source of food-supply. Every civilized country has a Fisheries Department or organization which has conferred benefits on the industry, trade and people. A food industry, second only to agriculture in

Madras, demands the special attention of Government especially as it is in the hands of a backward community in a primitive condition, bereft of capital, initiative and knowledge. Therefore, in 1907, the Government of Madras constituted a small department of fisheries on the recommendations of Sir F. A. Nicholson, that a special department which will make fisheries its sole and continuous business, was absolutely essential to deal with the vast and important fishery industries of the Presidency. They are not only an important source of food, but also of manure and require years of continuous study, experiment, stimulus and assistance before they can be developed on a sound basis.

The principal aims of the department are—

(1) to increase the food-supply of the masses directly or indirectly (as manure) by developing to their utmost capacity the marine fisheries of the Presidency by fuller exploitation and the fresh water fisheries by culture and protection ;

(2) to stimulate the main and allied industries by improving old and introducing new methods with the object of gradually augmenting catches by intensive fishing or protection and scientific pisciculture as fisher-folk show capacity and initiative and to convert the fish which cannot be consumed as food into oil, manure and other by-products ;

(3) to popularize improved method and gear by providing technical instruction on up-to-date lines and exhibitions and by publishing leaflets and bulletins through the medium of its expert staff ;

(4) to translate the results of scientific investigation and study into actual commercial methods and practice of the country as a whole, by framing rules and regulations as required, for the proper development of the industry, by the safeguarding of fishing rights, public and private, by working bounties (fish-curing yards), Crown monopolies (Pearl and Chank) and by safeguarding and augmenting revenues (inland fisheries) ;

(5) to constitute a Bureau of expert knowledge and information for reference by Government and the public in all matters concerning fish and fisheries ;

(6) incidentally to stock waters with larvicidal fish to mitigate mosquito-borne diseases and to supply zoological specimens to educational institutions ;

(7) to improve the material and moral condition of the fisher-folk—a backward community to which the industry is relegated by the prevailing caste system—both in the interests of general welfare and as the best means of infusing life and introducing organization and initiative for the development of the industry ; and

(8) in order to provide the only possible sound basis for the above, to engage continuously in technological and scientific research (biological, hydrographical, bio-chemical, piscicultural and statistical investigations) with the aid of a competent and

qualified expert staff which will result in introducing reforms and improvements that will gradually modernize the industry in all its branches in both apparatus and methods and ultimately render it absolutely up-to-date and efficient.

2, 3 & 4. Most of the aims enumerated above have been partially achieved by the department—vide note, paragraphs 2 to 32, of the printed evidence. But with regard to (1) and (8) practically no progress has been made. Prior to 1923 deep sea fishing and research representing an expenditure of Rs. 1,34,300 was quite a small section, but since the acquisition of the trawler and the entertainment of a master-fisherman it has become a major activity of the department. Fishing methods now in vogue have remained primitive and inefficient. Sea fisheries are carried on all round the Coast with canoes and catamarans and primitive nets and tackle and the area fished is no more than the narrow inshore belt of 5 to 6 miles width. The potentialities of the sea beyond, have not been explored or ascertained. A great deal of investigation by experts is needed in surveying grounds and for effecting improvements in fishing gear and methods. Though Sir F. A. Nicholson has urged the need for work in this direction from the very inception of the department—vide paragraphs 186 to 191 of his Note on Fisheries in Japan (1907) and his subsequent letters in Bulletin No. 1 (vide page 82)—no material progress could be made in the absence of experts and a proper research vessel. The history of the work done is briefly as follows :—

In 1908, the Honorary Director discussed this question *in extenso* in his letter of 5th May 1908—pages 82 to 96, Bulletin No. 1. He concluded that steam trawlers or drifters are not needed for the present, being too far removed from indigenous craft. He therefore decided on the introduction of large sailing boats. Two boats, one a sailing vessel of 12 tons and the other a 15 horse-power motor vessel of 25 tons (Sutherland), were constructed and fishing experiments beyond the usual range of the local boats were conducted. A little later, two Ratnagiri sailing boats were chartered for the same purpose for a short period. The pearl fishery steamer *Margarita* was employed as an inspection boat and for deep sea fishing and research. In 1908, Mr. Hornell reported on possible fishing centres and harbours of refuge for fishing boats. He also conducted a preliminary cruise on the Malabar Coast and round the Laccadive Island with S.S. *Margarita* (Reports Nos. 3 and 4 of Bulletin No. 4). In 1916, two Ratnagiri boats were purchased for further experiments but were abandoned soon after. From 1917 to 1921, experiments were tried on the East Coast with Malabar canoes and nets, but these also led to no useful result. It is not surprising that these experiments were not a practical success and led to no tangible results since there was no expert master-fisherman to direct them. They did, however, indicate the need for a suitable large power boat for purposes of inspection and investigation. In 1919, the question of building

an inspection vessel on the model of a modern steam trawler was examined by a Committee, but Government vetoed the proposal in view of the enormous cost involved. In 1924, on Mr. Hornell's recommendations, experimental Danish seine net fishing was conducted off Cochin with a motor launch specially purchased for the purpose through the India Stores Department, under the supervision of a European master-fisherman, but the motor vessel proved unsuitable in design and equipment and the experiments ceased.

The proposals to obtain a full-sized trawler for inspection, deep sea fishing and research were again revived in 1924 for the following reasons :—

(1) New Admiralty trawlers were available at a small cost after the conclusion of the war.

(2) Previous experience with sailing boats and motor vessels had shown that the exploration of deep sea fishing grounds can only be done satisfactorily by a proper large-sized steam trawler. (Fishery research vessels in Europe, Ceylon, Federated Malay States and elsewhere are of this type.)

(3) Only such a vessel could afford the facilities and comfort required for the work to a European master-fisherman.

(4) The cost of purchase and upkeep of the trawler will be more than paid for by the transport of salt to the West Coast fish-curing yards during her research cruises.

In March 1926, the department acquired the services of an expert master-fisherman and a fishing vessel for the development of marine fisheries, but the Stores Department failed to exercise the necessary care and scrutiny and the vessel arrived with defective boiler and equipment.

Its immediate object is a survey of our coastal seas up to the 100-fathom line and the quantitative testing of these waters by trawling, Danish seine netting and all other up-to-date gear. The work is an enormous one and will take many years. Owing to defective gear, boiler and difficulty in obtaining suitable crew, serious work commenced only in November last. The extensive submarine plateau of some 40,000 square miles in extent, off Cape Comorin, being the best known deep sea fishing ground, was first taken up for systematic examination. A preliminary survey has been made and a report will be submitted to Government. The nature of the bottom so far ascertained has been mapped. The places where abundant fish were caught have been noted. The obstructions and dangers to trawl-nets have been charted in the maps prepared. The same ground will have to be fished at all seasons of the year before its fish contents can be accurately ascertained. The grounds will have to be tested by the Danish seine net, the American purse net, by long lines and full sets of drift nets, before the quantities and kinds of the mid-water and surface fish on the bank can be determined. The trawler is not

equipped with such gear at present, nor has she a laboratory and cabin accommodation for proper research. Proposals to refit her are under the consideration of Government. Only after the conditions are fully ascertained and the grounds properly surveyed, can the question be considered of equipping local boats with new gear or building larger craft for the purpose and can the possibility arise of inducing private enterprise to work the new grounds discovered with such craft and tackle.

Simultaneously with experiments in deep sea fishing, the trawler has been making observations and collections and noting data regarding temperature, salinity, plankton (fish-food floating in the sea) and bottom organisms. The presence of shoals of fish, their local movements and migrations, their appearance and seasonal abundance have been definitely traced to three important causes :—

(1) Spawning.
(2) Feeding.
(3) Hydrographical and climatic changes.

The hilsa have long been known to migrate in shoals up the rivers and the flying fish have recently been discovered to congregate in enormous shoals along the shore for purposes of breeding only. The sardine and herring visit the coasts of Europe and America almost exclusively for their food consisting of plankton and the mackerel have been shown to migrate with the rise or fall of temperature. I need hardly emphasize therefore the importance of a study of these causes in ascertaining the whereabouts of food-fish in India also. Everywhere in the world where fishery research is conducted such data are invariably collected and we cannot but follow this lead, if research is to be pursued on sound lines. The Calicut and the Krusadai stations are working out the collections made by the trawler under my personal supervision and at the Madras Aquarium laboratory the samples of water collected by the trawler have been analysed for chlorine, etc.

5. At present, the department has no machinery for the instruction of the men who are required for its administrative and scientific duties. We have officers ranging from Rs. 30 to Rs. 750 per mensem, occupying posts of great responsibility and requiring technical and scientific knowledge besides administrative experience and practical training. In actual fact, none of these officers possess all the necessary qualifications. The men in the higher rank carry on their duties in a satisfactory manner because they have natural ability and long experience and have equipped themselves with a working knowledge of their duties. Nevertheless, they would achieve still better results, if they had had the benefit of a thorough grounding in the theory and practice of fisheries at the start. Such senior men are difficult to duplicate or replace. Coming to subordinate ranks, the majority have no technical knowledge or training worth the name, and, I regret to

say, most of them have not the calibre to cope in their untrained condition, with the difficulties and problems that beset them when, as often happens, they have to take responsible charge of operations. The following is a list of the present officers with their pay and qualifications :—

Designation	Pay. Rs.	Qualifications.
Assistant Director (Coast)	250—25—500 —50—750	B.A., History; has undergone co-operative training and possesses vast administrative experience.
Assistant Director (Inland)	250—25—500	B.A., History; has a working knowledge of fish farms and tank stocking operations.
Superintendent, Pearl and Chank Fisheries.	200—20—400	Matriculation; has put in long years of service in the department and has intimate knowledge of the conduct of the pearl and chank fisheries work.
Inspector of Fisheries, Vizagapatam ..	70—250	B.A., Zoology; has undergone two years' course in the Medical College.
Inspector of Fisheries (North), West Coast.	70—250	Intermediate; possesses experience in socio-economic work.
Inspector of Fisheries (Central) ..	70—250	B.A., History; holds a permanent appointment in the Salt department, as Assistant Inspector; possesses administrative experience having worked in the Secretariat for some years.
Inspector of Fisheries (South) ..	70—250	S.S.L.C.; has experience in canning and socio-economic work.
Inspector of Fisheries (Inland) ..	70—250	Intermediate, one part in B.A. (Zoology).
Inspector of Pearl and Chank Fisheries.	70—250	S.S.L.C.; has experience in pearl and chank fisheries work and has nautical experience.
Inspector of Fisheries, Trawler ..	70—250	B.A., Zoology; has considerable experience in socio-economics and inshore fishing experiments.
Research Assistant, Ennur	70—250	Matriculation; has undergone special training under Mr. Hornell in the zoological specimen supply work.
Research Assistant, Tanur	70—250	B.A., Chemistry; has undergone training in the Indian Institute of Science, Bangalore, for a year.
Research Assistant, Krusadai ..	70—250	M.A., Zoology.
Research Assistant, West Hill ..	70—250	B.A., Zoology.
Laboratory Assistant, Ennur ..	65—4—125	Unpassed; exempted; has undergone training in pisciculture at the Ennur Station.
Laboratory Assistant, Aquarium ..	65—4—125	S.S.L.C.; one part in chemistry (Intermediate); has undergone training in pisciculture at the Tanur Station.
Survey Assistant	50—2½—100	Unpassed; exempted; advanced drawing and painting, etc.
Chank Fishery Supervisor	50—2—80	Matriculation.
Assistant Inspector, Headquarters ..	40—3—70	Middle School, first-class; undergone training in levelling and surveying.

Designation.	Pay. Rs.	Qualifications.
Assistant Inspector, Kurnool ..	40—3—70	S.S.L.C.; has undergone training in pisciculture at the Ennur Station.
Do. Vellore	40—3—70	Do.
Do. Chingleput ..	40—3—70	Do.
Do. Nellore	40—3—70	Do.
Do. Mopad	40—3—70	Unpassed; exempted.
Sub-Inspectors, Fish-curing yards (26), West Coast.	35—80	S.S.L.C. men.
Sub-Inspector of Fish-curing yards (Northern Circars).	35	Unpassed; exempted.
Sub-Inspector, Fish-curing yards under the Superintendent, Pearl and Chank Fisheries.	35	S.S.L.C.
Sub-Inspector, Fish-curing yards under Assistant Director (Inland).	35	Do.
Chank Fishery Overseers (3) ..	[illegible]—60	Do.
Mechanic, Cannery	35—3—80	Post held in abeyance.
Do. Tanur	35—3—80	Drivers' test
Sub-Assistant Inspectors under Assistant Director (Inland).	30—1—45	passed; exempted.
Canning Overseer	30—1—45	Post held in abeyance.
Church Island Overseer	30—1—45	Unpassed; exempted.
Fieldmen (4) under Assistant Director (Inland).	23—1—35	Unpassed.
Fieldmen, Ennur ..	20—1—35	Do.
Laboratory Attendant	20—1—35	Do.
Petty yard officers (48)	20—½—25	Do.
Keepers, Aquarium (3)	23—1—35	Do.

I have come to realize that, if we continue simply to choose the most intelligent applicants, to give them what training we can and then put them in charge of responsible work, the activities of the department will be seriously handicapped, especially on the research side; and real development will cease, as such men need far more supervision than can possibly be given. Every Government department requiring the application of science and technology to its operations has passed through the same stage that this department now finds itself in. Each has begun in a tentative way with the human material available on the spot and has had eventually to develop an organization specially devised to train the recruits needed for replacement and extension. The Forest, Public Works and Agricultural departments are instances in point. They have found this development necessary in the course of their evolution and fisheries cannot reasonably be expected to form an exception to the rule.

We have reached a limit. Future progress in all sections of the department, dealing as they do with matters varying from fishing experiments to trade organization, requires more and more expert knowledge and direction. In the initial stages, for instance, of fish-curing, canning or manufacturing of fish-oil and guano, trade methods and practices, as well as recipes from books, have been tried, with considerable initial success. Now that the preliminary work has been done, however, the problems that

remain to be solved call for expert technical knowledge. The most immediate technical and scientific problems before the department are—

(1) the tracing of sardine and mackerel and other fish shoals when they leave the coast, the methods of capturing them in deeper water with enlarged boats and special gear ;

(2) the softening of the bones in tinned Malabar sardines ;

(3) the determination of the periods of safe storage of canned goods ;

(4) the prevention of the dark discolouration in prawn tins ;

(5) the elimination of excess oil in fish meal, the correct method of manufacture of medicinal fish-oil with maximum vitamin and the refining of fish-oil for various industries ;

(6) the detection of the causes of the irregular periodicity of the pearl fisheries and the discovery of remedies ;

(7) the formulation of measures to prevent undue depletion of chank beds ; and

(8) the artificial culture of hilsa and other food-fish in backwaters and rivers.

All of these and other less emergent questions demand the application of highly technical and up-to-date methods by experts.

What is therefore required is an entirely new departure which will ensure expert attention to all scientific operations and experiments on the one hand, and will provide on the other the staff and machinery which will make possible the training of apprentices for all the administrative posts and the subordinate ranks of the department. The staff of the department should therefore consist of two classes of officers—

(1) experts with their assistants and staff for research ; and

(2) administrative officers with their assistants and staff for executive duties.

Such a distinction, I find, exists in Fisheries departments in other countries. In Great Britain, for instance, the research laboratories at Lowestoft, Conway and elsewhere are staffed by qualified biologists, hydrographers, chemists and statisticians while executive officers (Superintendents, Inspectors, Water Bailiffs, etc.) are stationed at important centres for administering laws and regulations relating to fisheries and gathering statistics connected with these and allied industries. The latter are largely men with practical experience of fishery work and a grounding in fishery science, but are not experts in any branch of that science. The distinction has perhaps been unnecessary here in the past, but I consider that the time has now arrived when we must make it.

With this end in view I proposed the re-entertainment of Captain Cribb as fishing expert when the trawler was purchased and have been redesignating the subordinate posts in the department according to the nature of their duties. For technological

work at the Chaliyam Cannery and Tanur particularly, as well as for other chemical investigations relating to fisheries and pisciculture, I have submitted proposals for the appointment of a qualified *Fisheries chemist* (my letter to Government No. 1471-C/27-2, dated 16th August 1927). The intensive biological investigations relating to pearl and chank, marine and inland fisheries likewise require the services of a whole-time biologist for their effective and proper prosecution. I would propose that a competent and fully qualified biologist with brilliant Western academical degrees in Natural Science and, if possible, Fishery Science with some experience of biological research work with a knowledge of Indian Zoology if that could be had, should be carefully selected and entertained as *Fisheries Biologist* on a suitable salary which I will for the present fix at Rs. 750—50—1,200 or thereabouts. He should be competent to supervise and guide the work of the Assistant Biologists and control the work of the biological stations ; besides, he should be an understudy of the Director and should be kept in touch with all major schemes so that he could act for the Director when the latter goes on leave and ultimately take his place when the present Director retires. Of all the experts, he is obviously the one that could be trained to take the place of the Director and therefore, great care should be exercised to entertain a sufficiently young man of brilliant attainments and absolutely first-rate qualifications and merit. The above are the urgent present requirements on the research side of the department's work. Other experts may become necessary as the work develops ; for instance, a qualified *Pisciculturist* when the number of hatcheries increases, a *Hydrographer* when hydrographic operations are extensively carried on and possibly a *Statistician* and *Economist*.

The expert staff of the research section when appointed will provide the requisite machinery for the training of the rest of the Fisheries staff from Assistant Directors to Overseers and the subordinate research staff at least from Research assistants to Laboratory attendants.

The training of experts is at present out of the question as there is no institution in the whole of India that provides courses in the higher branches of fishery science. If such existed, we could obtain men with a sound grounding in fishery science, who, after training and experience in the department, would be capable of taking the position of experts. At present, experts with foreign training will almost certainly have to be selected.

The improved curriculum of studies in the Fisheries Training Institute will also require assistance from the experts who should supervise studies relating to their subjects and examine the students in them. The fishery elementary education has already had the desired effect in creating an interest for advanced technical education in fisheries among sections of the West Coast fishermen. A scheme for providing such technical education has

been submitted to Government. The Fisheries Training Institute at Calicut and those proposed at Mangalore, Vizagapatam and Madras, with the assistance and help from the experts of the department, will provide the means of imparting such education and training recruits for the department.

The staff required for the efficient running of the department may now be considered under the two sections *Research* and *Administration*.

I—Research Section.

1. *Fishing and Sailing Expert.*

Fishing and Sailing Expert is now styled Assistant Director (Marine). Captain Cribb is a specialist in fishing and constitutes the only expert officer among the present Assistant Directors. His wide and varied experience in European and Eastern seas and his long professional career as a North Sea fisherman from the eighties, in sailing vessels and subsequently in steam and motor vessels, have specially fitted him for his task in India. His work is the improvement of fishing craft, gear and methods, and the exploration of deep sea fishing grounds. He has rare qualifications for the task. He is on a short-term contract of three years from 12th March 1926. Defects in the trawler and difficulties with its crew delayed serious work till last October. He has only another year of service. I have proposed that his contract should be extended for another three years.

2. *Fisheries Biologist.*

The two Research Assistants already working in the biological stations at West Hill and Krusadai are local graduates and have yet to be trained in fishery research. These or other men from the department should be sent to a Western University for training and on their return be appointed as Assistant Biologists. All the four marine biological stations at Calicut, Krusadai, Madras and Vizagapatam and the fresh-water biological station proposed at Chetput should be under qualified Assistant Biologists. Besides the Assistant Biologists each biological station should have the following subordinate staff :—

One Research Assistant, a Local Honours B.A. or M.A. ;
A Laboratory Assistant ;
A Laboratory Attendant ; and
Two peons.

One Assistant Biologist is also required to work on board the trawler, with the present Inspector and peon under him.

3. *Fisheries Chemist.*

Under him there should be a Research Assistant with staff on the scale indicated in the preceding paragraph, viz., a Laboratory Assistant, a laboratory attendant and a peon. He can probably

work at the Industries laboratory in Leather Trades Institute till a laboratory designed to meet his requirements is established on the West Coast, where most of his work will, for the present, lie.

4. *Other Experts.*

Other experts, such as a hydrographer, pisciculturist, statistician, etc., are not at present urgently required as the work done is not so large or extensive as to require whole-time officers and I can continue to supervise them in addition to my other duties.

II—Administrative Section.

If the aims of the department and its present activities as I have tried to show above are accepted, the present executive staff is the bare minimum and in several cases inadequate to cope with the increasing work in the different sections. There is certainly no superfluity which calls for curtailment. The department is run on the most economical and, if I may be permitted to say, stingy lines. The gazetted officers of the department, with one possible exception, are not on the usual provincial service grade. One Assistant Director's maximum pay stops with Rs. 500 and that of the Superintendent, Pearl and Chank Fisheries, practically an Assistant Director with Rs. 400. This has led to considerable dissatisfaction which necessarily reflects on the quality of work done.

On the West Coast, before the fish-curing yards were taken over by the department, there was a socio-economic Sub-Assistant (Inspector), an Inspector of oil and guano factories, two Assistant Inspectors to assist the Assistant Director (Coast) in the inspection of about 6 to 10 fish-curing yards. When, however, over 50 fish-curing yards were transferred and the work increased fourfold, the number of inspecting officers was reduced to 3, who are now called Inspectors of Fisheries. The posts of both socio-economic Sub-Assistant and oil and guano Inspector were abolished and the three Inspectors were transferred to the fish-curing yards. They have therefore been obliged to concentrate their attention chiefly on these yards and the inspection of oil and guano factories as well as co-operative societies and socio-economic propaganda, as a whole, have not received adequate attention. The fish-curing yards on the East Coast suffer from want of adequate inspecting staff and the men in charge of most of them are ill-educated peons.

The duties of the four controlling officers on the East and West Coasts are at present somewhat ill-defined. I would suggest the following reorganization and allocation of work for the future :—

The Superintendent, Pearl and Chank Fisheries, should be raised to the rank of Assistant Director in status and pay (Rs. 250—25—500—50—750). The Assistant Director (Inland) should be on the same grade of pay and Vizagapatam should be the

headquarters of a third Assistant Director on the East Coast. The territorial jurisdiction as well as the duties of the three officers should be fixed as follows:—

The jurisdiction of the Assistant Director (Southern Division) at present styled Superintendent, Pearl and Chank Fisheries, will comprise the districts of Tinnevelly, Ramnad, Madura, Trichinopoly and Tanjore.

That of the Assistant Director, Northern division (proposed), will consist of the districts of Northern Circars including Guntur, Coimbatore, Nilgiris, Malabar and South Kanara will form the Western division under the Assistant Director at present styled Assistant Director of Fisheries (Coast). The remaining districts will constitute a Central division under the Assistant Director at present styled Assistant Director (Inland).

The Assistant Directors should be in charge of all executive duties connected with the management and development of fisheries and socio-economic work among fishermen in their respective areas. These duties will comprise—

(1) Executive work relating to marine fisheries, supervision of the inland fisheries already under the control of the department, the gradual acquisition of fresh-water fisheries in new districts and anti-malarial operations.

(2) The control of fish-curing yards.

(3) The establishment of schools, formation of co-operative societies and other socio-economic work on the West Coast and ultimately probably on the East Coast also.

(4) Such special duties pertaining to the different sections as the inspection of the oil and guano factories in the Western division, the conduct of pearl and chank fisheries and the resuscitation of the chank bangle industry in the Southern division, deep water fishing experiments in perennial tanks in the Central division, and the development of the Collair Lake prawn fishery and Hilsa operations in the Northern division.

The subordinate staffs of the four divisions may remain as, at present, except for the staff attached to the fish-curing yards. I have submitted to Government a reorganization scheme. According to this, the West Coast would be divided into four sections under the four Inspectors and ten sub-sections each under a Sub-Inspector. The East Coast would be divided as at present into three sections each under one Inspector but the northern and southern sections would each have two Sub-Inspectors and the central section one. All peons in charge of yards should be replaced by Petty Yard Officers. The additional staff should not only inspect fish-curing yards and collect fisheries statistics more efficiently than now, but should also at least on the West Coast, be in charge of socio-economic work and the inspection of oil and guano factories. Such a revision of the establishment, I have

shown, could be made without extra cost. But, for the supervision of the co-operative societies when their number and scope increases and for the proper development of socio-economic work on the East Coast the transfer of which to this department has been proposed to Government—some further additional staff will be necessary.

In the inland section the existing staff is adequate for present needs. As the work expands, some additional staff will be needed for the new fish farms and hatcheries and tank stocking work, especially in districts where they have not yet been started.

Director.

The work of the Director is obvious. He should possess administrative experience, knowledge of Indian needs, habits, social conditions and prejudices, conflicting interests of trade, etc., together with a good knowledge of all sections of fishery work, industrial and scientific, throughout the world. These qualifications will enable him so to combine the work of the experts and that of the administrative officers as to obtain optimum results. He should shape and control the general policy and lines of action and sanction them in the order of their importance. He should co-ordinate, regulate and criticize the work of the different sections, help the experts and the executive staff with instructions, suggestions and advice as required and have sufficient leisure to discuss the general lines of work and, if necessary, the details of operations with Government and with his subordinate staff. He should elaborate new schemes, negotiate with other departments and bodies, write reports, books and bulletins, review papers that will be published from time to time by the experts, and generally stimulate and push the work of the whole department. He will have to be thoroughly posted up with work in all sections of the department so as to be in a position to supervise and control the work of the experts on the one hand and that of the administrative officers on the other. If burdened as at present with administrative, clerical and account routine, without proper assistance in the headquarter's office, and with the entire work down to the most petty experiments, scientific and technological, he will get neither time nor opportunity to devote his best to the more important and legitimate duties of the Director. The appointment of the Fisheries biologist and Fisheries chemist will set the Director free from the detailed supervision of most experiments and research. It is difficult to supervise the operations from a single centre like Madras, for they have to be carried out in various places and require whole-time officers on the spot to deal with them. I refer to pearl fishery research at Krusadai, the routine and special work at the research station at Calicut and the laboratory at Ennur, fish-curing, fish meal and oil experiments at Tanur, details of canning processes at Chaliyam, etc. So long as I am Director,

since I have specialized in pisciculture I hope I shall be able to continue to devote close supervision over the work of the fish farms, hatcheries, and cultural experiments with marine, brackish and fresh-water fish. In addition, the collection and compilation of fisheries statistics, the hydrographical and meteorological investigations at sea and inland stations must continue to receive my personal attention.

Personal Assistant.

If the Personal Assistant is made a gazetted officer, it will relieve the Director of administrative, accounts and clerical routine, which now claims much of his attention and time to the detriment of more important work. This is bound to increase in volume and scope with the appointment of the additiontl Assistant Directors and Experts and the enlargement of the scope of operations on the research and the administrative sides. The Government refused the gazetting of the Personal Assistant in 1921. The number of leave applications, contingent bills, vouchers, the procedure connected with the new scheme for the control of expenditure, attesting the cancellation of sub-vouchers as the only drawing and countersigning officer, have all increased to a considerable extent since 1921. The transfer of the fish-curing yards, the purchase of the trawler and the additional schools have resulted in increasing the staff to four times the number in 1921, with corresponding increase in administrative, account and clerical routine. I am, therefore, of the opinion that the proposal should now be reconsidered. This will incidentally enable the Personal Assistant to deal with disbursements of pay and amounts drawn on travelling allowance and contingent bills. These often have to be dealt with by some one at headquarters during my absence on tour though I am personally held responsible for such payments. It will also give him the necessary status to interview officially the Collector of Salt, Collector of Customs, Presidency Port Officer, Deputy Conservator of the Port Trust and other heads of departments when I am away.

6 & 7. The aim of the department has been defined as the development of fisheries as a source of food-supply and as otherwise contributing to the national wealth of the country. If this is conceded, the programme of work relating to the fisheries should be classified as follows in the order of their importance :—

(1) Development of marine food fisheries.
(2) Development of inland food fisheries.
(3) Development of pearl and chank and other minor fisheries.
(4) Improvement of the material and moral condition of the fisher-folk as the only method of improving the fishing industry.

The main lines of activity of the department at the present time, arranged in the order of their relative cost and magnitude are given below :—

	Budget Estimates for 1928-29.
	Rs.
(1) Fish-curing yards	2,67,500
(2) Deep Sea Fishing and Research ...	1,34,300
(3) Inland Pisciculture and Oyster culture.	1,22,900
(4) Pearl and Chank Fisheries	69,200
(5) Education and Socio-economic work ...	65,300
(6) Industrial research at Chaliyam and Tanur	37,300
(7) Biological research and Aquarium ...	13,850
(8) Anti-malarial operations and supply of biological specimens	5,850

These do not materially differ from the arrangement proposed above.

Item (1), Fish-curing yards, and (2) Deep sea fishery research, are the largest items of work absorbing the major portion of the expenditure of the department and relate to marine food fisheries. The technological experiments carried on at Chaliyam and Tanur (item 6) really form a sub-item of the same major head.

The items (3), (4) and (5) are in their natural order. Item (7), Fishery Research, is not a separate head but comprises the scientific work relating to both marine and fresh-water fisheries and should be absorbed in these two items.

Item (8), Anti-malarial operations, and Biological specimens supply, are petty heads of expenditure, only incidentally connected with fisheries. They therefore occupy the last place.

However haphazard the nature of the various developments of the department may have been historically, it will be seen that the relative value and degree of concentration on the various lines of activity pursued are not out of proportion to the importance of the subjects with which they deal. I am unable to suggest or to conceive of any totally different arrangement in the relative position and importance of existing activities. The defects in organization and work relate only to details or subdivisions of the major activities. The most important of these, I consider, is the want of staff and facilities for biological and technological research. What the department desperately needs is a large addition to its scientific and expert staff so that fisheries research may take the primary place that the development of fisheries demands for it. I have dealt with this in reply to question 5.

If due emphasis is laid on research, one important result in all the major activities of the department would be a corresponding increase in what may be called unremunerative expenditure which

cannot be set off against receipts in the annual balance-sheets of the department. If the primary place that research should occupy in fishery activities is conceded here, as it is in all other countries of the world, the department will become a scientific one and should not be expected to counterbalance its expenditure by revenue. Wherever it is possible without subordinating its primary aims, every effort may however be made to secure revenues. The Finance Department of Government, as well as the general public, have been inclined to gauge the success of the department's operations mainly by profits earned. As a result, an undue fear of cost has compelled the department to concentrate on the administrative revenue-yielding aspects of its work and to neglect pure research and experiment. As instances, I may refer to the Retrenchment Committee's findings, the proposals by Mr. Hornell for the abolition of the posts of the Marine Biologist and Marine Assistant, the closure of the cannery within a year and a half of the commencement of its work as a commercial concern, the enhancement of the issue price of salt in fish-curing yards and the constant demand for making the oyster and biological supply section self-supporting. Consequently the administrative side of the department is fairly well organized while the organization of the research side has only just begun.

SECTION II.—FISH-FOOD SUPPLY.

Mr. Gopala Menon stated that fish-food supply was seasonal and uncertain as in the case of paddy and other cereals. As an instance, he quoted the migration of sardines from the West Coast during the last few years and complained that no attempt had been made by the department to induce them to return to the coastal waters.

Mr. T. K. Rajaram Rao stated that fish, being cheaper than other non-vegetarian food, formed the mainstay of the poorer classes and if, as the result of large-scale operations, the price of fish could be brought down so as to be within the economic reach of the half-starved people, it would not only solve one of the greatest economic problems, but also bring into evidence a healthy, robust and strong race. He pointed out that the difficulty of a greater supply lowering the price would not arise, as there were very large potential and latent markets in all the district and taluk centres where, with proper facilities, fish could be made available without swamping the market and lowering the general price so low as to make it a commercial failure. He was of opinion that any quantity of fish could be easily absorbed provided proper facilities existed for transport of fish to the various markets.

Dr. Natesa Mudaliyar was in favour of treating fisheries as a national asset and thought that it had not been sufficiently exploited in the interest of the nation. As a doctor, he was of opinion that fish-food is rich in proteid matter, is also equal to meat and less costly than mutton, if available. He also stated that, in times of famine when vegetable food was less available, fish went a long way in relieving the sufferings of poorer classes.

Mr. Subba Rao Nayudu stated that, though fish-food was cheaper than other kinds of non-vegetarian food and there was effective demand for more fish-food throughout the year, sufficient quantity of fish was not caught to serve as food for the people. In his opinion, greater supply would create greater demand and he stated from his personal experience that any material increase in the supply was sure to be absorbed.

Mr. P. Lakshmanaswami Garu said that fish-food being cheaper than meat or other kinds of non-vegetarian food there was, as a matter of fact, enough demand for which there was no adequate supply.

Mr. J. A. Fernandez thought that sufficient fish was caught for existing demand, but that it was likely to increase enormously with greater improvements and inducements.

Mr. Moses was of opinion that sufficient quantity of fish was not caught for local consumption. He thought that the market problem would present no difficulties if speedy transport from the fishing grounds to favourable markets could be provided; this would prevent tainting of the fish and glut in the market.

Mr. M. P. Krishnan considered that there was an effective demand for more fish-food in the interior parts, provided it was supplied cheap and was of opinion that any material increase in the supply was likely to be absorbed without difficulty.

Mr. Suryanarayana Rao felt that, though there might be adequate supply of fish at present, increase in supply was sure to increase the demand as fish-food is cheaper than any other non-vegetarian or vegetarian food. At any rate that would be the case on the West Coast where the people are very poor and are content with very cheap food.

Mr. Saldanha observed that fish, cheaper as it is than other non-vegetarian food, the supply was far below the demand of the middle and lower classes. With greater facilities created for transport, the said fish could however be sold in larger quantities in the interior.

Rao Bahadur Govindan stated that under normal conditions the quantity of fish caught was not only sufficient for the consumption of people living within a radius of eight or ten miles, but usually there was a surplus which was salted or dried and sent into the interior parts of the country or exported to Ceylon. He said that

there was always a demand for fresh fish from all parts of the country and the best way to meet this demand was the introduction of freezing methods by means of which fish could be sent to far distant places. If cold storage was provided in addition to freezing, he added, it was possible to keep such fish in the best condition for a few months.

Mr. Annayya was of opinion that any material increase in supply of fish was not likely to find a ready market elsewhere without bringing down the current price.

Mr. Gopalan stated that sufficient quantity of fish was not caught for local consumption and that a greater supply of fish-food could create an effective demand. In the rural parts away from the sea-coast towns, he said that there was an effective demand for more fish-food.

Mr. M. Viswanath stated that, as far as possible, the consumers would like to eat fresh fish and, to gain this object, the department, he observed, must devise some cheap method of preserving fish fresh at least for three days so that it might be sent to up-country markets. In his opinion, the insufficient quantity of fish caught was not due to want of improved methods in catching or to lack of better boats or nets, but to the non-appearance of fish on the Coast.

Mr. Othenan stated that fish, especially sardines, was one of the staple foods of the poorer classes on the West Coast being very tasty and nutritious and, at the same time, cheaper than most other foods. So, the failure of the sardine, he remarked, affected the poor more than the failure of the paddy crop sometimes.

Mr. Raman Menon said that a material increase in the supply would tend to lower the price and that would push up the demand. In this case it was the general population that would benefit and not the fishing classes alone. But, if improvements in the various methods of fish preservation kept pace with the increase in supply, he saw no reason why the fishermen should not also profit because then the surplus fish would be absorbed by markets in the interior.

Rao Bahadur Cruz Fernandez doubted whether a greater supply of fish would create an effective demand.

Mr. A. V. Achuthan said that the creation of an effective demand for more fish-food meant the adoption of better methods of preservation. In other words, refrigeration should be made practicable and, at the same time, sufficiently cheap for the laymen.

Mr. Andy Sankaran said that the fish caught on the West Coast was more than sufficient not only for local consumption, but also for drying and curing and for exportation from the curing yards of the Coast to Colombo, Arkonam, Villupuram, Trichinopoly and other places.

In reply to questions Nos. 8 to 12, Dr. Sundara Raj stated as follows:—

8. No. Also see reply to questions Nos. 10, 11 and 12 below.

9. Yes. It is cheaper where fresh fish is readily available in the fishing villages along the Coasts and the neighbouring markets, also in the vicinity of large tanks, if and when they run dry. Fish is dear because of—(1) the enormous fluctuations in production (by capture or cultivation) and (2) the uneven distribution due to lack of efficient communication and preservatives.

10, 11 & 12. Yes. Apart from any considerations of food or manure supply to the country which by themselves are weighty reasons for the development of fisheries, its future prospects like that of all other industries should normally depend on demand existing or capable of creation and possibility of adequate supply. Both the requisite conditions of demand and supply exist in India. At least 95 per cent of the population of the Madras Presidency and a much higher percentage in the rest of India where even Brahmins are fish-eaters will eat fish if they can get it. There is therefore an existing local demand, apart from export trade in fish and fisheries products for which also there is always a considerable scope. Please see also reply to question No. 69. In 1925–26, 177,790 maunds of cured fish were exported to Ceylon from the Madras Presidency.

SECTION III.—IMPROVED METHODS OF FISHING.

Mr. Gopala Menon stated that the present methods of catching fish were relics of primitive days and not at all effective to cope with increased demand. He could think of no improvements effected and he attributed this to want of organized attempt. He pointed out that there were no means of mechanically handling any bigger or improved types of nets and suggested as improvements in this direction the supply of better types of boats with live wells and mechanically fitted nets.

Dr. Natesa Mudaliyar thought that the fishing methods were as old as human knowledge went. He said that the old nets and old catamarans should be replaced by better kinds of boats and pointed out that there should be better equipped steam boats, if fishermen were to go beyond five miles.

Mr. T. A. Subba Rao Nayudu stated that the present methods of catching fish were not at all effective and that no improvements had been effected especially on the East Coast, partly owing to insufficient funds and partly because the Government did not

encourage private associations or persons who undertook the development of fishing industry. He suggested the following improvements :—

(1) The supply of "Poliki" timber for catamarans at concession rates.

(2) Supply of yarn Nos. 14, 20, 22 on credit system to prepare the required nets of different kinds. Improvements would vary according to the nature and situation of the place.

(3) Opening up of communications wherever necessary.

He said that if fishermen could be provided with a motor launch to go and return, they could have three or four times the catches they had at present. He advocated the introduction of night-fishing with a motor launch by means of electric search lights.

Mr. Roche Victoria said that the present methods were not effective and wanted that Government should demonstrate the best methods of catching fish and, for this purpose, he did not want Western methods to be introduced, but indigenous methods to be developed.

Mr. P. Lakshmanaswami wanted the introduction of bigger boats and more modern nets.

Mr. J. Fernandez stated that the present methods of fishing were effective so far as the supply was concerned. No improvements had been effected. In his opinion, the fishermen could not take to improvements on account of their economic condition. He would suggest removal of illiteracy and promotion of thrift among the fishermen ; with improvements in these directions, he hoped the fisher-class would become self-conscious and the fishing industry was likely to improve automatically.

Mr. Moses stated that, though primitive, many of the methods were effective considering the average buying power of the fishermen in the matter of boats, nets, etc. He suggested the following improvements :—

(1) Importation of Ratnagiri boats into S. Kanara and adoption of Tuticorin outrigger for whiffing for seer and ousting the Ceylon Kulla.

(2) Importation of Ratnagiri nets into S. Kanara, adoption of long lining in Malabar and adoption of Ennur method in tank fishing.

(3) Opening up the deep-sea fishing grounds, demonstrating the fish wealth as has recently been done by *Lady Goschen*.

Mr. M. P. Krishnan stated that no improvements in the methods of fishing had so far been effected and suggested the following :—

Indigenous methods of fishing practised at Ratnagiri and Malpe should be introduced in other places. The noise made by using "Chalavala" and "Kolli" in certain seasons must be

stopped and as this noise frightened away the shoals out of the water, it should be made penal ; similarly, drift-netting at night should be stopped from the middle of September to the end of November as such night fishing prevented the shoals of fish, such as kora, cat-fish, sardines and mackerels from coming to the shore from deep sea.

Mr. J. A. Saldanha wanted that the fishermen should be trained at Mangalore and Malpe in manufacturing Ratnagiri nets already introduced into S. Kanara.

Rao Bahadur Govindan said that in some areas the existing methods were effective making allowances of course for weather and other local conditions.

Mr. Annayya stated that no improvements had been effected in any of the kinds of fishing. The old methods continued in practice with sufficient advantage.

Mr. M. Viswanatha stated that no improvements had as yet been effected in fishing crafts, gear and tackle and that, to his mind, no improvements were necessary at present. He was of opinion that any attempt to introduce new kinds of nets would not be suitable to a particular locality on account of the rocky conditions or the shallow nature of the sea.

Mr. Othenan stated that the present methods of catching fish could not be said to be very inefficient or ineffective, but the chief difficulties that the fishermen found in catching fish now with their present implements were that they were not able to go far and wide in search of the fish nor could they catch the fish even if they saw them, if the currents and wind were not in their favour. If methods could be devised to enable the fishermen to go far and wide and to tide over the difficulties of adverse currents and winds, the catch of fish could very much be improved. He said that the fishing implements remained where they were some decades ago. He attributed the inability to effect any improvement to lack of technical and practical knowledge on the part of the officers deputed to the work. He advocated the introduction of small steam and motor boats in the place of small canoes used by the fishermen now.

Mr. Raman Menon said that the future of the fishing industry depended upon the use of large boats. A fairly large type of boat adapted to the work and to the nature of the Coast working with wind and power, supplemented, whenever necessary, by a small detachable motor engine might prove suitable.

Rao Bahadur Cruz Fernandez stated that the present methods of catching were effective so far as the demand was concerned. He was of opinion that the efforts of the officers of the department to introduce improved methods and appliances had not been successful in the majority of cases tried. This failure was largely

attributable to the conservatism of the fisher-folk and the difficulty of getting teachers and demonstrators conversant with the new methods. He suggested the following improvements :—(1) The fisher-folk should be taught by actual demonstration as to the advantages of using improved methods and appliances ; (2) a number of them should be selected and trained ; (3) State-aid should be freely given to enable them to build better crafts and purchase new appliances.

Mr. A. V. Achuthan stated that the methods of fishing in different parts on the Coast varied considerably and the effectiveness of each could be tested only by comparison and transferred for adoption. He was of opinion that time and distance, the main drawbacks that prevented the ordinary fisher-folk from catching more fish should cease to be such with the help of science.

Mr. Unni stated that the present methods of fishing on the West Coast were, to a very large extent, effective and suggested that Government must stop the four destructive methods of fishing, viz., Ayila, Chalavala, Mathichalavala and Mathikolli by legislation as these kinds of fishing made a lot of noise and disturbance in the sea and consequently mackerel and sardines had begun to disappear.

Mr. Andy Sankaran was of the same opinion as Mr. Unni.

In reply to questions 13 to 16, Dr. B. Sundara Raj stated as follows :—

13. The fishing crafts in use are primitive and inefficient. The characteristic sea fishing craft, on the East Coast, is the catamaran, a keelless craft formed by lashing together from 3 to 5 pieces, occasionally 7 pieces, of light rough hewn wood. A more primitive contrivance cannot be imagined. The heavy surf on the East Coast prevents small boats or canoes being employed throughout the year. The only boats are the so-called Masula boats, built of planks sewn together, but without frames or ribs which, owing to their construction, are elastic enough to stand the surf. On the West Coast, the usual fishing vessels are crank canoes (dug-outs), the largest of which do not exceed 32 feet in length by 3 feet in width and $2\frac{1}{2}$ feet in depth. They hold from 2 to 8 men.

There is no room in catamarans, canoes or boats for the free movements necessary for using nets effectively. Only small nets could be carried ; and as different nets are required for catching different kinds of fish, each net has to be necessarily of very small dimensions. The cruising distance is very limited ; ordinarily it does not extend beyond the five-fathom line. The farthest limit is the ten-fathom contour, at a distance of from 5 to 7 miles from the Coast. Very often, when only one kind of net is taken out in the expectation of finding shoals of a particular species of fish and shoals of another species appear, the fishermen are unable to catch

any fish at all. Again, owing to the smallness of the boats, the duration of each trip is short, and ordinarily fishermen never stay out at sea for more than 24 hours. The time taken to return after the catches, when a lull or adverse wind prevails and the absence of any facility for keeping the fish alive or fresh, on its way to the shore, cause it to taint in a tropical climate ; and the fish become quite unfit for consumption. The boats and men are numerically small, compared with the length of coast, the length of fishing grounds and the population. Less than 3 per cent of the population are fishermen, whereas in Japan nearly 3 per cent of the population are engaged in fishing. The crew employed is often disproportionately large, arguing inefficient labour, compared with the size of craft and tackle. For instance, two crews of seven men each in two boats are required to work a small 'idam' (dip net) on the West Coast ; while on the East Coast 12 to 14 men with four catamarans are required to work the 'mada valai' a rectangular dip net 48 to 60 feet long ; whereas a modern British steam trawler, with its gigantic trawl or a steam drifter, with a fleet of nets, miles long has but 11 or 12 men, including the engine room crew.

The only nets of any size, which can at all be mentioned in comparison with the nets used in Western countries, are the Masula boat net in universal use on the East Coast and the Rampini net in the South Kanara district ; both shore-seines of some size and catching powers. The ordinary nets are small and inefficient, compared for instance, with the trawl-net, the Danish seine net, the American purse net, etc. Drift-netting and long-lining in India, is also done on a very small scale, owing to the limited size of the fishing boats. The usual length of the long-line is from 100 to 600 fathoms, carrying from 20 to 500 hooks ; whereas European long-lines extend from 5 to 6 miles and carry from 5,000 to 7,000 hooks. The drift nets are in extensive use, only in the Palk Bay, the Gulf of Mannar and the Malabar Coast. The length of a fleet of nets hardly exceeds 800 feet or $\frac{1}{2}$ a mile as may be expected from the size of the fishing craft, whereas a fleet of nets employed by a steam drifter extends to miles.

Vide also replies to questions 2, 3 and 4.

The craft and gear employed by fresh water fishermen are even more primitive than those of the sea fishermen. The introduction of improved methods for the continuous fishing of deep permanent water tanks and rivers, now wholly unworked, will add enormously to the productivity of our rivers, tanks, ponds and wells. Some improved methods in fishing inland tanks were tried by the department at Chembarambakum and Mopad.

14 (*a*), (*b*) and (*c*) and 15.—Vide answer to question 13.

A great deal of investigation by experts is needed in surveying grounds and for effecting improvements in fishing gear and methods. Though Sir F. A. Nicholson has urged the need for

work in this direction from the very inception of the department, vide paragraphs 186 to 190 of his Note on Fisheries in Japan (1907) and his subsequent letters in Bulletin No. I, page 82—no material progress could be made in the absence of experts and a proper research vessel.

16. *Future programme—Fishery cruises.*—Systematic cruises should be undertaken by the research ship *Lady Goschen*, which should be well equipped to continue and complete the investigations already made on both the East and the West Coasts. The aim is to test the suitability of all available modern methods of fishing in Indian waters. The following lines of work are suggested:—

Trawling.—Systematic trial trawling with otter and beam trawl in offshore grounds throughout the Coast.

Danish seine net.—Trial netting may be made with the Danish seine net of the usual type or with suitable modifications to meet Indian conditions.

Drift net, gill net and tramel net.—A series of experiments should be conducted with the above as in the European waters to test possibilities.

American purse seine net.—In the East, Japan is the only country where the net was tried and has been adopted on a large scale. The net is said to possess enormous catching powers and is well worth a trial in the waters of this Presidency.

Long lining.—The full length of a long line should be given a trial.

Survey and charting of banks and fishing grounds.—In all cruises, data of catches, depth, currents, nature of the bottom, assemblage of characteristic animals and plants should be kept for the charting of the fishing grounds for the benefit of the fishing industry.

Tank fishing.—The experiments contemplated at Mopad should be conducted till the best methods of fishing permanent water tanks are finally evolved.

SECTION IV.—DEEP SEA FISHING.

Mr. Satyaraju, of Cocanada, said that their fishermen went only two miles from the shore and fished in a depth of 10 or 20 fathoms.

Diwan Bahadur Arogyaswami Mudaliyar said that the trawler should be made absolutely useful. It should be better equipped by providing refrigerating plant, holds for fish and also cabin accommodation for officers.

Mr. T. V. Subba Rao Nayudu stated that fishermen usually went up two to three miles from the shore and they could not go longer distances for want of big fishing nets and for want of small motor launches to provide sufficient accommodation for the catches and to return in time to sell their catches.

Mr. Roche Victoria suggested that the department should maintain some launch which should go in case of need to rescue fishermen exposed to danger at sea. He advocated the provision of a cold storage room in the trawler. He was for allowing the trawler to engage in salt transport work only in the intervals when it had no other work, but not at the sacrifice of its work of catching fish.

Mr. P. Lakshmanaswami stated that the longest distance to which fishermen went in the sea was four or five miles from the shore.

Mr. P. E. Manikkavelu Chettiyar however maintained, that the fishermen went to a distance of 15 to 20 miles and brought enough fish to make a livelihood.

Mr. J. A. Fernandez stated that as regards vessels for deep sea fishing no retrenchment of expenditure was possible as only the minimum was incurred. During the off seasons these were laid up with skeleton crew.

Mr. S. T. Moses stated that, on the West Coast, the fishing zone was within the 40 miles limit, but the five-mile belt with a depth of ten fathoms was most regularly exploited; only the deep sea shark netters and the Ratnagiri men ventured to the uttermost limit of the zone. The chief reason for fishermen not going beyond the ordinary line, Mr. Moses stated, was the unseaworthiness of the boats employed. The greater the distance of the fishing ground from the shore, the more difficult the question of transporting the catches to the markets before the fish got tainted.

Mr. J. A. Saldanha advocated the employment of trawlers to educate the more enterprising section of fishermen. He said that the process would be slow and gradual, as large capitalists were needed with more experience in joint stock and co-operative business. He also suggested the introduction of the methods employed by the Bombay fishermen in deep sea fishing.

Rao Bahadur Govindan stated that there was absolutely no need for all the steam and motor vessels in the department and that their number could be considerably reduced and, if this was done, there would be reduction in expenditure. He also stated that the Malabar and S. Kanara fishermen had no boats that had room for cooking and sleeping and hence they were obliged to return to the shore before nightfall. The Ratnagiri men, on the other hand, had boats in which they could live for a number of days and they could therefore go out and stay in the sea for a couple of weeks if they found it necessary to do so. The Malabar and

S. Kanara fishermen did not go beyond ten miles, but the Ratnagiri men went to distances of nearly 100 miles. On the East Coast the catamaran men at times went as far as 25 miles. In his opinion, the trawler would never be a commercial success and that research should be conducted in a well-equipped sailing vessel.

Mr. Annayya, Malpe, stated that for fear of not being able to return to the shore the same day with the fish caught and for fear of the fish being spoiled, the fishermen did not go far.

Mr. Viswanath stated that if deep sea fishing was attempted and if it became a success it could only be done by capitalists. This would deprive the poor fishermen on the coast of their daily bread. He also said that the fishermen on this coast fished up to 30 to 40 fathoms deep and went up to a distance of 10 to 15 miles from the shore. They did not go beyond this distance because of fear lest they should fail to bring their catches to the shore before the fish got tainted.

Lieut.-Col. R. B. S. Sewell stated that only a very small part of the area around the Indian coasts was suitable for sea fishery by means of the present methods. Indian fishermen in their small craft rarely ventured out of sight of land. The most prolific fishing ground for trawling, however, would probably prove to be certain areas lying at a considerable distance. Such areas as the estuarine regions of the continental shelf were isolated banks, for instance, Wadge Bank and Pedro Bank; the edge of the continental shelf and the upper part of the continental slope and areas which so far as present experience went, would prove to be the most prolific from the point of view of fish-supply and fishing in such areas could only be done by trawlers or similar crafts. With regard to the question of finance, Col. Sewell observed as follows:—

"There seems little doubt from the experience of trawlers that have been working round India and those working in other countries that trawling will be a reasonably profitable undertaking. Even in scientific circles, the view has somehow or other gained ground that tropical waters, such as those of India are unprolific, and that the catches that a trawler can make would be small in comparison with those made by trawlers working in sub-tropical or temperate areas. This view, I believe, to be entirely unfounded and the average catch of the trawlers that have been engaged round India and Ceylon coasts for experimental work compared quite favourably with the catches made by trawlers working on a commercial basis in some of the most prolific regions round the coasts of Europe and elsewhere."

Rao Bahadur Cruz Fernandez stated that the general opinion in regard to deep sea fishing was that the attempt was a thorough failure and that the trawler purchased by the department had not answered the purpose and its work had not been as efficient as anticipated.

In reply to questions 17 to 42, Dr. B. Sundara Raj stated as follows:—

17. There are one steam trawler and four motor vessels, including the inspection schooner *Lady Nicholson*, besides a few canoes. One of the motor vessels *Sutherland* is disabled and is unfit for further use.

18. Yes. The motor vessels *Leverett*, *Sea Scout* and *Pearl* are maintained for towage of chank canoes to and from Tinnevelly and Ramnad districts and for the control and supervision of the fishing operations, such as the return of undersized chanks while still alive to the sea, the systematic fishing of chank beds and the prevention of over-fishing of banks, the safeguard of left-handed chanks whenever they are fished and the safe landing and storage of chank shells and so forth. During the pearl fisheries, they subserve a similar function and patrol the pearl banks and pearling operations. The inspection schooner *Lady Nicholson* is the only schooner that provides accommodation to inspecting officers for the periodic inspection, annual or biennial, of pearl banks and chank beds, for buoying the beds for fishing and for other scientific work connected with inspections.

19. No reduction in the number of vessels and boats is immediately possible. When, however, the trawler *Lady Goschen* is equipped with a laboratory and cabins, it might be possible to use her in the place of *Lady Nicholson*, provided the *Lady Goschen* could spare the time amidst her varied duties.

20. No.

21. Does not arise.

22. In April 1926.

23. She remained at Pamban where she had been sent in May 1926, for safe anchorage till October 1926. As she had insufficient crew and incomplete gear, she could not go to sea. The fishing gear supplied by the Stores department in England was inadequate and the full equipment was obtained only in November 1926. A minimum crew was sanctioned by Government on 21st December 1926. Considerable difficulty was experienced in procuring qualified hands as none of the ports in South India including Madras, Tuticorin and Cochin are ports of call for ocean-going steamers and no arrangements, therefore, exist for recruiting crew for continued work at sea at any of these ports. A crew, however, was tentatively entertained before January 1927 and the trawler was able to leave for the West Coast with schooners laden with 13,000 maunds of salt on 12th January 1927. The engine crew struck work at Calicut and the vessel had to lie idle for a week on this score. She conducted a preliminary survey of the off-shore fishing grounds at Calicut and a night's trawling on 24th January 1927. On her way back to Tuticorin on 28th January 1927, a few

of the boiler tubes burst. She could neither be used for salt transport nor for the pearl fishery which was then about to begin. The vessel was, therefore, ordered to proceed immediately to Colombo to have her boiler surveyed by a competent authority and to obtain estimates for repairs. The surveyor to the Lloyd's Registry of Shipping, Colombo, after examining the boiler tubes condemned all the boiler tubes (178 in number) as unsafe and wanted that these should be replaced by new tubes. The trawler returned to Tuticorin after repairs on 26th March 1927, and was engaged on pearl fishery work from that date to 30th April 1927. After the pearl fishery, the trawler went to Colombo for docking and coaling on 7th May 1927. As the South-West Monsoon had commenced she was ordered to come to Madras, for deep sea fishing experiments. She arrived in Madras on 26th May 1927. The set of otter boards supplied with the trawler having proved unserviceable in the fishing experiments off Calicut, a new set of otter boards had to be manufactured locally.

The crew entertained at Tuticorin proved most unsatisfactory and had to be dispensed with and new crew entertained about six times in the course of the last 14 months since the trawler arrived in India. A suitable Bombay crew was entertained for the engine room. Deep sea fishing experiments off the Coast of Madras commenced in September 1927. After a few experiments the trawler had to go to Colombo as the Deputy Port Conservator, Madras, reported that the weather was unsafe for the trawler to remain at Madras. In November 1927, serious work commenced. The extensive submarine plateau of some 40,000 square miles in extent, off Cape Comorin, being the best known deep sea fishing ground, was first taken up for systematic examination. A preliminary survey has been made and the nature of the bottom so far ascertained has been mapped. The places where abundant fish were caught have been noted. The obstructions and dangers to trawl nets have been charted in the maps prepared. Simultaneously with experiments in deep sea fishing, the trawler has been making observations and collections and noting data regarding temperature, salinity, plankton and bottom organisms. The trawler has been sent to the Royal Indian Marine Dockyard, Bombay, for alterations.

24. The original purposes for which the trawler was purchased are—

(1) Exploitation of deep sea fishing grounds and organized fishery research.

(2) Pearl bank inspection and the many duties connected with the conduct of pearl fisheries.

(3) Economic salt transport.

From the detailed work of trawler referred to in the answer to question 23, it will be seen that its work has been consistent with the original purpose for which it was purchased. The main purpose is deep sea fishing experiments and research and during her long shore trip which the trawler has to make in this connexion, she is utilized for towing schooners laden with salt to West Coast.

25. (*a*) From January 1927 to March 1928, six long shore cruises for fishery research occupying 35 days, she also transported salt.

(*b*) She was engaged for about a month in pearl fisheries in March–April 1927.

(*c*) On pearl fishery research she was engaged since March 1928, for about 8 weeks. The rest of her time has been devoted to trawling experiments.

26. No. All the scientific observations so far as they relate to specific stations opposite ports could be carried out simultaneously with deep sea fishing experiments. But the scientific investigations, particularly the hydrographical and meteorological data, should also be gathered along a series of observations taken from south to north or *vice versa*, i.e., along shore, for the coast as a whole, if tangible results are to be obtained within a reasonable time. The more numerous such long shore trips are, the more conclusive will be the results obtained from such data as they are not peculiar to any particular spot but are general to the whole Coast. Such trips will have to be carried out independent of trawling and deep sea fishing, as the latter must be systematically done and proceeded with, step by step, according to the nature of the bottom to be investigated. At present, such long shore journeys are performed once a fortnight and they are combined with the journeys that the trawler makes for obtaining coal and water every 24 days or so to Colombo. According to the programme approved by Government, the trawler goes to Colombo ten times in a year for coal and water and during the intervening periods she makes biological and hydrographical collections and observations throughout the length of the Coast and transports salt to the West Coast. The extra five trips which the trawler makes are also advantageously combined with the transport of salt from Tuticorin. From the above, it will be seen that the original purpose was not in any way defeated by the trawler being used for other purposes.

27. Yes. But she will require to be remodelled and equipped. Though she is said to have been remodelled to suit tropical conditions, the cabins are too hot for any one to live in. New cabins for officers and crew are necessary. A laboratory for fisheries research must be fitted up on board. Her boiler though certified and passed by the Stores department proved defective. Several boiler tubes burst on her maiden voyage to West Coast. The surveyor to the Lloyd's Registry of Shipping, Colombo, after

examining the boiler condemned all the boiler tubes (178 in number) as unsafe. They were replaced at a cost of Rs. 8,000. Even so, the boiler is not absolutely sound and causes difficulties now and then. The trawl gear supplied by the Stores department was also defective. The boards were too light and small and would not sink. Other equipments such as a fleet of drift nets, long lines and American Purse nets will be obtained as work develops.

28. Please see answer to question 27. The necessary apparatus for research has been purchased, but could not be fitted on board the trawler for want of a laboratory room.

29. Both technological and scientific work is expected of the trawler.

30. Captain Cribb is the expert officer entertained, vide reply to question 5, Research Section, Fishing and Sailing expert. The European crew entertained were disbanded immediately on arrival in India, in April 1926. A suitable full complement of Indian crew was sanctioned by Government in December 1926, but could not be entertained till October 1927, for reasons stated in my answer to question 23 *supra*. Captain Cribb has been trying to secure a capable, intelligent and educated young man among the sea-faring classes as mate on board the *Lady Goschen* and to train him in trawling, Danish seine netting and other methods as well as in net-mending, etc. He has tried several, but has not found one who is either capable or interested. The usual type of seamen who obtain the Master certificate are elderly men who have put in a long series of years at sea but lack intelligence and general education. Besides, they consider themselves officers as soon as they obtain such a certificate and are reluctant to study fishing or any other new profession. Recently, it has been proposed to train an Inspector of the department with practical experience of the sea for the post, vide answer to question 35 *infra*.

31. Captain Cribb was employed as Assistant Director (Marine) on and from 13th March 1926.

32. Two years and three months.

33. He has navigated the trawler on all her cruises and has conducted trawling, dredging of pearl banks and the transport of salt.

34. Owing to the difficulty in obtaining suitable crew it cannot be stated that necessary assistance was offered to Captain Cribb. The mates appointed were all men with no aptitude for learning work.

35. One of the Inspectors, M.R.Ry. Ramaswami Nayudu, who is a local graduate in Zoology, was appointed Inspector on board the trawler with a view to carry out biological research and incidentally study trawling and fishing methods. The arrangement has failed to achieve the expected result. While the

Inspector has done the biological work as far as he was able to do, he has not been able to adapt himself to the life of sea or to learn anything of the fishing methods. It is evident that the two functions (technological and scientific) must be separated. I have proposed that an officer with aptitude for navigation and seamanship should be deputed for training to Bombay on board the I.M.M.T.S. *Dufferin*. An Assistant Biologist will be stationed on board the trawler for carrying out scientific research.

36. The expenditure for 1926–27 was Rs. 65,671. The budget estimate for 1928–29 is Rs. 1,30,600. If the trawler was engaged throughout, her expenditure will work up to the budget estimate.

37. Various Governments in India, Ceylon, Burma and Straits Settlements have attempted deep sea fishing. The investigations of *Golden Crown* in Bengal, *William Carrick* in Bombay and recently *The Violet* and *Nautilus* in Ceylon have proved the existence of deep sea fishing grounds which yield fairly abundant catches comparable to those of the best fishing grounds of Europe. The few experiments conducted by the *Lady Goschen* have confirmed these reports.

38. The local fishermen fish the inshore belt extending to five or six miles from the Coast irrespective of depth.

39. They do not go beyond that line for the following reasons :—

(1) Food and water cannot conveniently be taken especially on the catamarans or canoes ;

(2) the exposure and confinement in catamaran and dug-out canoes cannot be borne long ;

(3) much of the work has to be done by rowing or paddling ;

(4) in this climate fish can nowhere and at no season remain in good condition for more than a few hours after death ; and

(5) no cheap or simple methods are known or at least practised for the proper treatment or preservation of the fish from taint.

40. It is the distance that prevents them.

41. On fishing cruises she has fished banks as much as 38 miles from shore off Cape Comorin.

42. The trawler, if it strikes suitable fishing banks, is expected to catch on the average about a ton of fish a day.

SECTION V.—FISH-CURING YARDS.

Messrs. Venkataratnam and Satya Raju stated that they had no fish-curing yards on their Coast. Naupada Penuguduru and Managanapudi were some of the fishing villages along the Coast. They now purchase salt at 12 annas per maund, but would gladly

purchase salt from the Government if they could get it at quarter-anna per pound. They wanted that Government should help them by establishing fish-curing yards.

Dr. B. S. Mallayya stated, that, after the Fisheries department took over the fish-curing yards, some improvements were effected by replacing the briny ponds and the dirty floors with cement structures and the like. But he did not know whether the Department had made arrangements for the removal of entrails of the fish and other things outside the area immediately. In his opinion, the District Health Officer would be a better person than a Specialist in fish-curing to supervise the sanitation of these areas and he must be held responsible for their sanitary condition. He suggested putting up manufactories and running them by Government, but wanted that the Fishing (Mogear) community on the West Coast should be encouraged and helped to get employment as it would be to the good of that community as well as to the trade if individuals of that community alone were employed in that trade. He said that women did not now frequent fish-curing yards, but if they were encouraged to do this work, labour would be cheaper and work would be provided for these women who are, at present, idling away at home or tempted to take away the fish to their own homes and do the curing there which would mean insanitation in the whole village.

Diwan Bahadur Arogyaswami Mudaliyar stated that the reduction of issue price would benefit the consumer, middlemen and the curer. The curer was, at present, rather at a disadvantage inasmuch as he had to come in and pay any price that was charged for salt as otherwise the fish would be spoiled. If the issue price was reduced, it would result in cheapening the salt fish, in increasing inland and export trade and thus enabling us to compete more favourably in Ceylon markets. He stated that the establishment of more fish-curing yards would depend upon the demand. There was the difficulty of transporting salt. The fishermen lived in places which were inaccessible. There was not even a bandy in many of those places and rivers and vast expanse of sandy areas had to be crossed. Personally, he could not see any obvious difficulty in manufacturing as good salt on the West Coast as on the East.

Mr. Gopala Menon stated that the results of the transfer of the control of the fish-curing yards to the Fisheries department had not fully justified expectations. The administrative rigidity had no appreciable change and the expenses the curers had to incur under the guise of introducing improved methods of curing were heavy without any corresponding improvement in the general turn-out of the cured products. He said that, so long as the curers were in their present impecunious state, no improvement was possible, that curing sheds on improved lines and the plants required for the same should be put up at State expense, the cost

being reimbursed in long terms by means of a small cess on each maund of salt sold. He wanted that the restrictions with regard to weighment of fish into the yard should be regulated to avoid delay in salting and consequential putrefaction and that methods said to be existing in the Bombay fish-curing yards might be tried. In his opinion, the existing rate of issue price of salt should be materially reduced and the rate should include the factory cost price and transport charges and other incidental expenses. For an efficient supply of salt to the yards, so as to relieve all anxiety of depletion of stock during the season of heavy catches, he suggested the revival of the local storage system which was in existence years ago.

Mr. T. V. Subba Rao Nayudu remarked that fish-curing yards in this Presidency were not kept under the same conditions as in other civilized countries and suggested that one on the West Coast and another on the East Coast should be constructed on the same lines as yards in foreign countries, at least on a small scale, to begin with. Standard designs of curing yards with modern equipment should be made available and the working of such yards should be demonstrated to the public. Private enterprise should be encouraged to take up the work with loans from Government, at a small rate of interest.

Mr. Roche Victoria said that these yards should be treated as model curing stations and better methods of curing should be demonstrated. He was of opinion that the issue price of salt should be reduced to 10 annas as before and if, by that, the department lost, they should face it, at least for the sake of giving an impetus to the fish-curing industry which would promote the material prosperity of the fishermen.

Mr. P. Lakshmanaswami stated that it was not necessary that Government themselves should build fish-curing yards. If the methods and sanitary conditions insisted upon were demonstrated the fishermen themselves would construct them and use them. But the Government should advance the necessary funds on condition of recovering the same in ten yearly instalments. Salt should be supplied at half the present rate.

Mr. Samuel was of opinion that, since the establishment of the fish-curing yards, the quality of dried fish has greatly improved.

Mr. M. C. Govindan stated that the treatment accorded to the fishermen, in the fish-curing yards, was better now than under the Salt department. The Fisheries department should demonstrate the results of their experiments on the several kinds of fish treated in the yard so that the curers might follow their methods and be able to market their fish. At present, the fishermen were following their old methods. No improved methods were taught to them. They required 1 lb. of salt for 6 lb. of fish. He observed that, if the issue price of salt was reduced, it would go far to

relieve the poverty and suffering of the fisher-folk. He suggested that there should be a sort of advisory board to settle any differences that might arise between the curers and the officers, just as there were non-official visitors in the case of Jails. He agreed that it would be an advantage to have a body of visitors for a number of yards, so that they might know what took place in different yards, confer together and compare notes. To his mind, the sheds were no doubt cleaner and more neat-looking, but the processes of salting and curing were the same old methods.

Mr. J. A. Fernandez said he would suggest the appointment of a curing demonstrator trained in the fishing industry on the West Coast, who should visit all the yards and frequently demonstrate by means of magic lanterns, films, etc., improved and hygienic methods of curing. He saw no reason for reducing the price below the charges of transport and production. If the fisher-class got salt, free of duty, that would be a sufficient encouragement to the fishing industry. Reduction below transport charges would otherwise mean a bounty which he considered as artificial and unnecessary. He advocated the establishment of more yards and a relaxation of the existing rules, care of course being exercised that no duty-free salt passed into consumption. In his opinion, the cost of effecting improvements in curing methods should be met by Government as it practically means fishery education.

Mr. S. T. Moses was for opening more fish-curing yards. He said that the staff manning the yards should be trained, and curers and their men, etc., should be taught improved methods. The latter, he suggested, might be done by "demonstration peripatetic schools." In his opinion, the hygienic conditions and methods of curing were satisfactory in a fish-curing yard, except when the catches were too large and the staff insufficient for proper supervision.

Mr. M. P. Krishnan said that no new methods of curing had yet been demonstrated to the fish-curers. He suggested the following improvements :—

(1) Pucca curing sheds with better floor.

(2) With a view to carrying away the old brine directly into the sea, a proper drain should be devised.

(3) There should be a better supply of water within the fish-curing yards.

(4) Tickets should be given to actual fishermen.

(5) Fish-drying rooms should be provided at all the important fishing centres. He said that it would be good if the yards could be managed directly under the Government of India, in which case certain high appointments of fishery officers could be dispensed with. He said that the maintenance of the fish-curing yards could be cheapened, by placing their management under the Government of India or under the Co-operative department.

Mr. Subbayya Bhat stated that, in some of the fish-curing yards he had visited, he found none of the improved methods advocated by the Fisheries department adopted by the curers, but remodelled sheds with masonry tubs and cemented floor were however constructed in most of them.

Mr. R. Suryanarayana Rao said that it was possible to popularize hygienic methods of curing to a great extent by considering and giving effect to the following suggestions :—

(1) Construction of platforms at Government expense for drying salted fish ;

(2) regular and adequate supply of salt ;

(3) supply of salt at cheaper rates as was done some years ago by (*a*) providing better and cheaper transport facilities, and (*b*) not including in the price of salt, the cost of establishment and of sheds constructed either for curing or storage of salt ;

(4) constructing one demonstration shed in each yard ;

(5) allowing for wastage of salt ; and

(6) not collecting overtime charges from the curers.

In his opinion, if the issue price of salt was reduced, both fishermen and the consumer would be benefited and more fish converted into human food. He was for reducing the issue price to the old rate of 10 annas. He said that the curers should not be asked to pay overtime fees, but such charges should be met by Government.

Mr. J. A. Saldanha said that processes other than curing by use of salt should be taught to curers. Salt should be sold much cheaper, at 10 or 12 annas per maund. Salt might be transferred much cheaper from N. Kanara than from south or east to S. Kanara. It would be advisable to transfer fish-curing yards to the Salt department for curing by means of salt. He would not press for the transfer of the control of the yards to the Salt department, if the issue price was reduced.

Rao Bahadur Govindan said that the issue price of salt should be reduced to at least 10 annas per maund which was the price fixed by the Salt department. He suggested the demand for salted fish might be met by making the price of salt cheap, reducing the rail freight, exempting the poor fisher-folk from payment of licence and other fees which the local boards were levying on them. He observed that the methods of curing were not satisfactory from the view-point of the reformer, but considering the various difficulties which the curers had to face, no more satisfactory arrangements could be expected in the near future. He said that the cost of improvements in the methods of curing would not amount to much and most of it could be recovered from the curers as a tax. He said that he had no objection to the Fisheries department managing the yards, provided there was no duplication of officers for control and other things. He was for sending a capable man from yard to yard to hold demonstrations

and allow people to copy the methods. He was of opinion that salt could be supplied from Bombay at cheaper rates by inviting tenders and giving contract for delivery on the West Coast.

Mr. Annayya stated that the Fisheries department was able to control the fishing industry more rigidly. He was of opinion that the present system of fish-curing, viz., Colombo, Ratnagiri, and local systems were cheap enough and satisfactory to the ordinary fisher-folk and that any improved methods which were likely to involve additional labour and output might not find favour with the people in the district. He advocated reduction of issue price of salt. In his opinion, the maintenance of fish-curing yards might be cheapened by keeping a limited number of people in the establishment during the period of heavy catches and an efficient peon at other times when there was less work. He said that the hygienic conditions and methods of curing were satisfactory.

Mr. M. V. Gopalan, Health Inspector, Wynaad, stated that the hygienic conditions and the methods of curing were not satisfactory. He suggested the erection of up-to-date and improved fish-curing yards with sanitary troughs which could be let out on payment of fees to fishermen and traders who might be directed to close all the private fish-curing yards and utilize only Government fish-curing yards. The use of private fish-curing yards which did not provide for an impervious floor of concrete and cement, proper flushing with chloride of lime or some other disinfectant and the quick disposal of effluent waste water should be prohibited by enforcement of laws and regulations framed for the purpose. This, he said, if done, would to a great extent prevent the insanitary conditions and public nuisance now prevailing on the Sea Coasts of Malabar in general.

Mr. M. Viswanath stated that the main consideration which led to the transfer of the fish-curing yards to the Fisheries department appeared to be the introduction of better and more scientific methods of curing. He did not know whether the transfer was justified by the results so far achieved in the matter of curing. The only improvement effected after the transfer was the introduction of cemented floor in curing sheds. He was for reduction of issue price of salt to the old standard and stated that the supply could be made by the Madras Government or the Government of India whichever Government supplied salt cheaper. He said that dried fish now sent out contained less sand.

Mr. M. Othenan stated that the main consideration that led to the transfer of the fish-curing yards to the Fisheries department was the improvement in the methods of curing fish which the department was experimenting upon, but the results so far achieved did not justify the transfer as no improvement worth the name or of any great advantage to the curers had been effected.

He characterized the raising of the issue price as a real menace to the industry and suggested that the issue price of salt should be reduced to as minimum a rate as possible. He said that the demand was likely to increase with the introduction of new methods of catching fish. The maintenance of fish-curing yards could be cheapened if the present staff is replaced by a clerk on Rs. 20—25, a peon on Rs. 10—15 and a night watchman on Rs. 10. In his opinion, the Inspectors were a superfluity as they seemed to have very little to do at the yards. He was of opinion, that the cost of improvements could be met by the levy of a small cess on the salt issued in case the price of salt was reduced.

Mr. U. Karunakara Menon stated, that the fishermen appreciated the improvements but, of course, they protested against the increased issue price of salt. In his opinion, the issue price should be reduced to annas 10 a maund. He said, that the Fisheries Department should arrange for the supply of salt to the curers, because the officers of the Fisheries Department were in closer touch with, and more sympathetic to, the fishermen than the previous ones. In his opinion, the reduction of issue price would cause more fish to be cured and the fish now used as manure would then be brought into the yards as also the large quantities of fish now privately cured with bazaar salt.

He said that the pay of the fish-curing yards establishment should be improved. The minimum pay of Inspectors should be Rs. 150, Sub-Inspectors Rs. 60—120 and Petty yard officers Rs. 25—30.

Rao Bahadur Cruz Fernandez stated that the results had justified the transfer from the Salt department. The progress in the improvement of this industry has been steady, though slow.

Mr. A. V. Achuthan was of opinion that the issue price of salt should be reduced and that Government should not aim at profit-making at all. He would be glad if steps were taken to shift the experimental station either to Calicut or Tellicherry as these places were more central and there were educated young fishermen to take advantage of the improved methods.

Mr. N. Unni said, that the price of salt must be reduced to the former rate, viz., 10 annas per maund and that the rules governing the issue of salt at the fish-curing yards must be relaxed to some extent in order to prevent corruption among yard officials. Adequate supervision must be made by higher officers to see that no *mamool* was collected by the yard officers from the curers. He suggested the following :—

(1) the appointment of a small and effective Committee consisting of officials and non-officials for the special purpose of conducting enquiry regarding the collection of *mamool* ;

(2) the hygienic condition of the yards must be improved ;

(3) there should be proper drainage to send filthy refuse water to the sea ;

(4) the department must provide for adequate lighting arrangements in the yards ;

(5) in every yard there should be a demonstration shed where a specially trained yard officer should demonstrate to the curers the improved methods of curing ;

(6) Government must see that the curers had a good market for the products of improved methods of curing or else the curers would be tempted to resort to their own old methods of curing ;

(7) an advisory board of qualified non-official fishermen must be instituted to visit yards, schools and co-operative societies of the department ; and

(8) care must be taken to see that yard officials behaved respectfully towards the women ticket-holders instead of considering them as coolies or menial servants.

Mr. Andy Sankaran said that the issue price of salt should be reduced to the rate of 10 annas per maund. The enhancement of the rate had adversely affected the dry fish industry and trade. In addition to the increased rates, the fisher-folk were compelled to pay 8 annas per bag of salt by way of *mamool*. He wanted that steps should be forthwith taken to put a stop to the *mamool* system now in vogue and thus reduce the price of salt issued to fishermen.

Mr. B. Korugappa suggested the reduction of issue price to 10 annas a maund.

Mr. K. Sundaram said that the issue price of salt was extremely high and so it was essential to reduce the price.

Mr. B. Mohanappa Thingalaya suggested the opening of a co-operative society in every hamlet having ten or more fisher families and that salt, for use in the fish-curing yards, must be supplied free of duty to the co-operative societies through the agency of the co-operative and the Fisheries departments. The salt should be distributed to the members through Panchayat members of the society and the fish thus cured should be sold collectively. If this suggestion was adopted, the annual recurring expenditure of thousands of rupees now incurred by the Government in respect of fish-curing yards in the shape of pay, travelling allowance, pension, outlay on buildings, etc., might well be avoided resulting in much saving. Fish-curing salt would then become available to fishermen at their very doors at 75 per cent less than what it is at present and the concession provided by the Government in the matter of salt benefit the very people for whom it was particularly meant. A possible objection to this system might be raised on the ground that the salt supplied free of duty might be diverted to other use, thus causing loss of salt-revenue to Government. An answer to this objection would be

that the salt supplied by the fish-curing yards was much inferior in quality to the ordinary salt, is much bitter to taste and inapplicable to purposes other than that of fish-curing. To avert the chance of such a loss, a Committee might well be appointed to consider the restrictions with which to hedge this arrangement. On this Committee, the Salt, Fisheries and Co-operative departments and the fishing community must be represented on the lines indicated by the by-laws which may be suggested by this Committee. A few experimental factories might be started and their work watched before final orders are passed on this question.

In reply to questions 43 to 60, Dr. Sundara Raj stated as follows :—

43. The issue price of salt which remained in this Presidency at 10 annas a maund until 1st April 1924, was causing huge losses to the Salt department and in the three years ending 1923–24 the loss averaged more than $1\frac{3}{4}$ lakhs per year. It was these annual losses that led the Salt department to press for the transfer of the yards to the Department of Fisheries on the bifurcation of the old Salt and Abkari department. The Government of India declined to contribute any portion of the expenditure on fish-curing yards beyond remitting the duty on the salt supplied. The Salt department, therefore, relinquished the yards as a losing concern while the Excise department was not concerned with either fish-curing or supply of salt.

Another consideration which led to the transfer was that the Fisheries department whose officers are in a position to improve the methods of curing and which is interested in the welfare of the fisher-folk, more particularly than any other department should have control over the fish-curing yards.

44. On the West Coast where the department took over its first few yards, there is no comparison between their condition before and after it assumed control. The fisheries officers in charge of the Government fish-curing yards are given a preliminary training at the Tanur Station and the new methods are taught by them to the curers. The innovations were bitterly opposed as the curers failed to realize why they should be put to extra expenditure in manufacture when fish sold equally well whether cured hygienically or otherwise, and there was actually a strike of curers at some of these yards. In spite of this, however, progress has been very fair. At present there are 108 fish-curing yards under the management of the Fisheries department and new yards are being established wherever there is a reasonable demand for them. As the new methods of fish-curing are slightly more expensive, wholesale reform cannot be effected except very gradually as most of the curers are extremely poor. Some of the methods which have been popularized are the provision of masonry curing sheds with

cemented washable floors and adequate ventilation, cemented salt vats with rounded bottoms and corners, adequate salting, drying of fish on raised *thatis* or platforms, thorough cleaning and disinfection of the troughs and vessels used for curing, etc. The use of dirty self-brine has been stopped. Demonstration sheds where the curing is carried on departmentally have been constructed in three yards and more will be constructed as funds permit. The curers have been taught the correct proportion in which salt is to be applied to the fish to produce the best results and prevent waste.

In many cases, the sheds and salting tanks required are constructed by Government in the first instance and the cost subsequently recovered from curers gradually by a slight addition to the price of salt purchased by them.

The methods of curing are being constantly improved as a result of continuous experiments that are being carried on at the Tanur Station in order to improve the excellence of the cured products and to increase its keeping qualities. Every doubt or difficulty and every new problem in respect of fish-curing is referred by the officers in charge of the fish-curing yards to the Tanur Station for advice or solution.

The Fisheries department since the yards came under its control has steadily followed the policy of increasing the proportion of fishermen among the ticket-holders in the fish-curing yards and such proportion is much higher to-day than before the yards were transferred to this department. Attempts have also been made to open yards exclusively for fishermen ; more than half-a-dozen are in existence now. Considerable reduction and economy have been effected in the establishment connected with fish-curing yards. The price paid for salt and rates for salt transport are less than those paid, when the yards were under the control of the Salt department. Wastage of salt is being minimised during transport. Fish-curers are getting almost the full weight of the salt that they pay for which was never the case before and corruption in fish-curing yards has been appreciably reduced.

The Government of India have recently declared that the control of the fish-curing yards by the Fisheries Department is constitutionally appropriate and administratively effective.

45. In paragraph 72 of my Annual Report for 1923–24, I stated that the department would set itself, to train the fish-curing yard staff into expert advisers in the art of curing and marketing fish and into social workers for the inculcation of thrift, co-operation and, if possible, for the dissemination of progressive ideas (new industries) that the department will be in a position to impart from time to time. Besides, with a properly trained staff

in a hundred and odd yards, situated in the most important fishing centres, it should be possible to collect statistics regarding the value and quantity of sea fish landed as well as to record observations of great scientific, and economic value to the fisheries concerned, such as the occurrence, abundance, breeding and other habits of the more important edible sea fish. As it is, full advantage could not be taken of the widespread yard staff for the furtherance of these aims. I have submitted to Government a reorganization scheme according to which the West Coast would be divided into four sections under four Inspectors and ten sub-sections each under a Sub-Inspector. The East Coast would be divided, as at present, into three sections each under one Inspector, but the northern and southern sections would each have two Sub-Inspectors and the central section one. All peons in charge of yards would be replaced by Petty Yard Officers. The additional staff would not only inspect fish-curing yards and collect fisheries statistics more efficiently than now, but would also at least on the West Coast be in charge of socio-economic work and the inspection of oil and guano factories. Such a revision of the establishment I have shown could be made without extra cost. The reorganization proposed will detach a number of men, now fixed permanently at the yards, for socio-economics and statistical purposes while securing at the same time protection of the salt revenue and a more efficient administration of the yards than at any time previously.

46 and 50. The issue price should be reduced. On the East Coast due to the immediate proximity of fish-curing yards to salt factories, there is practically no difference between the issue price of salt in yards and the bazaar price of the same salt. I found at Sathankuppam, for instance, that the bazaar price of salt is Rs. 3-4-0 a bag, and the issue price of yard being Rs. 2-8-0 per bag. There is a difference of only a few annas, hardly sufficient to induce curers to resort to the yards and submit to the regulations in force there. There are other yards where the difference is still less. In consequence the operations in the East Coast yards have materially fallen. The bazaar salt on the West Coast ranges from Rs. 4 to Rs. 4½ per bag and as the issue price of salt in the fish-curing yards is Rs. 2-8-0 a bag, the margin of difference is only about Rs. 2. To obtain this gain of Rs. 2 the ticket-holders have to subject themselves to inconveniences and restrictions and carry on curing-work in the yards under disciplinary rules. They have also to incur charges for transporting fish from the beach to the yard, pay overtime fees for night operations and also invest money on pucca masonry sheds and other incidental charges, e.g., wages of the masalchi, charges for removing old brine, etc. Compared with this, a saving of Rs. 2 per bag may be a negligible item from their point of view. Against this, there is the advantage of getting white salt in the yards which they usually prefer, but in places

where there are no fish-curing yards or when it is inconvenient to resort to such yards, large quantities of fish are cured with Bombay salt. They may also get down if they like white salt from Madras or Tuticorin as was done a few years ago when the Tanur ticket-holders went on strike, and be free of all restrictions. There will be a considerable fall in the curing operations in the yard. It is also likely that the whole industry will be monopolized by a few capitalist merchants who have ready money. The poor curers will have either to quit the yards or resign their tickets in favour of these merchants as they have little or no capital and their margin of profit will be comparatively small. The result will be that the actual fishermen will be victimised. The doubling of issue price was proposed at a time when the duty on salt had been doubled. The duty on salt is now Rs. 1-4-0 per maund and if the issue price be not reduced the effect will sooner or later be to nullify in a great measure the grant of the concession by the Government of India to the fish-curing industry. The position is really worse than even this. With the economic working of the yards under the Fisheries Department, the receipts have during the last three years exceeded expenditure after debiting all conceivable items of expenditure including pensionary charges. In other words, the local Government profits at the expense of the curer, though it is to the latter that the Government of India granted the concession of duty-free salt. Prior to 1924–25, the Government of India not only remitted the duty on salt but contributed a moiety of the charges relating to fish-curing yards, the other half being borne by the local Government. When Fisheries became a transferred subject, the Government of India agreed to forego the duty on salt amounting to Rs. 3,25,000 but declined to contribute their share of the charges towards the upkeep of the yards amounting to about Rs. 68,000 (net expenditure). On this, the Madras Government doubled the issue price with a view to recouping not only the contribution made by the Central Government, but also the share borne by themselves (Rs. 69,192) and as I have said before they have been by this method actually making profits. The position is therefore anomalous. The Government of India contribute over Rs. 3 lakhs to the industry and though it is a provincial concern the Madras Government are refusing to contribute anything for the promotion of the industry but have been incidentally making small profits. If the issue price of salt is not reduced, the curers will be driven to illicit methods of obtaining it cheaply and instances are not wanting to show that, when the price of salt increases, salt crimes also increase correspondingly. The curer will seek to compensate himself, for the loss sustained by the dearness of salt, by manufacturing and selling fish of inferior quality and he will try his utmost to cheapen his production naturally at the sacrifice of quality and hygiene. The demand for cured fish is at a certain price and, if that price is enhanced by an increase in the cost of salt, either the price of cured fish will

have to be raised or the increase in the price of salt will have to be counterbalanced by a reduction in the cost of fish supplied at the yard. In either case the fishermen, whether they cure the fish themselves or supply fish for curing to merchants, will be eventually hit.

These are the considerations which should, in my opinion, induce the Government to lower the price of the salt.

47. Yes. By means of transport of salt by trawler. The transport of salt by the trawler is cheaper than the cheapest rates for the transport of salt by schooners through a contractor. Expeditious transport by the trawler saves the entire railway transport which, on an average, amounts to Rs. 38,000 a year. It will reduce by Rs. 10,000 or more the subsidiary transport of salt from ports of call to different fish-curing yards which cost on an average Rs. 20,000 a year. It will prevent the fall in revenue amounting to about Rs. 8,000 by the depletion of stock of salt due to consignments in sailing vessels failing to reach the yards in time and it will altogether eliminate the heavy wastage and loss of salt that always result in transport by schooners. Almost every season, one or more schooners have been sunk in salt transport. On the whole, if the entire transport be undertaken by the trawler, it will result in a saving of about half-a-lakh of rupees in the transport charges now incurred.

48. The Madras Government. The Government of India have stated that there is no justification for transferring the control of the fish-curing yards in the Madras Presidency to the Central Government and have declared that the present arrangement is constitutionally appropriate and administratively effective.

49. The fishermen curers who are 62 per cent of the ticket-holders in the West Coast yards and almost cent per cent in the East Coast yards will benefit appreciably even if they do not obtain the sole or entire profits and have to share it with the middlemen. The market price of cured fish is governed not only by local produce, but by outside competitions as well. A concession to the local curer of the Presidency is not likely, therefore, to appreciably affect the market price to the benefit of the consumer.

51. The quantity of fish salted in the public fish-curing yards in the Presidency during the year 1926–27 was 692,079 maunds. To this should be added a considerable quantity of fish cured privately with bazaar salt for which no statistics are available.

52. There is demand for more. The year 1926–27 was a very poor year. In 1920–21 which was a bumper year, the quantity of salted fish removed from the yards was 10 lakhs of maunds.

53. I would suggest that more fish-curing yards be opened in the Presidency to suit requirements of the curing industry. The improvement in fishing methods is bound to result in larger catches which in its turn will enhance the quantity of fish cured and a greater number of fish-curing yards will ultimately be necessary to deal with the catches.

54. Please refer to paragraphs 127, 128, 129, 130 and 131 of my Annual Report for 1924–25. In addition, I have proposed that large storage sheds should be constructed in most of the yards on the West Coast to enable at least a year's requirements of salt to be stored. This will avoid the necessity for inter-yard and supplemental transport which is always expensive and in addition often causes inconvenience to the curers and cessation of curing operations when catches are heavy. At present, there is no accommodation in some fish-curing yards for the full or even a reasonable quantity of salt required by these yards. Consequently, frequent transport of salt has to be done if the yards are not to be starved of salt. The resulting expenditure on transport and the fall in revenue through want of salt on occasions in the yards is appreciable.

55. In no country, institutions like the fish-curing yards in India seem to exist. Fish-curing is an ancient and thriving industry in many countries, but are conducted under private management. The quality of cured fish differs according to the taste of the consumers and the requirements of the markets. On the whole, however, fish cured in Western countries and in Japan are far cleaner and more hygienic than fish cured in India which in consequence is not acceptable to markets in Europe, America, Australia and even Egypt and Palestine.

56, 57 and 58. Sir F. A. Nicholson's early experiments at Tanur and efforts of the department ever since have been directed towards the discovery of the most hygienic methods of curing fish under tropical conditions with a view to their introduction into the trade. The result of years of research and experiment in the technology of fish-curing at Tanur would have remained unused, but for the fact that the department gained possession of the yards and has pushed reforms in the fish-curing industry by demonstration, instruction and persuasion. Considerable improvement in the quality of fish cured has already resulted. The process however is slow as the fishermen and the consumer are alike conservative and ignorant. The fisherman is too poor to adopt reforms wholesale and the only incentive for the curer to adopt improved methods is the inducement offered by the remission of tax on salt. Further concessions may be necessary if appreciable progress is to be made. The East Coast curer for instance, often an impecunious fisherwoman, deals in such small quantities of fish that to enforce the purchase of even sanitary glazed pots costing Rs. 3 to Rs. 5 will

prove an unbearable financial burden to be recouped only after many years. On the East Coast, specially additional inducements in the form of bounties are necessary for the introduction of reforms.

59. The improvements are bound to be gradual and a bounty amounting to some Rs. 15,000 or Rs. 20,000 a year, at about Rs. 5 per curer, will have to be given for a period of 5 or 10 years so as to enable each curer to repair his curing utensils. This will be the first measure of reforms.

60. By Government.

SECTION VI.—FISHERIES CANNERY, CHALIYAM.

Mr. Arogyaswami Mudaliyar stated, that if the canning industry was to prove a profitable concern and to successfully stand competition, a protective tax should be levied. He was of opinion that the cannery should be continued for the following reasons :—

(*i*) there were several problems connected with canning which still awaited solution, e.g., hard bones ; and

(*ii*) the cannery should serve as a training centre.

Mr. Gopala Menon attributed the closing of the Malabar canneries to the following reasons :—

(1) the Manager who knew all about the business became too old and retired ;

(2) the prices which were about Rs. 90 during War time came down to Rs. 15 immediately after the armistice and this necessitated closing ; and

(3) they had a large stock and so lost heavily.

He was of opinion that the manufacture at the Cannery should be continued in order to educate the private canner.

Mr. T. K. Rajaram Rao stated that it was not unlikely that, with improved recipes, the Indian Cannery may be able to fight out the foreign product ; but some sort of protection was needed.

Mr. M. P. Krishnan suggested reduction of price, more extensive advertisement and preparation of the stuff to suit Indian taste.

Dr. Suryanarayana Rao suggested that the question of transferring the Cannery to the Industries department might be considered and that research relating to canning might be carried on at any Research Station. He was for making provision for regular training of apprentices.

Mr. J. A. Saldanha said that the Chaliyam Cannery should be revived and canning should be taught in more centres than one. He remarked that Chaliyam was not a convenient place for apprentices to board and lodge.

Mr. Govindan was of opinion that, both from the technological and business point of view, the Cannery had proved a failure. According to him the reasons for canned fish from Malabar not finding a ready market in competition with imported canned fish were as follow :—

(1) deterioration in quality ;

(2) the increased cost of production due to creation of posts carrying high pay ; and

(3) the inability of the Cannery products to compete with the imported goods which were sold at a comparatively cheap price.

Mr. Viswanath stated that, in Malabar, canned fish did not find a ready market in competition with imported canned fish ; it was because of the higher price of the Malabar stuff and its inferior quality.

Mr. M. Ramaswami Nayudu stated, that the Cannery had failed because the business side had been neglected. He recommended wider advertisement and under-selling of the goods so that a market for the goods could be created.

Rao Bahadur Cruz Fernandez said that the reason for canned fish from Malabar not finding a ready market in competition with imported canned fish, was that the consumers were mostly Europeans who preferred home-made tins to local products, however much the department might claim that the quality of the goods canned locally was equal to similar European products.

Mr. A. V. Achuthan wanted that Government should extend the scope of the Cannery, in order to enable enterprising men to come forward and take to canning as an industry.

According to Mr. M. C. Madhavan the reasons for canned fish from Malabar not finding a ready market in competition with imported canned fish were—

(1) imported canned fish was available in all markets at cheaper rates than canned fish from the Chaliyam Cannery ;

(2) the size of the tins manufactured by the Government Cannery was not the size which found a ready sale in the markets ;

(3) the labels used by Government Cannery were not at all attractive to the customers ; and

(4) want of sufficient advertisement.

He said that the Government Cannery was not in a position to reduce the price of canned fish because of the costly oil and tin plates obtained through the Director-General of Stores.

For improving the sale of canned fish, he suggested that Government should bring down the sale price as low as possible to begin with, and enhance it gradually after a few years when it was found that Government Canned fish was in greater demand everywhere.

In reply to questions 62 to 69, Dr. B. Sundara Raj stated as follows :—

62. The immediate object of the Cannery was to demonstrate the possibility of canning fish in India so as to produce an article which could rival Western products in delicacy of flavour and keeping quality. This was successfully achieved by the Cannery. It was also proved that a number of other fishes and prawns could be advantageously canned. A large number of new recipes were discovered and adopted.

Owing to accumulated stock after the war, the cannery suspended operations in 1925. Almost the whole stock has since been sold in Burma. Proposals for working the Cannery as a commercial concern on remunerative lines are before Government. I have pointed out that an attempt to run the Cannery as a business concern was made since 1924, during the first year 1924–25 as a fully working concern and during 1925–26 with the manufacture suspended and that two years and a few months were too brief to decide the commercial possibilities of the fish-canning industry, especially as this industry took nearly eleven years to be established in an advanced Western country like America with its industrial resources and facilities. Besides, the extremely short time, hardly three years, allowed to the Chaliyam Cannery to prove its commercial possibilities, there are several other adverse factors that have operated against its financial success in the past :—

(1) In estimating the financial condition of the Cannery as a commercial concern, the whole of the capital expenditure on plant, buildings, etc., which necessarily during its experimental stage was heavy, as is the case with all pioneer work, had been taken into account without any reference to the market value of the assets. In the balance-sheets of the commercial auditors, the assets of the Cannery are valued at about Rs. 1,10,728, but the real value of buildings, etc., would seem to have been about Rs. 20,000 to Rs. 30,000 when the Cannery assumed the role of commercial concern in 1924. This has obviously vitiated the accounts.

(2) The Cannery manufactured sardine tins of 7 oz. and 12 oz. and not the ordinary trade tins (viz., $3\frac{1}{2}$ oz.). The retailers all over the country demand that the cannery's tins should be of this popular size and openable by a key. For some reason the dies purchased for the cannery from the beginning, though declared by the manufacturers and the Stores department to be designed for the manufacture of tins openable by a key, have not so far stamped tins which are capable of being opened by a key. These two defects are the main reasons for the difficulty experienced in selling the old stock at the Cannery.

(3) A review of purchases made for the Cannery revealed an appalling drain on the slender resources of the concern resulting from orders placed through the Stores department of the High

Commissioner, to comply with financial codes, instead of in the cheapest markets. Dies ordered were found to be badly tempered. The tins manufactured could not be opened by a key. Rubber gaskets were inelastic or arrived in a sticky condition, both equally unserviceable. If tin plates and oil were of good quality, the price paid was so disproportionately high as to enhance the manufacturing cost above the ruling prices of tinned sardines in the market. No commercial concern, certainly not an incipient industry, could be run to commercial profit under such conditions. To cite only one instance, the Cannery paid Rs. 42 for a box of 56 tin plates, whereas a local firm quoted Rs. 20-8-0 for a box of 112 tin plates of slightly smaller size and harder quality. These plates, it is true, were not altogether suitable for our purpose, but there can be no doubt that suitable ones could have been obtained for much less than the price actually paid.

(4) One of the primary causes for the unduly high manufacturing cost of the Cannery has been the heavy overhead charges resulting from the very short number of working days, about a 100 in the best year as against 265 idle days. Unlike, for instance, a soap factory, raw material is not continuously available, but at the same time, in common with other industries requiring great skill and experience, the skilled labour of the Cannery requires to be kept from year to year and paid throughout the idle days, if the standard of its manufacture and the quality of its goods are to be maintained. The only conceivable remedy and the one resorted to by most private concerns is some bye-industry which, if it will not yield profits, may at least help to pay the skilled labour during the off-season. In a Cannery in which Government permits no interests outside tinning fish, it is difficult to provide a suitable bye-industry.

63. One of the original objects of starting the Cannery was to teach apprentices to can fish ; but, apart from giving training to a few students sent by the Travancore and Baroda Governments, no outsiders were trained possibly because suitable applicants were not available. The final batch of students from the Fisheries Training Institute annually receive their course of training here.

64. One student from Travancore and the other from Baroda are now employed as experts in the Fisheries departments under the respective Governments. I am not aware of any canneries either at Baroda or Travancore. There has been however exchange of trained hands between the Government Cannery and two or three private canneries. The recipes adopted at Chaliyam have also been widely used in the private canneries, vide page 130, Bulletin No. 10, Annual Report of Sir F. A. Nicholson for 1915–16.

65. Messrs. Wilson & Co. purchased the small Mahé Cannery and, with the aid of the experiments and experience of the Chaliyam Cannery, developed a commercial concern called the

Malabar Cannery. Another Cannery "Nanu Freres" was also started. The two private canneries started on the model of the Chaliyam Cannery had not prospered because the problems involved in the successful prosecution of the industry are complex and varied.

66. Yes. The Malabar Cannery went into liquidation and a third Cannery has been developed in its place by a local purchaser.

67. The adult Malabar sardine has harder bones and scales than the true French sardine "Pilchards." If young sardine, only a year old, be selected and tinned, the defect, is to a large extent overcome. Still, due to inadequate training of labour and want of continuous expert supervision, the highest class of sardine comparable with the French delicacy has not so far been produced. But this however does not affect the bulk of the trade in canned fish. The products of the Chaliyam Cannery have been tested from time to time by experts and approved as saleable even in England. During the British Empire Exhibition as many tins as could be sent were sold. The peculiar merit of the Chaliyam products is their delicate flavouring with condiments not available anywhere else in the world. The Cannery therefore has produced goods which can compete with the bulk of imported tins in quality. In cost, however, the high price of tin, packing oil and machinery have to a great extent prevented production at competitive prices. The difficulties are insuperable. If the Cannery could purchase at the cheapest markets and sell its products by suitable advertisements and agents, there is no reason why the price of the Chaliyam goods could not be reduced to that of imported goods.

68. Since the quality of the Chaliyam products has been approved by experts and compared very favourably with similar class of articles produced in Europe and America, there should be no difficulty in popularizing Indian canned fish, provided we are able to place them in the market at prices comparatively less than those quoted for imported tins. The most important item is cost. If Chaliyam canned goods could be offered at competitive prices they are bound to sell provided the quality is maintained. Inferior oil or bad handling and the like will destroy the most firmly established business. In order the State may set an example, I have suggested the Cannery may be worked with certain economies.

My recommendations were briefly that the Cannery should be continued as it has not yet been given a chance to prove the commercial possibilities of canning as a remunerative industry, especially as two private canneries started on the model of the Chaliyam Cannery had not prospered, because the problems involved in the successful prosecution of the industry are complex and varied. "The Malabar Canneries" have been wound up having

lost their market through the use of bad oil. "Nanu Freres" had sustained a heavy loss. If the industry successfully piloted through its initial stage by Sir F. A. Nicholson is to be established on commercial lines as a remunerative enterprise, apparently it is the duty of the State to lead the way. The Cannery has, therefore, yet to perform an important part of its work. If the Cannery is to be continued to test the commercial possibilities of the concern, I recommended that it should be worked with the following economies :—

(1) its assets should be revalued and the capital investment involved should be accurately determined for purposes of depreciation and interest ;

(2) the Cannery should manufacture tins of approved trade size already in the market ;

(3) the management of the Cannery and the Tanur research station should be combined with a view to reduce the overhead charges which at present amounts to nearly 50 per cent of the cost of manufacture ;

(4) if possible, a suitable bye-industry should be undertaken to fill up idle time at the Cannery; and

(5) the purchase of its Europe stores should be exempt from the stores purchase rules and full liberty should be given for the purchase of machinery, tin plate, etc., from the cheapest markets.

If it is decided, however, not to continue the Cannery as a commercial concern in view of the existence of two or three private concerns, its continuance is necessary as an important institution for the training of students and apprentices and officers and as a place of research. Many problems connected with canning still remain to be solved, such as the softening of hard bones and scales, determination of a suitable cheap oil for canning, and the many questions connected with the technique of canning, storage of tins in the tropics, deterioration of tinned goods, etc.

69. The figures given below show quantity and value of foreign canned fish imported into India as a whole and into the Madras Presidency for five years ending 1925–26 :—

Tinned or canned fish imported into the Madras Presidency.

	CWT.	RS.
1921–22	64	8,053
1922–23	308	20,758
1923–24	656	52,278
1924–25	1,033	72,674
1925–26	934	65,784

Tinned or canned fish imported into India.

	CWT.	RS.
1921–22	10,998	8,49,980
1922–23	30,982	18,97,303
1923–24	24,500	13,31,247
1924–25	42,762	21,37,022
1925–26	63,303	27,76,216

Owing to the caste system prevailing in India which forbids the eating of food cooked by others and the fact that tinned fish is a novelty in so far as the general population in this country is concerned, canned fish is not generally eaten by Indians ; the Europeans and Anglo-Indians are the people who consume the major part of the goods. Yet a fair number of educated classes has acquired the taste for this delicious and most wholesome fish-food.

SECTION VII.—TANUR EXPERIMENTAL STATION.

Mr. T. K. Rajaram Rao stated that all possible steps should be taken by Government in respect of intensive research and advertisement in the field of oil extraction and guano preparation, as the demand for guano was bound to be on the increase as more and more people became disillusioned of the results of higher education and the search for official preferment, and turned back to land.

Mr. M. P. Krishnan suggested that all successful experiments should be demonstrated and brought into practice in all fish-curing yards, that proper training should be given to fisher-folk and that the department must do away with the commercial aspect in the working of the station.

Mr. K. S. Bhat said that the fish cured at the Tanur Station were, in his opinion, far better in quality than those from ordinary fish-curing yards.

Mr. R. Suryanarayana Rao suggested that the manufacturing side should be separated from research work and that the station should be remodelled into a real research and teaching station equipped with a laboratory necessary for the purpose.

Rao Bahadur V. Govindan suggested the entertainment of one or two well-trained subordinates who should be deputed to visit important fishing centres and give demonstrations of some of the improved methods of fish-curing.

Mr. Gopalan said that the institution was started, as a model institution, to teach the fishermen and traders up-to-date sanitary methods of curing fish, manufacturing fish oil, fish guano and

fish meal. The experiments conducted at the station had benefited many fishermen traders and businessmen, and resulted in the improvement by owners of private fish-curing yards and factories in regard to fish-curing, oil extraction, guano preparation and manufacture of fish meal and in the adoption of model factories, barbecue and fish-curing yards.

Mr. M. Viswanath stated that the Tanur Experimental Station must be continued under an expert who should find out new and cheaper methods of curing and preserving fish fresh for export to upcountry markets. He wanted that the expert must be got down for the above purpose or one from the department or an educated fisherman who has had local knowledge of the coast must be sent at Government expense to the Imperial Fisheries Institute of Japan or other important fisheries stations to study the methods of curing and preserving fish in those parts.

Mr. M. Othenan stated that the working of the Tanur Station could be improved by the appointment of an expert and experienced man as its Manager and by shifting the station to Calicut where now the advantages of electricity were also available. He regretted that the results of the experiments carried out at the station had not been adequately published or circulated. He added that leaflets in Vernacular languages on the results of experiments, and demonstrations by the staff at the fishing villages would help the spread of the results among the people.

In reply to questions 71 to 74 (d), Dr. B. Sundara Raj stated as follows:—

71. The Tanur Station was instituted for experiment with improved methods of curing, smoking and otherwise preserving fish and with the manufacture of oil, guano and other bye-products.

72. Considerable advance has been made in the introduction of improved methods of curing, manufacture of oil, guano and fish meal.

The Tanur Station has accomplished much in determining the correct proportion of salt for curing, methods of sun-drying and the relative values of various methods of cure, including most of those adopted in England and America. Its products are far superior to those of the bazaar (*karuvad*). There is still an indefinitely large programme of work for the station.

Prior to the experiments of the department in 1908, the amount of sardine oil produced on the West Coast was inconsiderable and of the worst possible quality. The usual method was to obtain the oil by the putrefaction of a mass of sardines in a worn-out and filthy dug-out canoe. It was also a wasteful process for the proteid and other residue were thrown into the sea. Similarly, when fertilizer was made from sardine, the ancient and

accepted procedure was to spread the sardines on the sand of the open beach and so dry them in the sun. This had two drawbacks, viz., large quantities of valuable oils of no manurial value were wasted and the product became so highly impregnated with sand that analysis not infrequently showed the resultant mass to contain as much as 40 per cent of this useless adulterant. The experiments made by the department had unexampled and swift success. It was found that a simple and quite inexpensive plant could be devised to separate the oil and fertilizer effectively and profitably. The high quality of the oil and fertilizer (fish guano as it is called technically) reacted favourably upon prices and has rendered this new industry so profitable that there are now hundreds of small private factories not one of which existed before. No more striking proofs of the success of the Tanur oil and guano experiments is needed than the fact that in the 647 private oil and guano factories on the West Coast in 1922–23 the last abundant year for sardine, about 32,000 tons of guano and 12,000 tons of oil were manufactured approximating to a total value of 36 lakhs of rupees.

The crude oil which forms the bulk of that manufactured by private factories does not come up to the standard required by the arsenals, tanneries and other consuming industries. The bulk of this oil is sold to the jute mills in Bengal or to Germany for refinement, involving a loss of nearly 600 per cent in the selling price. The crude oil fetches Rs. 80 to Rs. 90 per ton during the manufacturing season. But the oil refined at Tanur was sold for Rs. 650 per ton. If Tanur ceases experiment, the arsenals and tanneries who have been induced to try the West Coast oil will be driven back to the foreign markets for their requirements to the detriment of the nascent industry on the West Coast. Refinement is thus the next step in the oil industry and a most important one if it is to be established on a sound financial basis. The refinement of oil at Tanur consists in the elimination of stearine, acidity, colour and smell. It has not hitherto been possible to remove the colour and odour entirely, but a great deal has been accomplished and investigation towards perfecting the process must continue. A moderately refined oil has been produced by the station on a commercial scale and marketed as already noted at a very high percentage of profit, but fully refined oil remains yet to be made. A further advance has been made in converting fish scrap (pressed fish) into fish meal, a valuable food for domestic animals and even for human consumption. The fertilizer or guano sells at about Rs. 80 per ton. A ton of fish meal is priced at Rs. 280. Success has been attained in producing fish meal from all the common fishes of the West Coast and comparatively cheap methods of producing the meal and sterilizing it have been evolved. The elimination of the objectionably high oil content of the meal is under investigation. When all the details in the manufacture of fish meal have been mastered, and the processes taught to

private manufacturers on the coast, it will confer considerable financial benefits on the industry.

73. In curing and preservation of fish there is a great deal to be done. The elimination of the defects, such as pink eye, rusting, salt excrescence, etc., as well as the adoption of improved methods of curing and preservation that are continually being discovered, such as the use of sodium hypochlorite, refrigeration and the new German method of pressing, instead of sun-drying and the like. There is also a good deal to investigate as regards the industrial possibilities of fish oil and its bye-products. Beyond the first comparatively simple process of expressing the oil from fish successfully copied by private producers, nothing has been done by them towards refining the oil up to the standard required by the various consuming industries or of converting the scrap (residual fish) into fish meal, a much more valuable product than guano. Refinement is the next step in the oil industry and a most important one if it is to be established on a sound financial basis. Success has been attained in producing fish meal from all the common fishes of the West Coast and comparatively cheap methods of producing the meal and sterilizing it have been evolved. The elimination of the objectionably high oil content of the meal is under investigation. These are problems that should be tackled by a Bio-chemist. For technological work at the Chaliyam Cannery and Tanur particularly as well as for other chemical investigations relating to fisheries and pisciculture, I have submitted to Government proposals for the appointment of a qualified Fisheries Chemist—vide answer to question 5 *supra*.

74. (*a*) A few fish merchants have adopted the improved methods of cure. As the taste of the public has not correspondingly changed, the average fish-curer has been reluctant to adopt better methods which are somewhat costly as better cured fish do not bring him increased profits. State aid was essential for the introduction of improvements ascertained at Tanur into the curing industry. As purveyors of duty-free salt in the fish-curing yards reforms have been pushed and notable improvement in the cleanliness of the products of these yards in the West Coast has been effected. The work in the East Coast yards commenced only three years ago and reforms are even more difficult here than on the West Coast on account of the extreme poverty of the East Coast curers who are for the most part fisherwomen —vide answer to question 58. Some additional bounty is necessary to enable the East Coast curer to acquire improved utensils for curing fish and this is the first step in the introduction of reforms.

(*d*) The preparation of fish meal is a further step in the oil and guano industry which was taken recently at Tanur. The process has not yet been perfected. Consequently, no private factory owner on the West Coast has yet been taught.

SECTION VIII.—INLAND FISHERIES.

Diwan Bahadur Arogyaswami Mudaliyar stated that it was possible to increase inland fish-supply and pointed out that, with the co-operation of the village establishment and a small staff, the stocking and preservation of fish could be attended to. He said he was for improving inland fisheries not so much for revenue purposes as for fish-food purposes.

Dr. Natesa Mudaliyar said that inland fisheries were still in their infant stage and suggested that there ought to be as many farms as possible all over the Presidency wherever water facilities existed.

Mr. S. T. Moses suggested that one or more permanent training institutes for fitting the staff for their work with well-equipped laboratories, etc., and a competent staff should be established.

Mr. J. A. Saldanha urged that the inland fisheries should be developed largely and that larvicidal fish should be fostered in all lakes.

Rao Bahadur Govindan pointed out that the methods adopted by the department for the introduction of new and rapidly growing fish should be simple and inexpensive to create confidence in the public. He was of opinion that fish farms should be started only in places with a perennial source of water-supply which could be utilized for growing fish without having recourse to expensive methods, such as pumping, etc.

Mr. Othenan reported that the department had not done anything in the matter of inland fishing on the West Coast even in rivers which abound with many varieties of fish.

In reply to questions 75 to 96, Dr. B. Sundara Raj stated as follows:—

75. The remedial measures adopted by the department consist of the following:—

(1) Establishment of hatcheries for the artificial hatching and breeding of such local fish as were subject to depletion (e.g., Hilsa) and of non-indigenous fish considered more suitable for improving the existing fishery (e.g., Trout).

(2) The construction of fish farms at suitable centres primarily for the breeding of the chief food-fish in natural ponds and, where necessary, by hatching appliances for ultimate distribution in tanks and rivers.

(3) The stocking of tanks and rivers, the fishery rights of which belong to Government, with suitable quick-growing species of food-fish carefully selected from natural sources, such as anicuts, rivers and the like.

(4) Importation into the country of well-known fresh water food-fish of reputation from other parts of the world and their acclimatization with a view ultimately to naturalising them in the waters of the Presidency.

(5) The conversion of natural breeding places and the formation of sanctuaries for the protection of fish, e.g., the upper reaches of the Bhavani River in the Coimbatore and Malabar districts.

(6) The framing of rules under the Fisheries Act for the prevention of destructive methods of capture in public waters.

(7) Experiments in improving the existing methods of catching fish in inland waters.

The object of the work is the development of the fisheries in inland waters by protection, stocking and culture. Unlike sea fisheries, where more extensive exploitation is required, in the case of inland fisheries the chief need is the prevention of blind destructive methods of fishing and the increase and improvement of stock by fish farming. The only principle adopted by the local fishermen is to catch and destroy all fish down to the last tadpole. The adoption of piscicultural methods, fish stocking and rearing and the introduction of improved methods for the continuous fishing of deep permanent water tanks and rivers, now wholly unworked, will add enormously to the productivity of our rivers, tanks, ponds and wells.

On a rough estimate, these fisheries are capable of yielding 502,500 tons of food-fish when properly developed, but it is certain that under present conditions, only a small part of this is actually produced. Further, the fisheries in most of the tanks and rivers belong to the Crown and this is an additional reason why Government should undertake their development. Mr. Wilson, a practical fish-culturist, was entertained in November 1907, to investigate the propagation of trout on the Nilgiris. Trout have since been established on the Nilgiri plateau through the medium of a trout hatchery at Avalanche. He took up investigations on the plains from 1907. Four fish farms were established as a result of his labours—

One at Sunkesula in 1909.
One at Ippur in 1914.
One at the Powder Factory, Perambur, Madras, in 1915.
One at Praema in 1916–17.

Three others were started in continuation of his work:

One at Vellore in 1922.
One at Mopad—1927.
One at Chingleput—under construction.

The purpose of the fish farms is to study the spawning, growth, food, etc., of different species of exotic and indigenous fresh water fish and breed large numbers of improved kinds in captivity

for stocking canals and tanks. The fisheries of tanks and rivers were assigned to district boards some years ago, but these local bodies did nothing to improve them. The Fisheries Department has initiated a scheme whereby irrigation tanks and other inland waters are surveyed, district by district, and those found suitable are arranged in groups round fish farms and centres where fish breeding and rearing are carried on and whence each year fry of good varieties are distributed in large numbers to reinforce the natural stock in surrounding tanks. The fish rents from tanks and rivers were assigned to district boards years ago as a source of revenue, but the boards did nothing to effect improvements. The fishing rights and revenues in these tanks are being reacquired gradually by Government, compensation being given to the district boards on the average of the previous five years' rents. The fresh-water fisheries administered by the department yield a handsome profit to Government deducting all charges, including compensation paid to the district boards, which is in itself an indication that the Fisheries Department has succeeded where the district boards necessarily failed through lack of expert knowledge.

The Retrenchment Committee and subsequently other critics have assigned the increase in fish rents to a general increase in prices all round and not to piscicultural operations. This doubt is eliminated in the case of the Chingleput and Nellore district tanks which were acquired in 1920–21. I give below the rentals realized for five years from the tanks in these two districts :—

Chingleput and Nellore district tank stocking scheme.

——	1922–23.	1923–24.	1924–25.	1925–26.	1926–27.	Total.
	Rs. A.	Rs.	Rs. A.	Rs. A.	Rs.	Rs.
Receipts from fisheries ..	16,185 5	15,706	18,046 5	25,240 4	18,370	93,548

Five years are quite insufficient to judge the efficacy of stocking. As the compensation paid to the district boards since 1920–21 is Rs. 13,615 and represents the average annual rent of these fisheries for the five years ending 1917, the average increase of revenue during the five years the department controlled the fisheries is Rs. 5,094 per annum or 37 per cent and this in spite of the fact that there was insufficient rains in two of the five years (1924–25 and 1926–27). There has been an appreciable decrease in prices in some foodstuffs, but no appreciable increase in prices since 1920–21 to account for the 37 per cent increase in revenue. There can be little doubt therefore that fresh-water fisheries when stocked and improved are bound to show an adequate increase of revenue despite the many difficulties and uncertainties in the realization of such revenue which is the only available index of the value of the fisheries as food for the masses.

The programme for the future is to bring the whole of the suitable tanks in the Presidency under the department's control eventually. So far, detailed schemes for the development of only three districts—Nellore, Chingleput and Ganjam, have been worked out, and the last has for the present been postponed by Government. To render successful the fish stocking of inland waters, much patient research and experiment are necessary. The subject is complicated owing to a tropical and dry climate, the habits of fish which are still largely unknown, the custom of the country, the nature of rivers, the irrigational use made of them and the like. Notable success has been achieved in breeding *etroplus*, *gourami*, *tench* and *hilsa* though the first named is the only fish in which the work has yet progressed far enough to improve the fish-supply in tanks and rivers. The following is a summary of the cultural work of the department :—

Murrel.—The earliest experiments in Sunkesula farm were in murrel breeding. Though the eggs of murrel are easiest to collect and hatch, the larvæ after a certain stage are exceedingly difficult to rear on account of the specialized live-food they need. Adult murrel also thrive on live-food and never keep in condition on a diet of artificial food in ponds. To maintain a few select breeders in special ponds with shallow margins and an abundance of weeds suitable for nesting, on a diet of live minnows, carp and frogs and annually to transplant the fry obtained to extensive marshes with rank vegetation teeming in worms, insects and frogs was found to be the best method of cultivating them.

Carp, labeo, catla, barbus and etroplus.—Preliminary experiments in rearing indigenous inland species of carp, labeo, catla and barbus were not a success. As however the best of these fish are bony and insipid, the acclimatization of estuarine and exotic species was taken up by Mr. Wilson. A backwater perch in South India *Etroplus suratensis* was selected as particularly suitable for introduction into tanks and streams inland. The fact that it is a nest builder and chooses submerged rocks for attaching eggs not being known, the earliest experiments to breed the fish proved abortive. It was only after the breeding habits of the fish had been studied and suitable nests were provided in 1917 that the prolific breeding of the fish in the fish farms followed. The culture of this valuable addition to the fresh-water food-fishes of the Presidency on an extensive scale, through the medium of fish farms for stocking tanks and rivers, has now been finally accomplished. That biological investigations, chiefly those relating to the habits and life history of fish, should necessarily precede successful piscicultural practice, or for that matter all schemes of economic fishery development is here clearly demonstrated.

Gourami.—This exotic fish, well known the world over as the best fresh-water food-fish, was introduced for acclimatization and cultivation in the fish farms, for stocking tanks, lakes and rivers ;

122 live specimens were transported from Java in April–May 1916 and 95 specimens from Mauritius in the same year. The fish have continued to thrive and breed ever since and many generations are now available. Though specially adapted for pisciculture, no experiments on intensive cultivation have been made on account of the limited accommodation available in the four fish farms that have been so far opened. It has not therefore as yet been possible to utilize them for stocking tanks.

Tench and English carp.—The first experiment to acclimatize tench introduced some years ago and now thriving on the Nilgiris, into the waters of the plains of the Presidency was made by bringing a consignment to Hosur on the Mysore plateau in February 1913 and placing the fish in Jeejur and Mattigiri tanks. In February 1914, a further consignment of tench and English carp was brought down from the Nilgiris and placed in ponds in the Sunkesula farm. In September 1921, after seven years the tench bred for the first time, indicating the success of the acclimatization experiment. Unfortunately, the fish and their offspring were lost in 1923. A new consignment of tench has now been brought to the farm for acclimatization. The English carp, however, have not bred so far, though they have grown and are in fine condition.

Fresh-water mullets.—The presence of stray specimens of large mullets in fresh-water tanks close to the sea in the Nellore district, discovered in 1918–19, led to the experiment in cultivating in fresh-water tanks the fry of selected species abundantly available in backwaters and estuaries everywhere. Growth experiments in the Ippur fish farm have proved that mullets grow very rapidly in tanks. The conditioning of mullet fry and their transport, however, presented difficulties as large numbers died in this process. But experiments proved that, if the fry are conditioned in running water in the very creeks or streams where they were taken, there was no appreciable mortality. As a result of these experiments, mullet fry have been extensively employed since 1920 in stocking tanks and channels in Nellore and Chingleput districts. But, the operation is still purely empirical and requires considerable research, before all the facts concerning mullets and the conditions governing their growth in fresh-water are ascertained and utilized. Only a few of the numerous species of mullets grow to a marketable size and of these still fewer are adapted to live in fresh-water. It is therefore necessary, if mullet stocking is to yield any result, to distinguish the fry of the large fresh-water mullets from others. This has not been done so far. The characters of the fry remain yet to be determined before selective stocking of fresh-water tanks, with these fry, could be done on a practical basis. The Inspector of Fisheries (Inland) has been instructed to undertake the work under my personal supervision in the laboratory attached to the Aquarium, but little has been accomplished owing to want of time, as both of us are touring officers with much other work to do.

Hilsa.—The Cauvery in the south and the Kistna and the Godavari in the north are the chief rivers in this Presidency which are visited during the south-west monsoon by shoals of breeding hilsa ; extensive and valuable fisheries exist in these rivers. Consequent on Dr. Day's report on the disastrous effects of anicuts which obstruct the free ascent of fish to their natural breeding grounds and facilitate their capture and destruction by fishermen in enormous numbers, Government have been taking steps since 1869 to safeguard the hilsa fisheries from possible extermination. The suggestion of Dr. Day to construct fish-passes across anicuts was tried in his time at the Lower Anicut, but were found ineffective as hilsa would not ascend them. In 1909, the question was revived by Sir F. A. Nicholson. After an exhaustive enquiry, fish-passes, as a protective measure, had to be finally abandoned. The proposal for the construction of a hilsa hatchery as the only satisfactory solution of the problem was approved by Government in May 1909. The proposal was—(1) to establish a hatchery at Lower Anicut (Coleroon), to strip fish artificially, fertilize and hatch the eggs and (2) to rear the fry in suitable growing grounds before liberating them into the rivers. The earliest experiments conducted were successful in fecundating a few eggs in earthen pots, but for some reason or other the hatching of eggs in the hatchery since its construction in 1909 to 1915 was not successful. From 1915—21 the experiments made by Mr. Wilson were continued by me, the details of the methods of impregnating hilsa eggs, their subsequent treatment and hatching on a large scale were all successfully worked out, and accomplished. The equally difficult problems of rearing the fry till they are of sufficient size before liberating them into the river, remain to be solved. The fry, when hatched, are mouthless, hardly 3 mm. long, float belly upwards when resting and swim at intervals by rapid corkscrew movements of the body. They are nearly as defenceless as eggs and, if hatching operations are to achieve the maximum results in increasing fish, the fry should be nursed in sheltered waters till of sufficient size to go to sea. The process of rearing the fry is one of the most difficult technical problems which confronts us and can only be solved after many experiments and prolonged research. The Collair lake and the network of Godavari and Kistna rivers seem a very favourable locality and a hatchery has been proposed at Bezwada.

Other fish.—Besides the fish mentioned above there are numerous other fish of potential value to inland fisheries, such as *catla*, *mahseer*, *labeo* and *barbus* in fresh-water and the *milk-fish*, *megalops*, *elops* and *polynemus* in backwaters which, when thoroughly studied and effectively cultivated, will enrich the fisheries of rivers, tanks and estuaries.

The conservancy of the Bhavani and Moyar and Hoginkal Falls, the fish breeding and stocking of tanks and rivers, the scientific control of the fisheries including regulation of mesh, prohibition of dynamiting and poisoning and other destructive methods and the evolution of methods of continuously fishing tanks have already benefited the inland fisheries to an appreciable extent. Fish rents have decidedly increased, towns in the neighbourhood of fish farms now obtain a perennial instead of a precarious supply of fish, for instance, Kurnool, Kanigiri and Udayagiri in the Nellore district, and inland fishermen almost on the point of extinction have been protected and encouraged to form co-operative societies by the grant of leases of tanks and rivers on favourable terms to them. Besides the many benefits mentioned above which only a technical department could achieve, the main result is the undoubted addition to the food-supply of the interior evidenced among other things by the rapid increase in rents.

76. The policy of Government is to resume river and tank fisheries and to stock them with fish and thus increase the fish-food supply of the people and incidentally secure increased rents.

77. On a rough calculation the inland fisheries when developed are capable of yielding 500,000 tons of food-fish, whereas the sea fisheries of the Presidency when efficiently exploited up to the 100-fathom line are likely to produce over 10 million tons of fish. The inland fisheries are therefore relatively unimportant and are not worth more than a twentieth of the value of sea fisheries.

78. (*a*) Pisciculture in India presents unique problems. The subject is complicated owing to a tropical and dry climate, the peculiar habits of fish still largely unknown, the custom of the country, the nature of its rivers, and the irrigational use made of them. To render pisciculture successful, much patient research and experiment are necessary. Notable success has however been achieved in breeding Etroplus, Gourami, Tench and Hilsa. The only rivers under the control of the department are the Cauvery and its tributaries. The upper reaches of the Bhavani and Moyar rivers and tributaries of the Cauvery, were found to be depleted of fish by destructive methods of fishing, such as dynamiting and poisoning. A section of 4 miles in the Cauvery below the Hoginkal Falls is a valuable sanctuary for breeding fish. Every year in the hot weather an army of fishermen, 400 to 500 strong, invaded this section and destroyed fish wholesale by dynamite and poison. The Bhavani and Moyar rivers and the section of the Cauvery below Hoginkal Falls have been closed to all fishing. An Inspector and a body of watchers have been employed to conserve the upper reaches of the Bhavani. In consequence, the Collector of Coimbatore has reported that the fish-supply in the river below has considerably increased. An attempt has also been made to introduce new varieties. *Catla*—one of the largest fresh-water carp limited to the waters north of the Kistna—has been successfully transported to the Cauvery River. During the last four or

five years, catla fry collected in the Godavari-Kistna rivers have been annually stocked in the Cauvery. No proof of its having established in the river is forthcoming as the period is too short to judge of the effect of stocking operations. The fish rent from the Cauvery river has also increased, due among other causes to the increase of fish.

Vide also reply to question 75.

(*b*) The Fisheries Department has initiated a scheme whereby irrigation tanks and other inland waters are surveyed, district by district, and those found suitable are arranged in groups, round fish farms and centres where fish-breeding and rearing are carried on and whence such fry of food varieties are distributed in large numbers to reinforce the natural stock in surrounding tanks. As the fish farms are limited, only exotic fish are cultivated in the farms. Besides the fry of such fish, large numbers of young indigenous carp and mullet obtained from rivers and estuaries are annually distributed to irrigation tanks which, for the most part, contain only eight months supply of water. Growth experiments in the fish farms have shown that catla fry of 3 to 4 inches grew to a length of $1\frac{1}{2}$ to 2 feet in the course of eight months the average period for which tanks hold water. Likewise, mullet fry 6 inches and less have been known to attain a length of a foot and a half in tanks stocked by this fish—vide paragraph 85 of the Administration Report for 1921–22. Stocking with exotic and quick-growing indigenous fish is the method employed to improve the fisheries of tanks.

(*c*) & (*d*) *Fresh-water Lakes and Reservoirs.*—These are for the most part dealt with in the same way as tanks, but as noted above, are never fished completely except in years of drought on account of the impotence of indigenous fishing methods.

79. No. The only available statistics are fish rents derived by Government and local bodies from public tanks, channels and rivers. The average rent for the five years ending 1913–14 amounted to Rs. 1,68,590.

80. No.

81. Yes. Please see my reply to question 75 above with reference to carp, murrel, etroplus, gourami, etc.

82. One hundred and ninety tanks have been taken over from local boards in 14 districts.

83. The annual compensation paid to the local boards on account of these tanks is Rs. 21,300.

84. The revenue realized during the past two years is given below :—

	RS.	A.	P.
1925–26	33,447	2	6
1926–27	26,446	15	8

85. The expenditure amounts to Rs. 23,891–11–0 and Rs. 23,982–2–0 respectively as shown below :—

	1925–26. RS.	A.	P.	1926–27. RS.	A.	P.
Compensation	21,300	0	0	21,300	0	0
Stocking of tanks ...	2,591	11	0	2,682	2	0
Total ...	23,891	11	0	23,982	2	0

The expenditure is justified judged by the revenue realized which is due among other causes to an increase in fish-supply. Besides small experiments in the fish farms, large scale experiments on a commercial basis have been conducted to demonstrate to the public the economic possibilities of tank stocking and pond culture. The fishery of the Vellore Fort Moat is an instance in point. The Fort Moat is divided into four sections, one of which is set apart for raising fish for the market. This section is regularly stocked with various quick-growing fish every year and sold in auction to demonstrate to the public the profits to be had by scientific fish farming. To mention a recent experiment, the section in question was stocked in September last with 450 Catla fingerlings from the Godavari 3 to 4 inches in length. They have grown now to 12 to 16 inches and there is a demand at present for the stock of Catla in this section for Rs. 700 to Rs. 800. When it is auctioned early next year the fishery is expected to fetch Rs. 1,000. The expenditure incurred on this stocking operation was only Rs. 90 as per details below :—

	RS.	A.
Cost of 450 fish at Re. 1 per 100	4	8
Cart-hire from Pippera to Tadapalligudem ...	1	0
Railway freight from Tadapalligudem to Madras and thence to Katpadi	61	0
Carriage of consignment from Katpadi to Vellore	2	0
Pay of attendant for two days	4	0
Travelling allowance of attendant ...	13	8
Pay of Inspector of Fisheries for one day ...	4	0
Total ...	90	0

The income on this single consignment is eight times the expenditure and proves what a profitable industry pond culture could be, if pursued scientifically. A similar demonstration to the public was made in a section of the Chingleput Fort Moat. The fingerling

Catla here grew to 18 inches and were sold with other fish for Rs. 120. The fish were much appreciated by the public and the fishermen and this year the Moat will be stocked heavily for further demonstration of the possibilities of scientific stocking. It will thus be seen that the stocking operations in fresh water tanks and rivers have much to do with the increase of fish-food supply to the country and consequent increase of revenue.

Vide also my reply to question 75.

86 & 86 (*a*). Please refer to my answer to question 75.

87. But for the fish farms, none of the cultural work done by the department would have been possible. All the early experiments connected with the selection of suitable fish, their conditioning and transport and their rate of growth and their best food have all been determined in the fish farms by observation and experiment. They are also places where valuable exotic fish, such as Etroplus, Gourami, Tench and Carp are under culture. Much of the knowledge we possess regarding these fish have been acquired in these fish farms. As the work of the farms is purely scientific and cultural, no direct monetary returns are available. The value of the work should be judged entirely by the knowledge gained and the success attained in the breeding and cultivation of different varieties of fish. Judged by this standard, the fish farms have justified the expenditure on them. With better qualified staff, greater results are sure to accrue.

88. Yes. The fish farms should be equipped with all necessary fittings and apparatus and the research on inland pisciculture should be placed under a fully qualified whole-time officer of the rank of an Assistant Biologist.

89. The only piece of fishery legislation is the Indian Fisheries Act (IV of 1897). In actual working, this has been found defective in preventing destruction of fry and immature food-fish or other species requiring protection. A draft Bill to amend this Act has already been published, vide Gazette Notification, dated 9th August 1927.

90. The fish farms are in charge of Assistant Inspectors or Sub-Assistant Inspectors.

91. Yes. The Assistant Inspectors who are in charge of fish farms were given a course of departmental training in pisciculture.

92. The Fisheries Training Institute at Calicut and the proposed one at Mangalore, Madras and Vizagapatam should not only train teachers for fishery schools, but also recruits for the subordinate executive posts of the department. The Fisheries Training Institute at Calicut, the only institution now available, is ill-equipped and insufficiently staffed at present. The appointment of specialists and experts who will supervise courses in the Fisheries Training

Institute in addition to their regular duties will furnish the machinery required for the training of recruits and apprentices in special branches of the fishing industry. The fishermen of Mangalore have already memorialised Government for the latter.

93. Larvicidal fish are reared in the Powder Factory Farm, Perambur, the Ippur Fish Farm and Praema Fish Farm, Nallamalais. No special or separate expenditure is incurred as the fish could be bred along with other food-fishes. One possible exception was the Praema ponds which till last year was exclusively devoted to the rearing of larvicidal fish for the Nallamalai tracts. The expense connected with this farm was Rs. 314 a year.

94 & 95. Ever since the discovery in 1905 that the island of Barbados enjoys an immunity from malaria through the presence in its inland waters of innumerable small minnows thenceforward called 'the Barbados millions' which effectively destroy mosquitos, and thus prevent the incidence of malaria, the principle has gained wide acceptance in scientific and medical circles that fish play a very important part in regulating and diminishing the degree of malarial infection in any given locality. Early larvicidal work consisted of the transport of the "Millions" from Barbados and their introduction into the waters of malarial tracts. But it was not long before zoologists discovered that there are other fishes possessing all the requisite attributes to render them efficient larvicides.

Since 1909 experiments have been made in Bengal, Madras and elsewhere to ascertain which of the small tank fishes of India are useful, in destroying mosquito larvæ. In the comparative tests made with indigenous species and the much-vaunted 'Barbados millions," Indian fish were found to be even superior to the latter. It was therefore needless to go to the expense of importing these or other foreign fish into India for this purpose.

At the instance of the Health Department, Mr. Wilson carried out investigations at the Government fish farm, Sunkesula, from the year 1912–13 with South Indian species of larvicidal fish to determine which were best for the control of malaria. The effectiveness of fish breeding to destroy mosquito-larvæ in tanks, ponds and wells was conclusively demonstrated by him to the medical profession, local bodies and the public and a practical paper giving detailed instruction about the kind of fish suitable for fresh, salt and brackish waters and the manner of using them to destroy noxious larvæ was read by him at the 'All-India Malaria Conference.' This paper is published in Bulletin No. 111 by the Madras Fisheries Department. Two of the Government fish farms, Ippur and Praema, specialize in breeding larvicidal fish.

The work of the department in fighting malaria with such fish consists of three phases—

(*a*) Breeding the fish and distributing them to municipalities, local bodies and private individuals ;

(*b*) periodical stocking of mosquito breeding pools in specially malarious localities with such larvicides;

(*c*) conversion of mosquito infested sheets of water into fish-breeding ponds which also serve the purposes of fry distribution centres for the stocking of irrigation tanks.

The department is able to supply specially selected larvicides in large numbers at the nominal cost of Rs. 10 per 1,000. But in spite of the earnest recommendations of the Government, Municipal and local authorities do not as yet avail themselves at all adequately of the facilities offered to them to obtain a good strain of these useful little fish. They appear either careless of the value of this cheap means of combating malaria or else depend upon local supply of what are too often species of inferior larvicidal quality.

The second form of operation is more directly under the control of the department and consequently much greater progress has been made in this method of fighting malaria. Inadequacy of staff and want of funds alone restrict operations. Mosquito breeding water-holes, ponds and streams in several localities in the Cuddapah district and throughout the Nallamalais in the Kurnool district have been treated with hundreds of thousands of larvæ-eating fish. Appreciable decrease in the incidence of malaria is reported from Nallamalais. The extension of operations to other malaria infected regions should be taken up as funds are available, especially in the agency tracts of the Ganjam, Vizagapatam and Godavari districts, in the Wynaad taluk of the Malabar district, the Gudalur taluk of the Nilgiri district, etc.

The third line of attack on malarious waters is perhaps even more important. Two schemes have already been completed, viz., the conversion of Fort Moats at Chingleput and Vellore into fish farms. In both the cases, until the operations were commenced, these moats formed stagnant pools overgrown with dense pond vegetation and supremely suitable as harbourage to mosquito-larvæ. As a consequence, malaria was endemic within both the forts, an extremely serious condition seeing that a large reformatory for boys is located within the Chingleput Fort whilst a Police Training School is located within that of Vellore. The moats have now ceased to harbour mosquito-larvæ and have concurrently become ideal fish-breeding ponds whence large supplies of fry will become available for stocking the large number of tanks in the districts of Chingleput and Nellore.

In the course of larvicidal operations, it was found that fish traps, basket traps and other contrivances were extensively in use in irrigation channels, paddy fields and field drains throughout

the country which destroy large numbers of immature food-fish and the small mosquito destroying species. As the waters standing in paddy fields presumably fall within the definition of private waters under the Indian Fisheries Act IV of 1897 (the only piece of fishery legislation available), the Madras Government did not see their way to frame rules prohibiting the use of these objectionable methods of fishing. If full benefits from larvicidal fish are to be derived, ways and methods must be found for preventing such wholesale destruction of these. This is one of the instances where the absence of adequate fishery legislation hampers development.

96. (1) The Health Department is primarily concerned. They may be consulted as to ways and means by which local boards and municipalities may be induced to avail themselves adequately of the help the Fisheries Department is capable of giving them in larvicidal stocking operations.

(2) Notorious malarious tracts, such as the Agencies and Wynaad, should ultimately receive attention and schemes, such as the Praema scheme may prove useful.

(3) In the course of larvicidal operations, it was found that fish traps, basket traps and other contrivances were extensively in use in irrigation channels, paddy fields and field drains throughout the country which destroy large numbers of immature food-fish and the small mosquito destroying species. As the waters standing in paddy fields presumably fall within the definition of private waters under the Indian Fisheries Act IV of 1897 (the only piece of fishery legislation available), the Madras Government did not see their way to frame rules prohibiting the use of these objectionable methods of fishing. If full benefits from larvicidal fish are to be derived, ways and methods must be found for preventing the wholesale destruction of these fishes.

SECTION IX.—KINDS OF FISH.

Mr. Gopala Menon said that oil sardines were the most important fish and mackerel came next in importance, and suggested that the department would do well to go into the question of the disappearance of shoals of the above fishes and investigate what food induce them to remain in shallow waters.

Rao Bahadur J. A. Fernandez stated, that the fishermen experienced considerable difficulties in getting necessary yarn, etc., for making drift and seine nets, generally in great demand in the Tinnevelly district and if the department could stock them in the various fish-curing yards and sell them at purchase price it would help the industry a great deal.

Mr. Moses suggested that the binomics of the following fishes of the East Coast were worth studying : Kuthippu (*Lactarius*), Soodai (*Clupea fimbriata*) and Moral (*Belone and Hemiramphus*). The problem of the uncertain periodicity of shoaling fishes and possibilities of pisciculture should be investigated.

Messrs. Othenan and A. V. Achuthan stated, that the most important varieties of fish of great economic value on the West Coast were—(*i*) Sardines ; (*ii*) Mackerel ; (*iii*) Cat-fish ; (*iv*) Ribbon fish ; (*v*) Prawns and shark (big variety).

SECTION X.—PEARL FISHERIES.

Diwan Bahadur R. N. Arogyaswami Mudaliyar said that the first problem was one of research as to the occurrence and movement of pearl oysters and suggested that the Director of Fisheries should get hold of some mechanical plants for fishing pearl oysters in greater depths, for investigating the habits and habitat of the pearl oysters and their life-history. He was against leasing the pearl fisheries.

Mr. J. L. P. Roche Victoria said that it was not desirable or profitable to lease out the fishing rights to contractors because the necessary capital would not be forthcoming ; and they did not possess the necessary experience. Even if a European Company offered to take the lease he would oppose it, for the interests of the fisheries and the public required State control and the preservation of pearl banks also required it. He stated that research work in rearing pearl oysters should be one of the functions of the department.

Mr. J. A. Fernandez was of opinion, that the only improvements necessary were—(*i*) increase of labour supply and (*ii*) systematic inspection of pearl banks. He considered naked diving to be the best method in shallow water. He stated that leasing out of pearl fisheries was neither desirable nor profitable.

Mr. Viswanath said that researches must be made to find out pearl beds on the West Coast or, if possible, pearl oysters must be reared if the conditions were suitable on that coast.

In reply to questions 99 to 111, Dr. B. Sundara Raj stated as follows :—

99. The history of these ancient fisheries is well-known. All available evidence seems to indicate that, from time immemorial, the pearl fisheries in the Gulf of Mannar were in the hands of a caste of shore-dwelling people, i.e., fishermen and divers known as

"Paravas." The Portuguese had control over the pearl banks from 1524 to 1658 and the Dutch from 1658 to 1796 when the sovereignty of the banks passed into the hands of the British.

Pearl banks exist off the Tinnevelly and Ramnad coasts. Owing to causes still obscure, the pearl banks are seldom productive. While chank fisheries are annual, the pearl fisheries are intermittent. Prior to the fisheries of the last three years there was no pearl fishery since 1908.

On an average the pearl fisheries yield somewhat more than chank fisheries. The net revenue on an average from either of these per year works out to about Rs. 15,011 and 14,333 respectively. These prerogatives of the Crown have been handed down from the ancient Hindu Kings. From the beginning of the 19th century these fisheries have been administered by the British. From 1801 to 1876–77 the fisheries were leased out to two cotton merchants of Tuticorin, Mr. Cocq and Mr. Barter, who undertook the entire organization and conduct of the fisheries. Difficulties with the renters and the belief that direct management of the fishery would result both in increased profits to Government and improvement in the condition under which the divers worked led the authorities to abandon the renting system in 1876. Henceforward the Port Officer of Tuticorin was Superintendent of these fisheries and organized and worked them departmentally. The anticipations of Government were justified. Against the annual rent of Rs. 7,566 realized during the 33 years prior to the resumption in 1876, Rs. 10,521, very nearly one and a half times the revenue, was realized from the chank fisheries during the subsequent 33 years up to 1908–09. Mr. H. S. Thomas in paragraph 96 of his report on the pearl and chank fisheries in 1884 recommended that if Government should ever contemplate constituting a Fisheries Department, these fisheries should be combined with it and given the benefit of scientific supervision. As it was, these fisheries were under a very busy officer (Port Officer) with a daily increasing business to supervise a distant duty totally foreign to his primary duties and one for which he, in all probability, had no previous training and possibly no taste. The administration of the fisheries under these conditions was found to be unsatisfactory. In the interest of the Government revenue and of the fishing population of the coast, they were transferred to the Fisheries Department in 1908 when Mr. Hornell was appointed Marine Assistant. With the greater attention to management and sale of chanks by the technical department, highly gratifying results have accrued in all directions.

The highest number of chanks ever fished in any season was in the year 1915–16 ; the maximum revenue in any year from chank fisheries was in the year 1918–19. The average annual revenue from chanks during the 18 years under the Fisheries Department

was Rs. 18,229. The greater revenue was not, as attributed by the Retrenchment Committee in paragraph 272 of their report, due to the fact that the prices of chanks have increased, but to the efforts of this department as the increase in prices is offset by the increased cost of labour.

The maximum revenue from pearl fisheries during the last 100 years was in 1927–28. Taking the productive cycle of years from 1926–28, the gross revenue was Rs. 9,08,915, a higher aggregate than for any previous period of three consecutive pearling years for which we have a record.

The departmental working of the pearl and chank fisheries has benefited the divers, chank workers and merchants and the present condition of the industry is highly satisfactory and prosperous. The divers are no longer under perpetual debt to capitalists (*mudalalis*), but are independent wage-earning labourers, to whom advances for boats and equipment are made directly by Government on easy terms. The consumers, the chank workers of Bengal, have been assigned the monopoly for the purchase of shells on highly favourable terms, thus cutting out the middlemen who fleeced them almost to the point of extinction. The pearl fisheries have been retrieved from the evil repute into which they had fallen during the last 100 years or more and the Tuticorin fisheries have outshone those of Ceylon which previously have always occupied a higher position in the estimation of pearl merchants. Conditions were never more satisfactory or prosperous for pearl and chank fisheries than they have been during the last few years. More economic or efficient methods of work are difficult to conceive of. Dredging of banks to save expenditure on labour, apart from the discontentment it will cause to the large body of divers, is objectionable on technical grounds as it would destroy the banks. In consequence, it has never been adopted in Ceylon or India.

The fishing for chanks as well as pearl oysters is by volunteer labour, paid by the number of shells in the case of chank but in kind in the case of pearl oysters. Facilities have to be afforded to divers free of cost, such as, towage to and from the fishing grounds, buoying of beds, provision of camping quarters, etc., to the mutual advantage of divers and Government.

With a view to economy and as a means of controlling diving labour, I have been enquiring for a suitable simple diving dress. A mask with an oxygen tube for breathing is largely used by Japanese divers in shallow waters. This is comparatively inexpensive and is well adapted to the warm waters of the tropics. One trial suit ordered arrived with the glass broken and the mask has been returned to the makers for repair. If the experiment succeeds, a regular body of divers could be trained and entertained on the permanent establishment of the department.

There are three motor boats and a motor inspection schooner, the annual maintenance of which costs Rs. 22,400. They are maintained for towage of chank canoes to and from the banks in the Tinnevelly and Ramnad districts and for the control and supervision of the fishing operations, such as the return of undersized chanks while still alive to the sea, the systematic fishing of chank beds and the prevention of over-fishing of banks, the safeguard of left-handed chanks whenever they are fished and the safe landing and storage of chank shells and so forth. The expenditure is unavoidable if the chank fisheries are to be worked efficiently. During pearl fisheries they subserve a similar function and patrol the pearl banks and pearling operations. The inspection schooner *Lady Nicholson* is the only schooner that provides accommodation to inspecting officers for the periodic inspection, annual or biennial of pearl banks and chank beds, for buoying the beds, for fishing and for other scientific work connected with inspections. When the trawler *Lady Goschen* is equipped with a laboratory and cabins, it might be possible to use her in the place of *Lady Nicholson* provided the *Lady Goschen* could spare the time amidst her varied duties. The matter can only be decided after experience of the next two or three years.

The pearl and chank fisheries are now as fully organized as present conditions permit. The benefits resulting from their departmental working are increased revenue, the improved material and moral condition of divers and the profits and satisfaction to merchants and the interested public.

100. The most important problem requiring research is the irregular periodicity of the Indian fisheries as opposed to annual pearl fisheries in the Red Sea, Persian Gulf, Malaya Archipelago, Australia and New Zealand, West Indies and elsewhere. This has not yet been satisfactorily solved ; much less have remedies been suggested or adopted. On the administration side, the problems are—

(1) Recruitment of divers and boats.
(2) Securing the services of suitable tugs.
(3) Inducing merchants to attend the fishery.
(4) Health of the camp, such as water-supply, sanitation and medical aid and prevention of epidemics.

101. Practically no research has been done for want of staff and facilities. Only in January 1928, Government agreed to initiate a biological station at the Krusadai Island and work on some emergent lines has just begun. This is highly unsatisfactory.

In the administration of pearl fisheries the years 1926–28 without exaggeration are unparalleled in the whole history of pearl fisheries. The highest revenues, the most satisfactory and perfect

methods of inspection, estimation, advertisement, planning and equipment of camp, provision of water-supply, safeguard of health and property and the maximum of satisfaction and profits to divers, merchants, public and the State were all secured.

Vide also my reply to question 99.

102. Systematic and intensive research, biological and hydrographical, should be carried out at the Krusadai Station by a qualified whole-time staff with a view to discover and remedy the causes for the mysterious disappearance of oysters. A simple form of diving dress used by the Japanese divers may prove invaluable to the local diver. I expect to go into this matter when I visit Japan.

103. Yes. A comparison with Ceylon fisheries will show that the highest amount of economy has been exercised in every direction in the conduct of pearl fisheries. Further experience may enable the department to economise expenditure whenever possible, but I cannot conceive of any great reduction in the running charges. As to the possibilities of leasing the pearl fisheries, there are objections. The proposal was never approved by Government. The Ceylon fisheries were leased to a Company early this century for a few years, but the Company wound up with heavy loss. The causes that lead to the success or failure of pearl fisheries are so numerous, so varied and so uncertain that only the Government are in the best position to control them.

104 & 105. Diving is the approved method. Dredging, apart from the discontent it will cause to the large body of divers, is objectionable on technical grounds as it will destroy wholesale young oysters on the banks. In consequence it has never been adopted in India and Ceylon.

106 & 107. Vide answer to question No. 103.

108 & 109. Recruitment of divers is the labour problem connected with pearl fishery. Diving, as a profession, is dying out. The sons of divers no longer follow the profession of their fathers as the occupation is despised. There are far less divers available in South India now than ever before. If the Japanese diving apparatus succeeds, we can have a regular body of divers trained under our permanent employ. The diver then could remain under water much longer than a few seconds and could systematically fish the banks. A few divers in the place of the thousands now employed will probably then suffice. A sufficient body of Arab divers who are far and out the best divers we have, should be recruited from Persian Gulf. It should be feasible to obtain true Persian Gulf divers in small gangs under men who can give adequate monetary guarantee for the good behaviour of the men supplied by them both for pearl and chank fisheries.

110 & 111. No research has been done by the department, vide answer to question 101. The causes for the irregular periodicity of the Indian pearl fisheries as opposed to the annual pearl fisheries in the Red Sea, Persian Gulf, Malaya Archipelago, Australia and elsewhere have not yet been successfully ascertained; much less have remedies been suggested or adopted. It is not fully known whether the absence of oysters for years is due to the destruction by natural causes, such as currents, storms and predaceous animals or to an absence of natural spawning oysters. If the latter, efforts should be made to start a pearl oyster farm or a sanctuary to keep alive a healthy stock of oysters or to artificially breed oysters and stock the beds with oysterlings. If the experiment succeeds one may be able to determine what effect the spawning of this stock of oysters in confinement or the stocking has in reviving pearl beds and restocking them with oysters during barren years. The proposals will require years of careful study and experiment at a well equipped station with a qualified whole-time staff. A marine biologist and assistants are indispensable for the work. To begin with, pearl oysters will be obtained from the banks and kept under observation in aquaria to see whether they would survive in surface waters and on ascertaining this, it is proposed to keep oysters on a larger scale in cages suspended from a wooden staging outside Krusadai Island. The experiment is for ascertaining—(1) the exact age and rate of growth of the oysters; (2) the period when they breed; (3) the food that they take; (4) the early stages of the oyster; and (5) the congenial surroundings and favourable conditions under which they will thrive and attain maturity. Eventually when such a farm is fully established, it is hoped that it might be possible to replenish the stock of oysters on the pearl banks more often than is the case under natural conditions by means of spat from the thousands of mature oysters in the oyster park.

Recent developments, in fishery science have shown the enormous influence of hydrographical conditions of the sea on fisheries. They have a direct bearing on the pearl fisheries, and the prosperity of pearl oysters. Accurate observations should be made and recorded of the temperature, tides and salinity and the like of the different strata of sea water and of the condition of wind and weather and correlated to observed biological phenomena. Practically no work has been done in this direction. Experiments on currents with drift bottles will be conducted and other hydrographical observations will also be made and recorded regularly by the station.

Diving is limited to a depth of 10 or 11 fathoms and the distribution of the pearl oyster in deeper waters is unknown. It is proposed to investigate deeper banks with dredgers, grabs and other apparatus operated from the trawler to locate, if possible, pearl oyster beds if there be any beyond the 10 fathom line.

SECTION XI.—CHANK FISHERIES.

Diwan Bahadur Arogyaswami Mudaliyar saw no reason why chank fisheries should not be leased so long as the Government are at an advantage and no loss was being incurred.

Mr. Roche Victoria stated that, unlike pearl oyster shells, the whole lot of chank shells fished by divers is paid for by Government to discourage them from catching small chanks.

Mr. J. A. Fernandez stated that the only method to increase the labour-supply or labour-conditions is to increase the wages and thereby get more divers. He was not in favour of leasing out the chank fishery right to contractors, for the following reasons :—

The divers will feel safer in the hands of Government than under lessees ; secondly, the divers may be sure of a fixed price ; thirdly, the lessees will have an eye to their own profits and, according to the labour available, they may increase or decrease the rates paid for chanks. The divers will become indebted to the *mudalalis* and they will be under the control of the capitalists. In his opinion, the working by the department of the fisheries leased from the Raja of Ramnad does not amount to interference with private enterprise or competition. According to Mr. Fernandez, the earnings of the divers are not sufficient to induce them to work at Tuticorin and they therefore prefer to go to Ceylon and work in the free fisheries there where they get nearly double the rates earned by them in India. His only suggestion for improving the labour-supply is to increase the wages and thereby get more divers and fish more chanks. In his opinion, the research on mechanical devices for fishing is a problematical affair and that it is only the naked diving that is best suited for chank fisheries.

Mr. M. Viswanath urged that wherever available chanks must be collected by the department and sold in convenient lots. He also wanted that some workmen who could convert these shells into ornaments, such as bangles, rings, etc., must be got down and our fisherfolk (women and boys) must be taught to make these little things and develop this as a cottage industry.

Rao Bahadur Cruz Fernandez said that the contract system was not likely to be more profitable, in view of the difficulty of getting contractors with the requisite scientific and expert knowledge. He would therefore recommend the working of the Pearl and Chank Fisheries departmentally as hitherto. He was for increasing the remuneration and wage to divers in such a way as to be attractive.

Rao Bahadur Govindan stated that the important problem in the chank fisheries is the difficulty to get a sufficient number of divers. In Mr. Govindan's opinion it is not at all a legitimate function of the department to lease out fisheries from private parties. He remarked that though the life-history of the chanks is well known, nothing has been done by the department to increase the production.

In reply to questions 112 to 126, Dr. B. Sundara Raj stated as follows :—

112. The chank fisheries of Madras exist along the coasts of the six southern maritime districts on the East Coast, viz., Tinnevelly, Ramnad, Tanjore, South Arcot, Chingleput and Nellore.

These fisheries are Crown monopolies exercised by the Hindu Kings of the Coastal Kingdoms from time immemorial and lately by the Madura Nayaks, the Nawab of the Carnatic, the Portuguese, the Dutch and finally from 1795 by the British. In practice this prerogative is variously exercised. In Tinnevelly the Madras Government work the fisheries directly through an officer of the Fisheries Department, the Superintendent of Pearl and Chank Fisheries. In Ramnad, the chank fisheries alone were granted to the Raja of Ramnad on an annual peshkash of Rs. 14,000. After the establishment of a technical department of fisheries for various administrative reasons the department took on lease the Ramnad fisheries, for, it was found necessary to resume control of the Ramnad fisheries for the proper organization and development of the chank fisheries and accordingly Government took the fishery on lease for a period of 15 years from 1913–14 for Rs. 60,000. The Ramnad Fishery, like the Tinnevelly Fisheries, have been worked departmentally since. On the Coromandel Coast, the chank fisheries off the districts of Tanjore, South Arcot, Chingleput and Nellore are leased to contractors—vide also reply to question 99.

113. The more important problems connected with the industry are—(*a*) the labour question connected with chank industry, (*b*) the reasons for the cessation and disappearance of the chank bangle industry from the South of India and its possible revival and (*c*) the advantageous sale of chanks fished to purchases in Bengal.

114. Yes.

115. The scientific control of chank fisheries and their cultivation to cope with increased exploitation is a feature of chank work to which little attention has been paid in the past. There are grounds for suspecting that intensive fishing is depleting the chank beds. It is therefore necessary to start investigation for the location of suitable growing grounds for the planting of young shells, the starting of new chank beds and for ascertaining the life-habits, growth, etc., of the chanks and to work the grounds systematically, e.g., like a forest so as to secure perhaps fewer chanks, but those of large size.

The provision of a suitable diving dress will also render fishing efficacious.

116. The expenditure now incurred is the minimum and no further reduction is either advisable or possible.

117 & 118. The improved methods of catching chanks are by trawling or dredging. But Mr. Hornell had come to the conclusion from the experiments made by him from 1912 to 1915, that neither

trawling nor dredging can furnish a desirable or adequate alternative to diving as a means of fishing chanks. The only other mechanical means suggested by Mr. Hornell is the utilisation of a sub-marine boat of cheap and simple construction which would enable men to collect shells from the bottom in sufficient quantities to be commercially profitable. I, however, entertain serious doubts as to the practicability of this scheme.

119 & 120. Yes. Leasing of chank fisheries was tried from 1801 to 1876, but proved unsatisfactory,—vide third paragraph of my reply to question 99, page 73.

121. To work on leased fisheries which are not the property of Government will be a legitimate function of the department in cases where it is highly necessary that the control of such fisheries should vest with Government.

The lease of the Ramnad chank fisheries from the Raja of Ramnad closes with June 1928. For the progressive improvement of the chank fishery, a renewal of the lease seems necessary. We depend entirely on the Ramnad district for divers for working the Tuticorin pearl and chank fisheries. The independent working of the Ramnad chank fisheries will cause innumerable difficulties and friction in the adjustment of wages, with the fixing of prices and, worse than all, it will facilitate the illicit removal of Government shells. Further, since the pearl and chank beds are for the most part identical, it will be necessary to prohibit chank fishing when there are oysters on the beds. In such a contingency, the interests of Government are likely to clash with those of the Raja besides giving opportunities for the Raja's men to pilfer pearl oysters.

122. No. The Raja could not work the fisheries as advantageously as by leasing them to a technical department of fisheries. A comparison of his revenue before and since the lease will show this. His chank fisheries are not taken on lease against his own interest.

123 & 124. Vide answers to questions 108 and 109.

125. No.

126. Yes. We have no knowledge of the age of the chank nor a correct idea as to its vertical distribution and migration, nor even whether intensive fishing had led to the depletion of the fishery. The three years' rest in the case of chank beds off Tinnevelly and Ramnad, owing to the occurrence of pearl fisheries during the chank fishing season, has shown an unusual abundance of large chanks on the beds. It seems, therefore, clear that the beds are being fished to their maximum capacity, if not more. Research on the life-history, food, growth, etc., of the chank has therefore become an immediate necessity. The possibilities of breeding,

stocking and otherwise protecting and developing the chank fisheries should be investigated. The lines of investigation will be roughly as follows :—

(*a*) The fauna and flora of the chank beds will be studied.

(*b*) The food of the chank will be determined by dissection and by aquarium experiments.

(*c*) The rate of growth of the chank will be determined by marking specimens in aquaria as well as on the banks.

(*d*) A study of bathymetrical distribution of chanks according to sizes and seasons, up to ten fathoms by divers, and beyond by dredging, will be made.

(*e*) The migration of chanks, young and old, will be ascertained.

(*f*) Piscicultural experiments with chank eggs involving the artificial cultivation of the chank and the study of its early stages will also be undertaken.

SECTION XII.—RESEARCH AND AQUARIUM.

Research.

Diwan Bahadur R. N. Arogyaswami Mudaliyar stated that, at present, there is no research establishment. He was of opinion that there should be at least two men to begin with. He would ask for a Research Chemist and a Research Biologist. He was for starting an institution in Madras or Calicut which would be a combined teaching institute and research institute for training the future etablishment of the department and a means of training interested persons among the public who would like to take up special branches of the fishery industry, like fish-curing, fish oil, etc., for purposes of trade. He suggested that there should also be a small factory attached to this institution to enable the students to readily see the processes and acquire practical training just as there are workshops attached to the Engineering College.

In the matter of inland fisheries he said a good deal of research has to be done. The proper kind of fishes that can live in the tanks and ponds must be decided. The department has done some work and he was of opinion that nothing the department had done need be dropped. He said he would proceed cautiously in the matter of the expansion of inland fisheries.

He stated that the equipment for research work was rather desultory till the taking over of the department by the present Director who has given the Research Assistants more facilities than before.

Mr. Gopala Menon said that no investigation appeared to have been made to ascertain the causes for the appearance of sardine and mackerel at stated seasons.

Dr. C. Natesa Mudaliyar would like very much to have an expert to do research work in each branch of the department.

Mr. M. P. Krishnan complained that no additional knowledge has been acquired of the particular reasons for the appearance or non-appearance of particular kinds of fish at particular places. In his opinion, this knowledge alone mattered much for the fisherfolk as that would enable them to be equipped with the necessary kinds required for different catches at different seasons. He stated that the fisherfolk would further be benefited if, as a result of researches, a cheap method of preserving raw fish in large quantities at times of large catches was found, in place of the cold storage system.

Rao Bahadur Govindan stated that the present method of carrying on research work at Calicut could not give much valuable data. He suggested that work of that nature should be conducted at sea. He thought that the investigation of marine fishes was a matter that ought to be taken up by the Imperial Government because fishes under observation do not remain in the waters of the Madras Presidency and the results of such investigations were for the benefits of the whole of India. As regards research on inland fisheries he stated that the most important item ought to be the popularisation of fish rearing in private waters as is done in Bengal. Unless the department adopted simpler methods in pisciculture, he stated, it would not be possible to expect the public to take it up as a business. He further said that Technological Research was more important than Biological Research.

Mr. Ramaswami Nayudu explained the research he was doing at Calicut in connection with sardines.

AQUARIUM.

Diwan Bahadur Arogyaswami Mudaliyar stated that there should be an Aquarium if not in Vizagapatam, at least in Rameswaram.

Mr. S. T. Moses wanted an Aquarium to be established at Rameswaram and another at Vizagapatam.

Mr. Govindan advocated the opening of small Aquaria at Cochin, Tuticorin or Mandapam and at Vizagapatam for research for the students of the University.

In reply to questions 127 to 170, Dr. B. Sundara Raj stated as follows:—

127. The Personal Assistant, Dr. D. W. Devanesan, Research Assistants and one or two Inspectors who are Zoology graduates are capable of doing research work at present—vide answer to question 5.

128 & 129. Fisheries research may be classified into—(1) Technological and (2) Biological, hydrographical and other scientific research. I have alluded to the technological research done at Tanur and Chaliyam Cannery and to fishing experiments under the trawler and improved methods of fishing. For biological and scientific research, please see Chapter III, Technical and Scientific investigation in the pamphlet entitled "Aims and achievements of the Madras Department of Fisheries." Some recent items of research are the following :—

Studies on the development of edible oysters were undertaken at the Laboratory attached to the Aquarium and subsequently at Ennur and Pulicat. The experiments have revealed the percentage of salinity most favoured by oysters. The research has enabled us to correct certain erroneous ideas that had been entertained in the past regarding the optimum salinity required by the edible oyster ; while the oyster in England fattens and breeds when there is a rise in salinity, the Indian oyster seems to flourish only in low salinities. The freshes in rivers far from damaging them, as was supposed before on the analogy of the European oyster, provide the most favourable conditions for spawning and development of the Indian oyster. The research has also thrown considerable light on the characters of the early stages and the period of development of the oyster. Their value lies in the possibility of forecasting favourable and abundant oyster seasons in the backwaters if statistics of salinity are maintained in the oyster farm. The two Research Assistants attached to the Calicut Research Station were engaged on systematic research on sardine and mackerel. A preliminary report has been issued on the oil sardine and another on mackerel is under preparation.

130. Yes.

131. The investigation was undertaken with successful results in the case of fresh-water mullets and other dozen fresh-water fish and two of the most important economic food-fish of the West Coast, viz., sardine and mackerel and the flying fish of the Madras Coast. I have also unpublished manuscripts on the breeding habits of three or four fish partially worked out as time and opportunity offered.

A preliminary report has been issued on the oil sardine of the West Coast and another on mackerel is under preparation. This is the work accomplished by the research station at Calicut from 1921. The eggs, spawning beds, migration, reasons for uncertain periodicity, possibilities of culture in supplementing natural resources, etc., of the scores of other marine food-fish remain untouched. Before any attempt at systematic research on marine fisheries can be successfully undertaken, considerable knowledge

of the food and conditions of life of the fishes must be acquired. For this purpose, plankton, hydrographic and meteorological data are being collected and a general study is being made of associated animals and plants as opportunity offers.

Almost equally little is known concerning fresh-water fishes. The habits, spawning seasons and early stages of about a dozen have been worked out by Dr. Willy, Professor Narayana Rao, Mr. Panikkar and myself, independent of the department's investigations. I have noted on the breeding habits of an important fresh-water cat-fish and hilsa which remain to be published. Beyond this, little or nothing is known regarding the majority of fresh-water food-fish and investigation regarding them is an immediate necessity for the development of our inland fisheries. Gourami, Tench, European carp, indigenous labeos and barbels (including mahseer) and fresh-water mullets are the species that concern us immediately in our stocking and breeding and should be taken up first for study.

There has been little or no opportunity in the past to study scientifically the value of the fish and fisheries of our backwaters. Etroplus is the only fish that has been extensively employed in stocking fresh-water tanks. Mr. Whitehouse for two years (1919—21) carried out studies on the growth of mullets in a lagoon, near Tuticorin. I have proposed a fish farm at Surla (Ganjam district) for continuing these studies. The backwater species that are economically the most important and demand immediate attention are—

(1) *Mullets* (*Mugil spp*) several species.

(2) Cock up (Bengali *begti: Lates calcarifer*) growing up to 3 feet and more in length. It is one of the largest eastern sea perches which frequents backwaters, agreeing therefore in habits with its European relative the Bass (*Labrax lupus*) largely cultivated in Italy and France.

(3) The Indian salmon (*Polynemus tetradactylus* and *P. sp.*) also grow to a big size, say, even 6 feet ; a very highly esteemed fish for table.

(4) The milk fish (*Chanos chanos*) and the allied species *Elops indicus* and *Megalops cyprinoides*, all of which attain a large size are esteemed food-fish. The first of these has been extensively cultivated for centuries in Java and the third in the Federated Malay States and all the three would appear to be highly suitable for cultural treatment.

(5) Sea breams (*Chrysophyrys berda* and *C. datnia*).

(6) The Indian "Whiting" (*Sillago*).

(7) *Scatophagus argus*.—This is a good fish frequenting backwaters. It tastes very like pomfrets.

(8) *Soles* (*Cynoglossus sp.* and the Plaice-like *Pseudorhombus arsius* and *Pseltodes erumei*) ; these are esteemed as great delicacies and the last is a shoaling fish of great economic importance in estuaries.

132. There is at present no adequate equipment or qualified staff for prosecution of systematic research. The available apparatus and laboratories were utilized to the best advantage for conducting the researches so far done. Till recently, the West Hill Research Station was the only laboratory and ill-equipped with apparatus, books and staff. The only other facilities are—(1) a small room in the Madras Aquarium for chemical work where I have been conducting experiments in preservation of fish by sodium hypochlorite and the analysis of samples of sea water collected by the trawler in her research cruises ; (2) since January the Krusadai Station has been equipped with a few wall cases and apparatus for the proposed research on pearl and chank ; (3) the fish farms afford facilities for experiments in inland pisciculture ; (4) the hatchery at Lower Anicut now transferred to Bezwada has a battery of hatching jars for treating hilsa eggs.

Besides the two graudates in zoology, one a local M.A., there is no whole-time officer to conduct systematic research. The two graduates have neither the qualifications nor the capacity to conduct research independently. The Director has had continuously to supervise every detail and even write out reports for them. Being burdened with other administrative work, the research work turned out is extremely meagre and desultory and calls for considerable reorganization and reform. In view of the fact that there has been no definite policy in regard to research, except perhaps on technological lines at Tanur and Chaliyam, the Government called for a ten years programme of research. This was submitted and was approved in November 1926.

133. There has been a marked absence of sardine shoals during the last four years. The mackerel was available in fair quantities. The season that has just closed was a bumper year for mackerel and record catches of the fish were made. As to places where they disappeared—vide paragraph 25 of Annual Report for 1923–24, paragraph 17 of the Annual Report for 1924–25, paragraph 11 of the Annual Report for 1925–26. If more detailed information is required, it could be called for from the fish-curing yards.

134. Yes.

135 & 136. Vide answer to question 133. The phenomena however is a normal one. Similar disappearance of sardine and mackerel shoals for years have been known in the past. Such fluctuations are common to all shoaling fish throughout the world.

137 & 138. Some preliminary observations were made on the oil sardines relating to their age, food, spawning and seasonal

migration and occasional widespread mortality. These investigations were resumed in 1921–22. The information gathered relates only to seasons of 1908 and 1922 and hence is wholly inadequate for basing any weighty conclusions. The results arrived at are also admittedly tentative and require observations extending over a series of years before anything like sound inferences could be drawn. Certain lines of investigations on mackerel have been carried on till now and the results are awaiting publication. Though substantial progress has been made as in the case of sardine the bulk of the work still remains to be done in locating breeding grounds, collecting and studying eggs in early stages and in tracing the shoals where they live in the inshore waters.

139. Besides sardine and mackerel there are many kinds of food-fishes which yield valuable fisheries; practically nothing is known regarding them. Even the species have not been determined. The department will have to take these up according to their relative importance as time and opportunity offers. The fisheries mentioned below also require investigation:—

Shell fish fisheries—(1) *Pearl oyster.*—The essential problem of the irregular periodicity of Indian pearl fisheries as opposed to the annual pearl fishery in the Red Sea, Persian Gulf and elsewhere has not yet been solved. Much less have remedies been suggested or tried. The Government this year sanctioned some preliminary research on pearl oyster at Krusadai Island. Preliminary experiments in keeping stock oysters alive in wire cages have been successful. Young pearl oysters have also been found in the shallow waters around the island. Both augur well for the future success of work at the station for the pearl oysters.

The Krusadai Station will carry out studies in the habits, food, environment, spawning and early stages of pearl oyster and do cultural work. Concurrently with experiments on live oysters and their culture, I proposed to Government that the trawler should investigate deeper banks with dredges to locate, if possible, pearl oyster beds if there be any beyond the 10-fathom line. Diving as practised is limited to 10 or 11 fathoms but the pearl oyster need not necessarily be confined to that depth. It is quite possible that their range extends to greater depths and that only in exceptional years of abundance, their spat spread to banks within 10 fathoms. If so, the irregular periodicity of pearl fisheries could be explained by the fact that the mother-beds lie in depths beyond 10 fathoms which have never been reached by the local diver. The Government sanctioned the scheme in March 1928.

The dredging operations are in progress. It may be necessary to continue the work next year also as the area to be covered is large and unexpected difficulties have also been encountered in the work.

The next important shell fish is the chank which is the subject of an important fishery in six southern districts. Some initial work on the anatomy, spawning, etc., of the chank has already been done by Mr. Hornell. The chief food of the chank, its seasonal migration if any, its age and its rate of growth are important for determining whether the chank beds are subject to depletion or are capable of further exploitation and whether the chank is susceptible to artificial culture for augmenting natural stock. All of this remain yet to be investigated at Krusadai Island.

(2) *Edible oyster.*—Next in importance is the edible oyster, *Ostrea madrasensis,* found everywhere in estuaries and backwaters, but, in large beds of economic importance, only in a few places like Pulicat, Sonapur, etc. Though shell fish is discarded by caste Hindus and Muhammadans, they are of value not only as sources of food-supply to other classes, but also as commercial products for an extensive export trade. Tinned oysters are considered delicacies and dessicated oysters are esteemed in Malaya and in China. The cultivation of oysters at Pulicat was suggested in 1907. A certain amount of preliminary investigation on the spawning, age and growth of the oyster was done in that year, but no culture was attempted. The research was taken up last year as an oyster famine occurred at Pulicat, partly due to destruction of the beds by a shell pit contractor and partly to adverse weather conditions. The eggs, early stages and conditions of salinity for breeding have been investigated by my Personal Assistant. Thorough or systematic work could not be done for want of time. This will constitute one of the first items of work for the Fisheries Biologist when appointed. A scheme to investigate possibilities of oyster trade with Calcutta by conserving the extensive oyster beds at Sonapur in the Ganjam district has been pending with Government for the last two years. There are numerous other molluscs of food value and economic importance for chunam burning; chief among them are the sea mussel *Mytilus,* the arc shell *Arca* and the clam *Meretrix* which enters into the dietary of the poor classes everywhere. Studies of these will be taken up as time and opportunity offers.

Cuttle fish and squids.—Fair numbers are caught and sold in the market everywhere. Extensive fisheries for these exist in Palk Bay and the Gulf of Mannar. Nothing is yet known regarding them.

Prawn and shrimp fisheries.—Extensive and highly valuable prawn fisheries exist all along the Coast both at sea and in estuaries and backwaters. Practically no attention has been paid to these. The prawn fishery of the Collair lake has been partly studied. It is worth some lakhs of rupees and lasts for a couple of months during South-West monsoon. These fisheries are subject

to great fluctuations which require investigation. From the little attention I have been able to devote to the Collair lake fishery, the prawns seem to congregate for breeding purposes and like the hilsa they are captured and destroyed during this period. Whether this is prejudicial to the fishery can be determined only by further research.

Crab fisheries.—The most important edible crab of Madras (*Scylla serrata*) occurs in sufficient numbers to provide a fishery only in a few estuaries. There is a complaint that this crab is dwindling in numbers in Pulicat lake through overfishing. The fishery has never been scientifically studied and nothing is known regarding the crab to enable measures to be concerted for its protection. From a few of my personal observations, it appears that the crab is admirably suited by its habits for intensive cultivation for the market. The other commercially important crabs are *Neptunus, Charybdis* and *Thalamita.* These in turn will require attention.

Turtle fisheries.—The sea turtles are abundant, at certain seasons in the Laccadives and in the islands off the Gulf of Mannar. Regular turtle fisheries exist in the Gulf of Mannar where the common green turtle is captured and sold as food and the rarer hawksbill, which yields the highly priced tortoise-shell, is netted occasionally. Unlike the Singhalese fishermen of Ceylon, the turtle fishermen of Pamban resort to the destructive method of killing the hawksbill outright for the sake of its shell. The flesh is poisonous and is consequently never used. The leathery turtle is also found on these islands and is captured almost exclusively for its oil. The industry is crude, and unnecessarily destructive. It is susceptible of great improvement, but before practical steps for reform are undertaken, biological studies on the habits, food, growth, etc., of these turtles are essential.

140. No.

141. My recommendations are embodied in answer to question 5.

142. There has been no definite policy and programme of research.

143. Yes. Please refer to answer to questions 2, 3 and 4.

144 & 145. The essential problem in the development of deep sea fishing is the determination of the type of net or other method suited to Indian conditions. We are yet to test the suitability of seine net, the trawl, the full-sized modern drift net, the American purse net, the long line and all available methods of exploitation. The question of the 100-fathom line is one which concerns trawling primarily and possibly the Danish seine net. There is no such limit known for drift netting or long lining. The Ratnagiri boats of the Bombay Coast have been known to go beyond the

100-fathom line fishing with the small-sized drift nets and hooks. The question whether we should exceed the 100-fathom line will only arise after we have tested all known methods of fishing and decided on those best adapted to Indian conditions.

146. Certainly. This has been one of the fundamental aims of the department from its inception.

147. A definite programme showing the research to be undertaken during the next ten years has been drawn up. The research staff and equipment necessary for the purpose is detailed partly in that programme and fully in answer to question 5 above.

149. Vide my answer to questions 2, 3 and 4.

150 & 151. Vide answer to questions 27 and 28.

152. Vide answer to question 149.

153. (*a*) Please *see* reply to question 149.

(*b*) She has just completed eight weeks of dredging with a view to discover pearl oysters within a depth beyond ten fathoms. The work is incomplete and is expected to be continued next year.

(*c*) The trawler has not so far done any research work connected with chank fisheries. This will be done when the research on chanks proposed at Krusadai is conducted.

154. Vide research programme referred to in answer to question 147.

155. The urgency of the line of research depends on the importance of the fisheries concerned. The most urgent lines are perhaps exploration of deep sea fishing grounds and sardine, mackerel and pearl fishery research. It must, however, be clearly understood that no specific research is feasible exclusively by itself ; a great deal of general research on fauna, plankton, currents, salinity, etc., is required for the elucidation of problems connected with the above items of research. The trawler should continuously make observations and collect samples for analysis and study while engaged in deep sea fishing or in sardine, mackerel or any other fishery research.

A—Research on Inland Fisheries.

156. Vide answer to question 75.

157. No. If any of these are to be dropped, it should be only for want of funds. The development of inland fisheries is an integral part of the Fisheries Department, especially as ice is costly and sea-fish cannot reach the interior districts except at hight cost. The bulk of the population are far removed from the sea and the

reach of fresh sea-fish. The most important fresh food-fishes are under investigation and I cannot think of any other line of research of greater importance.

158. Beyond the Assistant Inspectors and Sub-Assistant Inspectors in charge of the farms, there is no one at present in the inland section engaged in research work.

159. I would propose a headquarter laboratory and a qualified Assistant Biologist to engage on research on fresh-water fisheries, vide my answer to question 5.

B—Technological Research.

160. Both are equally important. Under existing conditions of the industry in India, technological research assumes greater importance than in advanced countries where initiative, capital and enterprise are available from the public. While it is unnecessary, for instance in England, for its Department of Fisheries to undertake fishing experiments or the manufacture of cured fish, oil, guano and the like, every branch of the industry from capture to marketing had to be investigated and pioneered in countries where the industry was backward and are required to be developed. I refer to the working of the Fisheries Department in Japan and Ireland and more recently in Canada, South Africa and Australia. In all countries biological research is of supreme importance and devolves almost entirely on a State Department of Fisheries.

161. There has been a concentration on administrative and revenue earning sections of the department to the utter neglect of the research side; barring four Research Assistants there is practically no research staff.

162. Vide answer to question 5.

163. Vide answer to question 14.

164. Vide answer to question 16.

165. The fishermen have *no method at present of* keeping fish fresh for any length of time. Their cruising distance and duration of voyage are therefore short. Larger boats with equipment for preservation of fish fresh alive in live cars or wells or by preservatives, such as ice, etc., will be necessary when larger catches further afield are contemplated. In Bengal, fishermen employ large bamboo cages in which they keep live fish. The provision of special carriers or boats for delivering catches at shore will also be necessary when fishing on a large scale. At Tellicherry and Calicut, there are such boats which are called Kolodams, but being only canoes they are not very serviceable. The captured fish are now thrown at the bottom of the boat without any attempt to shelter it from the sun or keep it from taint. Beheading, gutting

and cleaning of fish from blood, little addition of salt or rice will all contribute towards more hygienic and better quality of fish for the market.

166. (*a*) No research on oil-content has been done. An estimate, however, of the quantity of oil in sardines in various years is made at Tanur. This analysis shows that sardines vary enormously in their oil-contents from about 4 to 16 per cent.

(*b*) In the manufacture of oil, boiling and pressing have been introduced in the place of the old method of rotting. Refinement of oil consists of—

(1) Clarification (Removal of stearine).
(2) Filtration.
(3) Dehydration (Removal of water).
(4) Neutralisation (Removal of high acidity).
(5) Deodorisation (Removal of odour).
(6) Discolorisation (Removal of colour).

The complete refinement of fish-oil has not yet been accomplished.

The skimmed sardine oil has been sold as a substitute for cod-liver oil, but an analysis made by Professor Drummond and Professor Hjort of Kristiania shows that the oil has no vitamin A. The former suggests that the method of preparation is possibly causing this defect. The latter however states that vitamin A is naturally absent in the oil and there is the possibility of vitamin D being present. Further report on the oil from Professor Hjort is expected.

(*c*) The chief problem engaging the attention of the station with regard to the manufacture of fish meal is the unduly high percentage of fat in the meal. Fish meal from *podimeen* has a low oil content, viz., 4 per cent, and was sold at 4 annas a pound; but sardine fish meal which has a greater percentage of oil could be sold only for As. 1–6 a pound. New methods for the reduction of the oil content are under trial. The failure of the sardine season has necessarily handicapped experiments and research.

(*d*) Good fish-guano has been manufactured and the process has been taught to manufacturers on the coast.

(*e*) Hygienic methods of curing fish were the first that were tried in Tanur Station. These have now been introduced in the fish-curing yards. The defects from which cured fish suffer are—(1) "Pink eye," a type of mould, (2) "Rusting," a red discoloration after long storage due to a chemical change in the fat of the fish and (3) in the case of semi-dried prawns, a special product of the station, the formation after a time of a white excrescence. During the last three years, the Tanur Station has been specially investigating these problems. Harmless ingredients (turmeric, mustard, etc.) in imperceptible proportions of about 1 in 20 of salt have been noted as excellent preventives. More

recently, pickling mackerel in brine in closed barrels free from light and air has prevented pink eye and rusting completely for months on, and though an absolute remedy has not yet been discovered the fish were subsequently dried for sale as salt fish according to demand and fetched excellent prices. The occurrence of salt excrescence was found to be connected with the length of time for which the prawns were cooked. By limiting the cooking to an absolute minimum, the defect was found not to appear for a considerable time. Another remarkable preservative, sodium hypochlorite which is absolutely innocuous and turns into common salt on application to fish, still remains to be tried. Only a few preliminary experiments have so far been done with it.

(*f*) The possibility of canning sardines and other local fish in a variety of ways has been proved and canned goods of good quality has been placed on the market. There are, however, many problems incidental to canning in the tropics which require to be investigated. Some of the recent researches at the Cannery were—

(1) A comprehensive range of samples, from the packs of 1919–20 which was the oldest stock available and of subsequent years up to 1923–24 was scrutinized and tested. The oldest stock were found to stand all the known tests. The contents had a good taste except a faint smell of tin. This showed that the Chaliyam tins stored under tropical conditions can remain sound for at least five years. Select tins were examined chemically for dissolved tin by the Chemical Examiner to Government and his report showed that the amount of tin dissolved increased, as was expected with the age of the tin and that in the oldest tin analysed, the percentage of dissolved tin was not more than 0·02 per cent, a perfectly safe and harmless trace. In the history of the trade, no thoroughly authenticated case of tin poisoning resulting from canned foods is available. This is because the dissolved tin has been shown by various investigators to be so firmly absorbed in an insoluble form in the solid parts of the food as not to act poisonously. It is known that the minimum quantity of dissolved tin that may prove harmful is two grains to the pound, i.e., 0·035 per cent which is 75 per cent above the quantity (0·02 per cent) found in our oldest stock of tins. The process of detinning in tin fish was found to be 14·7 times as rapid in India (tropics) as in America (temperate zone). Judging from the rate of solution of tin in India, canned sardines would appear to be safe up to a maximum period of seven years in India, after which time they are apt to contain a sufficiently high percentage of dissolved tin, which may prove injurious to health.

(2) The problem of preventing rust in tins stored at a minimum of cost has been solved.

(3) An important defect in Malabar sardine, viz., hard bones, has been traced to the age of the fish ; if young fish are canned, the defect will be greatly reduced.

(*g*) No chemical except salt is employed in commercial curing in the Presidency. In the early experiments by the Department at Ennur and Tanur, Sir F. A. Nicholson experimented with a large number of preservatives such as Boric acid and the like. Recently in 1923, sodium benzoate was tried and proved useful. But at no time were these re-agents employed in actually curing fish for the market. Since the publication of the report by the British Department Committee on preservatives and colouring matter, further experiments have been made and the employment of chemical re-agents as preservatives has been discarded. There is, however, one chemical re-agent, electrolytic sodium hypochlorite, which is absolutely innocuous, while highly antiseptic in property as it is converted into common salt when it reacts on organic matter. A few experiments by Sir F. A. Nicholson at Ennur were successful. A small modern plant for the manufacture of this chemical has been purchased and experiments are now in progress. Sodium hypochlorite can keep fish from taint more or less in a fresh condition for some 48 hours even in the tropics, which will enable fresh fish being landed in a fresh condition and transported to the interior markets much farther than those within a radius of 20 miles. If all that is expected of this chemical is realized, the benefit that this method would confer on the fresh fish trade of this Presidency will be incalculable.

Some initial experiments in refrigeration conducted by the department in 1912–13 with ice and subsequently with a small ammonia brine-freezing plant, according to the Henderson method in 1915–16 at the Chaliyam Cannery, proved that the method could be adopted with success technically. Further experiment in that direction was stopped after the machine became unserviceable and Government have since been unable to provide funds for restarting the experiment.

C—Aquarium.

167. Yes. Properly equipped aquaria are absolutely essential for conducting research in marine biological stations and invariably form an integral part of such institutions wherever they have been established. The casual analysis of the problems relating to the living organism in its environment calls for exact knowledge of not only the studies, etc., of the animal concerned, but of the environing factors, such as heat, pressure, salinity, nature of food, etc., and the influence of each of these on the living animal could only be experimentally studied in aquarium. The well-known Marine Biological Stations at Plymouth, Port Erin, Hill Port, Naples, Heligoland, Morocco, to mention only a few out of nearly 100 biological stations in Europe, have public aquaria attached to them. This is because no study of living animals is possible without a properly equipped aquarium.

168. Yes. An aquarium will disclose the wonders of colour and form characteristic of the fauna and flora of the tropical Indian seas and will reveal a new world of life of never-failing interest and pleasure to the general public, both young and old alike.

169. Yes. The aquarium may be advantageously enlarged and the research side of the aquarium should be developed. The laboratory should be enlarged and fully equipped.

170. Yes. For the present, one at Rameswaram and another at Vizagapatam should be established.

SECTION XIII.—TRANSPORT.

Mr. J. L. P. Roche Victoria stated that the paths leading to most of the fishing villages on the East Coast were mostly sandy on which even bullock carts were unable to pass. He said there should be good means of communication for the improvement of the industry and that otherwise the cost of sending fish to inland markets would be prohibitive. He further suggested that Government should lay a good road from the Tuticorin Municipal limits to the pearl-fisheries camp—a distance of about three-fourths of a mile.

Rao Bahadur J. A. Fernandez stated that transport facilities were poor in this country. He had no doubt that more fish could reach the interior if there were good roads.

Mr. S. T. Moses stated that as fish was likely to taint quickly, speedy transport was necessary from fishing grounds to the markets. In his opinion fast vessels, good roads, quick conveyances, were the chief requirements.

Rao Bahadur Govindan wanted that the local bodies should construct metalled roads and foot-paths in fishing villages where there were no roads or even foot-paths. He stated that this was one of the most important items of work undertaken by the Irish Congested District Board in their efforts to improve the fishing industry. In his opinion, provision of special vehicles to be made on the railways in which fish could be carried with minimum amount of exposure would also help the trade.

Mr. M. Viswanath said that arrangements must be made with the railway to transport fresh fish for immediate consumption at least at a much cheaper rate than the existing rates.

Mr. Othenan stated that much difficulty and inconvenience are experienced by the fishermen in carrying their catches to the railway station for export. He wanted that this difficulty and the objection of the customs authorities to ship the produce direct from the factory should be removed.

In reply to questions 171 *&* 172, *Dr. B. Sundara Raj stated as follows:—*

171 & 172. The trade organization is so poor that there are no facilities for collection or speedy landing of fish and for its transport to interior markets except at a few important railway stations.

The development of motor bus traffic has, to a large extent, removed one of the difficulties.

The railways may be approached for concessional rates for cured fish, guano and other fish products. At present, only fresh fish is booked at half parcel rates. Again, the difficulties in securing steamer freights for fish and fish products are even greater than in the case of railways. Shipping firms have vested interests and flatly refuse to ship fish-oil or fish-manure except what they themselves purchase and transport. This has crippled the trade in these commodities to the detriment of the small-scale manufacturers and factory owners.

SECTION XIV.—SOCIO-ECONOMIC WORK.

Diwan Bahadur Arogyaswami Mudaliyar stated that something had been done by the department in the matter of co-operation. A certain number of Co-operative Societies had been started but the majority of them were mere loan societies and the borrowed amount had got to be returned within a few years. He suggested that loans on long terms repayable in twenty years should be advanced.

Mr. Gopala Menon stated that the Co-operative work thus far conducted was very limited and almost confined to afford credit facilities. He suggested that modification or development should be in the way of conducting societies for purchase and sale. He stated that no attempts had hitherto been made to organize societies for catching fish and for sale of fish caught and suggested that it was in this line that the combined attention of the Co-operative and Fisheries Departments and non-official workers was needed.

As for education, he said that the Fisheries Department had done something. He wanted that the curriculum for the fishery school ought to be written in a way that would interest the fisher-boys. If the work of the Fisheries Department is to be expanded, he would not object to co-operation and education being transferred to the Minister in charge of these subjects, but that he would insist at least on the Fisheries Department being allowed to inspect the institutions and see if the work was being conducted satisfactorily and the interests of the fisher-folk looked after.

Dr. Natesa Mudaliyar admitted that more co-operative societies for fishermen should be formed and money advanced to them for purchase of boats, etc. ; side by side he advocated sale societies, and suggested the appointment of a special staff under the control of the Fisheries Department to supervise these societies.

Mr. J. L. P. Roche Victoria was of opinion that, in all the Coastal districts, district officers should be appointed to see to the spread of education among fishermen and generally to look after the interests of fishermen. He considered that benefits were likely to accrue, if co-operative societies were managed by the Fisheries Department itself. He wanted that the fishermen co-operative societies already started or yet to be started should be placed directly under the control of the Fisheries Department because the Co-operative Department has got so much other work to do that it will not be able to give the necessary attention for this special work. He was of opinion that a co-operative society for sales would ameliorate their condition.

A modified system of education, he stated, is required for the fishermen community and that it should be controlled by the Fisheries Department.

He wanted that the system of opening separate schools for the fisher-boys on the West Coast should be extended to the East Coast.

Mr. M. C. Govindan stated that the fishery schools started by the department had done some good to the community and that the line chalked out by the department for improving the condition of the fishermen was quite suited to their wants. He was of opinion that the special department would care more for the fishermen than the Education Department.

Rao Bahadur J. A. Fernandez suggested that there should be a fishery officer of the grade of Inspector of Fisheries to supervise and promote thrift and co-operation and education among the fishermen. He was of opinion that the modified system of education for fisher-children should be directed and controlled by the Fisheries Department.

Rev. A. T. Coldman stated that fisher-children should have some education up to a point, but that he did not think higher education was necessary. He said that Fisheries Schools were meeting a real need. He thought that a department like the Fisheries was the best one to look after the economic welfare of the fishermen and that it should undertake work of this sort or should contribute towards the welfare-work that he was carrying out. He suggested that the Fisheries Department should run a co-operative society for improving the economic condition of the fishermen at Calicut.

Mr. S. T. Moses stated that a modified system of education as devised by the Fisheries Department and recently perfected by the present Director for fisher-children was required and that it should be directed and controlled by the Fisheries Department. He was of opinion that the fishery industry had developed sufficiently to require technological instruction and training of apprentices in the several branches of the industry and suggested that the establishment of a technological institute to do this work was necessary and that it might be combined with advantage with the existing Teachers Training Institute at Calicut.

Mr. Soma Marakala wanted that, in order that the department might win the love and confidence of the fisher-folk, it must make it a policy to recruit its servants, teachers and officers, as much as possible, from the fisher-folk only.

Mr. M. P. Krishnan wanted more of credit societies for advancing money to fishermen for the purchase of boats and nets. He considered that there should further be a co-operative organization for the purchase and disposal of fish and its products. He thought a modified system of education was required for the fishermen community and suggested that vocational education should be given prominence.

Mr. R. Suryanarayana Rao stated that, if co-operative societies were to be really helpful to fishermen, the Government should come forward to advance loans to societies on easy terms. He suggested the grant of further loans on the same lines as they did to the two societies (at Blangad and Palapatti) for the clearance of prior debts of members, for maintenance during the non-fishing season and for the purchase of nets and boats.

He wanted that the policy of the department should be to raise as many Lower Elementary Schools as possible into Higher Elementary Schools where more about fisheries could be taught as vocational education and practical work also could be done by the pupils. He wanted that the department should not grudge to appoint more teachers, even one for each class, without proceeding on the basis of one teacher for forty boys. He urged the need for creating a socio-economic section in the Fisheries Department.

Mr. J. A. Saldanha wanted that the schools should be under the Fisheries Department. He stated that as long as India was caste-ridden, education of the fishermen, as a caste, was essential. He was of opinion that the schools should be along the coast and not in the interior and that the boys should be trained from the very beginning in fishing.

Rao Bahadur Govindan stated that people should have more training in the management of credit societies, before undertaking non-credit work. He suggested that the statutory control of these societies should be in the hands of the Co-operative Department and they should be held responsible for the proper working of

these societies while the fishery officers, such of them as take a special interest in the welfare of the fisher-folk, might be appointed as honorary visitors of these societies. He considered it to be a great mistake to grant bounties, but suggested the grant of loans on easier terms to societies that had been working satisfactorily. He was of opinion, that the work of the Fisheries Department with Co-operative Societies should be extended to the East Coast as that coast being more backward required greater attention being paid to it. Since the improvement of the condition of the fishermen by the organization of Co-operative Societies, schools and other social welfare work required experienced and patient workers whom the Fisheries Department does not at present possess, he said that it would be necessary to urge on the Labour Department to take up the work. So far as the elementary education was concerned, Mr. Govindan said there was no need for any modifications in the ordinary subjects except in Manual training and Object lessons. It was desirable to introduce such subjects as would enable them to make use of the knowledge in their profession. He suggested the desirability of transferring the management of the schools to the Education Department. He wanted that schools for elementary education should be opened in the fishing villages of the East Coast without the least delay.

As a separate fisheries training school was out of the question for want of properly qualified teachers to train the pupil teachers in Fisheries knowledge, Mr. Govindan stated that it was necessary to put the selected pupils drawn from the fishermen communities in the ordinary normal training schools and after they passed out, place them under the officers of the Fisheries Department so that they might see and understand the various branches of work carried on by the department.

Mr. Annayya stated that a modified system of education introducing industrial education suited to their profession would be, in his opinion, more useful.

Mr. M. Giriappa stated that there were 6 non-credit and 57 credit fishermen societies. He said that, owing to lack of intensive supervision, the non-credit thrift societies are in a bad condition. He was of opinion that there should be an agency to see that every pie of the savings of the fishermen was snatched away from them during summer and that the agencies or rather the societies should stock rice and other things and sell them cheap during winter especially. He therefore recommended Government societies instead of union societies. He suggested the reduction of interest on loans to societies from $7\frac{1}{2}$ to $6\frac{1}{2}$ per cent. He was not in favour of any society of the type of rural societies and strongly deprecated any attempt to give loans on cash, because as a class the fishermen were sure to fritter away money. He stated that, in the case of

one or two societies, the Fisheries Department did take interest and the societies did improve. He was therefore hopeful that the Fisheries Department could improve these societies.

He felt that there was considerable difference between teaching at home by parents and teaching at schools. He considered the fisheries bias to be of primary importance to fishermen. He wanted that teachers should be trained and after that, they should go and disseminate their knowledge in the fisher villages. If these teachers are trained in the ordinary schools, he stated they would not have the same sympathy towards the fisher-folk.

Mr. Othenan wanted that the socio-economic work should be directed towards the improvement of the health, wealth and education of the people. He suggested that co-operative societies should redeem the existing debts of the fishermen and enforce payment of the loans during heavy catches. He stated that the co-operative societies started in some of the fish-curing yards were doing valuable service. He was of opinion that the appointment of a few honorary socio-economic workers of the fishermen caste will greatly improve the socio-economic condition of the fishermen. He said that, with the opening of fishery elementary schools in fishing villages and the fishermen coming in contact with educated officers of the Fisheries Department, an awakening for education was visible among fishermen and that the elementary schools opened by the Fisheries Department were helping the spread of elementary education a good deal. He suggested that, before the shipments of guano are made, the Government should see that the samples are examined by experts to safeguard against adulteration and also make other arrangements to protect the industry.

Mr. E. Raman Menon attributed the decline in the working of the fishermen co-operative societies to lack of intense and efficient supervision. He strongly recommended that a large number of local supervising unions should be organized among the fishermen societies. He advocated the appointment of a separate officer for the socio-economic work, as the present system of Fisheries Inspectors supervising the work of the fish-curing yards and co-operative societies had not been found satisfactory. He said that he was convinced that the credit type of society was the best for the vast majority of the fishing population. He wanted that the activities of the Fisheries and Co-operative Departments with reference to fishermen societies should be more clearly defined. He suggested that the annual audit might remain with the Co-operative officials but that the organization and supervision might be done by the socio-economic officials of the Fisheries Department, working chiefly through the non-officials, paid as well as honorary. He advocated the grant of loans to producers' societies of fishermen by Government; but, if the Government had any apprehensions that the risks would be too great, he suggested that the local unions might be organized not merely as

supervising unions, but also as what was known as guaranteeing unions. He was of opinion that the Labour Department could not be in much intimate touch with fishermen as the Fisheries Department would necessarily be. The Co-operative Societies and Schools he considered would be the chief means of popularising the results of the technological researches made by the department and that if the societies and schools are under the control of the Labour Department, opportunities for such industrial improvement will be altogether lost.

He was of opinion that the (specialised fisheries) schools should be directed and controlled by the Fisheries Department. He strongly urged that the elementary schools which are now run by taluk boards or municipalities in rural or urban areas occupied by fishermen should be handed over to the Fisheries Department.

Mr. Karunakara Menon said that he could, with the help of Inspectors, afford the necessary time to supervise the societies in addition to his present duties. He said he would disaffiliate fishermen co-operative societies from local unions altogether, and have them audited by the Co-operative Department as usual, but arrange for all other supervision and control by the Fisheries Department. The ordinary fisherman is distinctly conservative and there is some difficulty in persuading him to adopt new methods and therefore he stated that, if the fisheries schools were under the Fisheries Department, their influence over the boys was likely to help them in persuading these boys as they grew older to try new methods.

Rao Bahadur Cruz Fernandez stated that the Fisheries Department had hitherto continued its activities to the West Coast alone and had been successful in establishing a good number of societies with the help of the Co-operative Department in spite of the conservatism and suspicion of the fisher-folk. He complained that the East Coast had been completely ignored. He wanted a special section of the Co-operative Department to be created to promote and organize co-operative movement among the fisher-folk in the East and West Coasts. He was of opinion that the education of fisher-children should be directed and controlled by the Education Department. He made the following recommendations :—

(1) Practical training should be given in net-making.
(2) Fishermen should be employed as teachers.
(3) Each school may be provided with a fishing boat and gear for practical training.

In reply to questions 173 *to* 195, *Dr. B. Sundara Raj stated as follows :—*

A—Co-operation.

173. *Co-operation.*—Probably there is no community or class in India which needs more but appreciates less the benefits of co-operation, than the fishing classes of the Presidency. Their

deplorable economic condition has been described in a previous paragraph. Though a large community, they do not thrive as well as they might, because the profits of the calling are uncertain, and occasionally it so happens that catches are very meagre for two or three years in succession. A good fishing season lasts for about nine months in a year, and no fishing is carried on during the monsoons. The profits made in a good season would certainly be sufficient to carry the fisherman and his family over the non-fishing months, but, by a long-standing habit, probably confirmed in the course of 2,000 years or more, the fishermen do not save. During the fishing months, they spend all that they earn ; and for the remaining months they are content to borrow from the middlemen who, of course, appropriate, in lieu of principal and interest, the lion's share of the next season's catch. The result is that the fishermen, in the course of a very few years, have to surrender their boats and nets to the middlemen whose servants they then become.

For these and other reasons unusual difficulties are experienced in the formation and working of co-operative societies among fishermen. Very few of them possess any immovable property. Their entire worldly belongings of any value consist, in most cases, of their boats and nets (often not even this) and their physical labour. As these are not recognized as assets on the security of which banks could advance loans, the fishermen co-operative societies have found it impossible to raise loans from the District and Urban Banks for the formation of their initial working capital. Until as recently as 1926, everyone of these societies had to provide their own working capital by means of share capital accumulated by monthly contribution from the members. To a people naturally averse to thrifty and saving habits, the compulsory saving necessitated by this condition, has served as a deterrent to their combining into co-operative organizations. Further, as the fishermen are out for fishing in the sea most of the day and often till late at night, the ordinary officers of the co-operative department and even the unofficial co-operative union, are unable to get into touch with them for the conduct of co-operative work among them, nor are they able, owing to the same reason, to maintain effective supervision over societies already formed. Officers of the co-operative department and union supervisors are handicapped, because they have to travel far from their normal field of work to inspect fishermen co-operative societies whose members live on the sea-shore and who can be got only at very inconvenient hours. The inspecting officers have to wait indefinitely for fishermen who have gone to sea to come back, and when they do come back they are so tired that they are seldom able to render any help to the inspecting officers. Further, supervisors are generally of higher caste than fishermen and have no facility for staying in a fishing village. Thus the inspecting agents of the Co-operative

Department have neither the inclination nor facilities for working the fishermen societies. Very little progress was therefore made in co-operative work among fishermen till about the year 1914, when the officers of the Fisheries Department at the instance of, and in collaboration with, the Co-operative Department began actively to interest themselves in the work.

There has been a steady increase in the number of special societies for fishermen since then. At the end of June 1927, the number of such societies totalled 80 for the Presidency. The work of keeping a society functioning, after it has been formed, has been the hardest task of all. The fishermen are ever-ready to take out loans ; but the loans are not repaid when due, and the instalments accumulate. Some societies have already become defunct. For the reasons stated, the regular co-operative supervising and inspecting staff was unable to do anything to improve their condition. The Fishery Officers that were available in the years previous to 1917, were so few in number that they could make but little impression on the work that had to be done. From 1917, however, when the Fisheries Department took over a few of the fish-curing yards, and with them the staff of those yards, the officers in charge of these yards were utilized to help in the management of the societies and the collection of arrears ; and things began to improve. From 1919 with the opening of fishery elementary schools, the staff of these schools also helped in forming and supervising fishermen co-operative societies. When in 1924, the rest of the yards in the Presidency came under the control of the department, the agency for carrying out such work was greatly strengthened, with strikingly beneficial results on the co-operative work among fishermen. The fishery officers in charge of the yards who are always present in the village, are just the persons who will always know when large catches are landed there and by whom ; for the arrival of fish has to be notified to the yard officers instantly, so that they might be in readiness to issue salt for curing before the fish turn bad. These officers also know the catches made in the neighbourhood as they have been assigned the duty of collecting statistics of landing even beyond the limits of their village. In 1924–25, in consultation with the Assistant Registrar of Co-operative Societies, South Kanara, a system of group examiners was tried and 13 societies were brought under it. The group examiners were found not to have sufficient influence to improve the condition of the societies. The co-operative society in the Ponnani taluk appealed to District Co-operative Bank for the organization of a union for the better supervision of fishermen co-operative societies. The idea did not appeal to the bank as the supervision funds collected from fishermen co-operative societies would not enable the District Co-operative Bank or a local union to pay for a Supervisor. It was conceded that fishermen societies cannot be improved, unless there is more intensive supervision than that

which a local or district co-operative union can afford. The only solution was, therefore, to entrust the work of the supervision to the Fisheries Department. The findings of the Committee on Co-operation in Madras this year are also to the effect, that the Fisheries Department should be responsible for all fishermen societies in districts where that department is sufficiently organized to undertake that responsibility, and that the Special Inspectors allotted for the societies should work under it. In districts where this is not the case, the societies should continue under the Labour Department, until the Fisheries Department, is in a position to undertake their supervision. In recognition of the fact that Fishery officers are in the best position to supervise co-operative work among fishermen, the Inspectors of Fisheries on the West Coast have been invested with powers to inspect the books of the societies. And recently the Assistant Director (Coast) has been invested with powers under sections 17 (3), 35, 36 and 37 of the Co-operative Societies Act and under rules viii-A and xiv of the rules framed under section 43 of the Act. The reorganization of the fish-curing yards now under the consideration of Government would, if sanctioned, enable the department to exercise still closer supervision over the work of fishermen co-operative societies.

Several societies have already been rescued from a state of collapse, and put on a satisfactory footing, by the exertions of the Fishery officers. Some societies continue to exist solely owing to the encouragement and supervision given by these officers. The slightest relaxation of departmental supervision has produced neglect and mismanagement. On the other hand, some societies have reached such a strong position as to have become independent of further departmental help of any kind. There is still a great deal to be done towards restoring the old societies and forming new ones, which cannot be dealt with owing to the limited staff of fishery officers available and the small amount of time that they can spare from their more immediate duties.

Apart from the work of supervision and the staff for it, efforts are necessary to wean the fishermen from the thraldom of middlemen capitalists by granting loans on the securities of their boats and nets. In 1926, at the instance of this department, the Government started a new form of direct help to fishermen by giving two new societies, formed for the purpose, a loan of Rs. 1,500 each to buy a set of fishing equipment, on the condition that the working of these societies is closely supervised by the Fisheries Department. This has helped to remove another outstanding difficulty, viz., that of financing fishermen co-operative societies which possess no assets recognized by the banks. The security for the loan is the fishing boats and nets purchased with the loan. The Government have allowed the societies in question to repay the loan in small instalments from the profits made by fishing conducted with these boats and nets. This is yet another

reason why the Fisheries Department should supervise co-operation among fishermen. Already the societies have paid back 30 per cent of the loan.

174. As explained the two difficulties are—(1) want of close supervision which the officers of the Fisheries Department alone seem capable of exercising ; either the Fisheries Department should be so strengthened as to enable close supervision of the fishermen society as proposed by the Committee on Co-operation or a staff of special Inspectors allotted to these societies should be made to work under the Fisheries Department ; (2) the second difficulty is the need for funds. Credit societies do not seem to help the fishermen from experience so far gathered. The only method is for Government to advance special loans as they have done in the case of two societies. If this is done, close supervision by the Fisheries Department is necessary to see that these societies work.

175. Considerable benefit has accrued. Vide answer to question 173.

176. Vide answer to question 174.

177. (*a*) & (*b*) & 178. In 1923–24, two joint purchase and sale societies of fish-curers and one wholesale society at Mangalore for fish-oil and guano were organized. The societies for the joint purchase and sale of fish have not been working satisfactorily. But last year, one of those societies, the Thalayi fish-curers' society revived and did good work when the Sub-Inspector of the yard began to interest himself in the working of the society. Another society, the Cannanore Women curers' society made a joint purchase and sale of rice during a time of distress in 1925. Two societies for joint fishing were started in 1927 with the aid of loans advanced by Government. Already within a year they have paid back 30 per cent of the loan granted to them, due to constant supervision exercised by the officers of the Fisheries Department.

179. I consider that societies of these two types are the best for fishermen and more societies should be formed.

180. Yes. Advances, bounties and subsidies are essential for the promotion of co-operative effort among fishermen—vide answer to question 174. Even in the most advanced Western countries, financial assistance is given to fisheries. To cite a few examples—

In 1889, in Norway to assist fishermen to purchase boats and gear a loan fund was formed, Government contributing Kr. 2,00,000 which was subsequently increased to Kr. 39,50,000 (about Rs. 29,62,500). In 1919, a Government Fisheries Bank was established for granting loans to fishermen's associations or co-operative institutions for the purpose of treating fish and selling fishery products. The funds of the bank amount to 5 millions Kroner (about Rs. 37,50,000) with a reserve fund of Kr. 7,50,000 (about Rs. 5,62,500).

In Denmark, financial assistance to Fishermen is given in two ways—(1) as direct loans amounting to Kr. 3,00,000 (about Rs. 2,25,000) and (2) as loans through the agency of co-operative associations amounting to Kr. 2,00,000 (about Rs. 1,50,000).

In Canada, by an Act of 1882, a provision of $1,50,000 has been made for distribution among many fishermen and the owners of fishing boats for the development of the sea fisheries and in the encouragement of boat building. In 1924, the total of the bounties amounted to $1,59,826 which is equal to about Rs. 4,39,384.

181. Yes. Though a few societies have also been, at suitable centres, organized on the East Coast for taking on lease fresh-water fisheries hitherto auctioned to highest bidders, usually middlemen work these fisheries through fishermen on scanty wages and pocket the profits.

182. Yes. The whole of the socio-economic activities on the East Coast now under the control of the Labour Department may be transferred to the Fisheries Department as this department has better staff and machinery for such work. There has been also numerous complaints from East Coast fishermen that their welfare is not attended to by the Fisheries Department.

B—Education.

183. At the inception of the department, its first and chief object of investigation and effort was naturally the development of fisheries as a source of food. Very soon it became obvious that, in developing the fishing industry for the benefit of the consumer, an essential consideration in the present condition of India was the producer. Not merely does the development ultimately rest with him under the peculiar caste system prevalent in India, but his welfare is just as important as that of the consumer. It was felt that it was not an absolutely new industry that was to be introduced to which anyone in the country may, and will resort, but the development of an ancient and indigenous one employing vast numbers of people, forming an exclusive caste, with immemorial interest and customs, who ought to develop in the same proportion as the industry, in status, intelligence, independence and wealth. In the words of Sir F. A. Nicholson "The fisher-folk on both the coasts are in general at a very low stage of intellectual, social and economic development ; their calling is despised largely by reason of the character of the material and products in which they deal and the consequent condition of their houses and hamlets ; they are, as a class, very poor, deeply in debt, in most places so controlled or exploited by middlemen, curers and money-lenders as to be almost serfs ; *sic vos non vobis lanificalis oves* and like the 'silly sheep' they cannot stir on their own behalf ; they are among the most utterly ignorant classes of the Presidency having in

general neither schools nor teachers, while their absence day and night at sea places them largely out of touch with the rest of the population with current ideas improvident, partly because of their poverty and hopelessness, partly by hereditary custom based on the fact that what the sea gives them to-day it will probably give to-morrow ; partly, because there is no means whatever of putting by savings or windfalls, such as often happen in lucky seasons ; intemperate partly because of their calling, partly from ignorance ; partly again, from hereditary custom which refuses to allow a son to despise or depart from even the weakness and vicious habits of his father, partly from the absence of recreations and outside rational or civilized interests or pleasures ; as the Assistant Director says the toddy shop is often 'the nearest sign of civilized life' and, in fact, it is too often at or near the toddy shop that their village consultations are held. Their position is totally different from that of an agricultural village with its mingling of castes and classes, with its village head and other officials of standing, with its schools and shops and trade and market and often its post office and savings bank, with its long-standing communal life and often its ancient co-operative interests as in the common management of its irrigation works, its temple and other items of village interest, or its share in the stir of life as one of a series of similar and continuous units in a union, taluk or district. The fishing hamlets mostly consist of a set of dirty huts, set in foul surroundings, inhabited by an ignorant set of people, without internal or external interests except the daily capture and sale of fish, without guides or teachers for almost all are on a similar level of ignorance ; without public-spirited men either within or without their own community to help them ; of interest to big men only as subjects of exploitation."

This is the reason why general education and influence of village schools had not perceptibly touched the fishermen of this Presidency and a new system and agency for education, specially designed to meet their needs and condition, had to be arranged *de novo*.

The first efforts of the department were necessarily of an informal and unsystematic character. From 1910, one of the Assistants of the Honorary Director of Fisheries who was himself a member of the fishing community, began the work of impressing on the members of the community, by informal talks and private conversations, the necessity and benefits of co-operative action, abstention from liquor, etc. He found the germ of co-operation in a society in Mangalore and helped to develop it. An indigenous temperance society at Malpe in the South Kanara district formed the starting point for temperance work in that district. A special fisheries school was also started in 1913 at Tanur. Gradually the number of co-operative societies, schools and temperance societies started under the auspices of the department increased. But the work was still carried on in a small and unmethodic manner.

Between 1917 and 1919, Sir F. A. Nicholson submitted to Government comprehensive schemes to establish special fishermen schools at every important fishing centre, to start co-operative societies and conduct propaganda against habits of intemperance, of extravagance and prejudices that have stood in the way of the progress of the community.

The proposals were that Government permit this department to organize the development of the fisher-folk as a primary duty of a special department—

(1) by the stimulation of co-operative societies on the basis found most advisable ;

(2) by utilizing such societies when necessary, as channels for Government loans ; and

(3) by training each year successive series of educated young men to live among the people in their villages, in order to be the right hands of the department, (*a*) in organizing co-operative, economic and social societies ; (*b*) in inculcating thrift, temperance, self-help, in serving as advisers and arbiters in cases of difficulty ; (*c*) in inquiring into the conditions of indebtedness, etc., of the villagers and assisting Government in combating or removing such indebtedness ; (*d*) in ascertaining the need and security for loans ; and (*e*) in establishing and teaching schools specially suited by hours and subjects to the fisher-children.

All fisher-boys above a certain tender age work on the boats or are in attendance on the men on the beach, etc. ; if the boats go to sea in the early morning, the boys will not be home till the afternoon, or if only in attendance on the beach, the boys will have to be there in the afternoon. If the boats are out all night, the boys coming back from the sea, will be too tired for the morning school and the others will be in attendance on the beach in the afternoon. Hence most unusual and irregular hours will have to be adopted in the schools which the fisher-children attend. The hours will vary according to the time of the month (bright or dark fortnight) or according to the season, the class of fish available, etc.

The course of studies in fishery schools should also be of a special kind in some respects and should be closely connected with the industry, for they will have no background of reality for the children unless they have special application to the condition and circumstances of their lives, their parents and their immediate work. The object should be to make them better fishermen, more intelligent, more adaptive, capable of understanding and applying better methods of fishing and handling fish and better able to keep to themselves the major portion of the profits from the fish industry which now go to outsiders. As they live in foul and loathsome surroundings and deal in putrescible matter, they should possess special knowledge of hygiene and sanitation. Thrift and elementary social science should be taught, because of all classes they are the most unthrifty and intemperate.

As a first step towards the starting of special schools for fishermen on a large scale, the Government sanctioned in 1919 the opening of a Training institute at Calicut for the training of special school masters. Simultaneously the starting of four day and four night schools were also sanctioned.

In addition to the curriculum followed in ordinary training schools, the pupil-teachers receive at the Fisheries Training Institute special technical instruction in fisheries and fishery science in all its branches comprising a history of the industry, a general account of the fish and fisheries of the world ; some account of the little we yet know of South Indian food-fish, their habits, life-history, food, abundance, economic importance, etc., oceanography of the oceans generally and of the Arabian Sea and the Bay of Bengal in particular ; an account of fishing craft and tackle, their origin and design including details of modern development ; a survey of fish industries, especially with the principles and practice of fish-curing, canning, refrigeration, manufacture of fish oil, guano and fish meal and other minor marine products ; elements of navigation and seamanship, such as use of the mariner's compass, barometers, signalling, stearing, sailing, taking cross-bearings, testing depths and bottom and the like ; and elementary biology and nature-study with emphasis on fish and animals of economic importance in the sea and fresh-water. On the practical side, they are given actual training in working and sailing different kinds of boats, in making and repairing canoes, oars and other appurtenances, in spinning and net-making, in the use of nets, lines, etc., in catching, curing and canning fish and the manufacture of fish-oil, etc., at Tanur and Chaliyam besides a series of practical exercises in improved methods of cure in the model shed provided for them in the Calicut fish-curing yard. They are also taught organizing and managing fishermen co-operative societies, hygiene, sanitation and first aid. A detailed syllabus of special studies in fishery technique for the Fisheries Training Institute was drawn up for the guidance of the staff last year.

In the fishery elementary schools for children of tender age, the object is not technical education, but to adapt the whole course of general instruction in the 3 R's, nature-study, etc., to their requirements, and correlate it to life in fishing villages and to the industry. As Sir F. A. Nicholson has said "The education should be directed to awakening their minds rather than to attempting industrial teaching."

The courses of study in the fishery elementary schools are—
(*a*) the compulsory subjects as per rules made under the Elementary Education Act—

1. The three R's,
2. Drawing,
3. Nature-study,
4. Manual work,
5. Physical training ;

(*b*) optional subjects not insisted on by the rules made under the Education Act—

1. English.
2. Civics.

Nature-study as applied to fisheries is taught and includes the elements of physics, chemistry, physical geography relating to the sea, meteorology, a study of the common objects of the sea with special emphasis on fish and other economic products suited to the age and intelligence of the pupils. The pupils are made familiar with the kinds of marketable fish, etc., and are given facts and figures concerning them, their importance, economic value and the uses to which they are put. In other words, this part of the course is no other than nature-study, such as is taught in other schools, but with special application to the sea and fisheries. Manual training includes net-making and carpentry to which will shortly be added refining of salt, simple curing of fish (such as beheading, scaling, gutting, washing, salting, drying, etc., specially emphasised in the case of girls), barking and tanning of nets, preparation of fish manure, demostic gardening, knotting and splicing, preparation of rigging and sail, the elements of signalling and the like. English is taught in some of the schools. Civics includes lessons on co-operation, sanitation, temperance and history intended to help the pupils to understand the main facts in existing social and political institutions and conditions.

184. Vide answer to question 183.

185. The aims with which the whole scheme of fishery education was originally conceived and the schools organized, could only be achieved by special schools manned wholly by specially trained teachers under the control of, and in constant touch with, the department. It may be that these schools have fallen short of the ideal and that the courses of instruction therein have not reached a standard of perfection. This is largely because the Fisheries Training Institute has existed only for the last eight years and the fisheries schools are not yet fully manned by teachers trained there. The curriculum of studies at the Fisheries Training Institute also has not been the best that could be devised and has recently undergone through revision. But the benefits that the fisherfolk on the West Coast have derived in the matter of education and enlightenment alone, since the inception of fishery education, bear ample testimony to the value of the whole scheme. The appointment of isolated teachers in board and other schools under the control of non-technical agencies and out of touch with the developments of the department, while probably involving nearly if not quite as much expenditure as regular fishery schools, will, I fear, defeat the aims of fishery education : at any rate, I

am confident that the marked progress in the matter of education among fishermen now seen on the West Coast could never have been achieved by any other agency.

The arrangement hitherto followed seems to be the most efficient and economical. Any other arrangement, if it should meet all requirements, is bound to be needlessly costly and is bound to duplicate staff and work of the Fisheries Department.

186. Thirty day schools and four night schools.

187. So great is the appreciation of the special educational work of the department that there is a constant demand for more fisheries schools from almost all fishing villages of consequence. Lack of funds alone prevents compliance with these demands as well as a more rapid progress in this essential method of elevating the condition of the fishing people. The indirect benefits of education have exceeded expectation. Thrift, co-operation, progressive ideas, realisation of their rights and privileges and desire to elevate and educate themselves have produced an upheaval among at least the young generation of fishermen on the West Coast and one sees on all sides the formation of societies for the promotion of education, temperance, thrift and self-help. This is not the case on the East Coast.

188. Yes.

189. Yes. The East Coast fishermen have urged for fishery schools to be opened on the East Coast by the Fisheries Department. In 1921, as the Fisheries Department had no staff on the East Coast, Mr. Hornell arranged with the Labour Department for the conduct of socio-economic work among East Coast fishermen. But the Labour Department has a limited staff and very little work appears to have been done among fishermen. The fishermen are not a depressed class actually coming under the care of the Labour Department. The Labour officers have neither the technical knowledge nor facilities to serve the peculiar needs of the fishing community. The Labour Department have to train their teachers at the Fisheries Training Institute and so far not a single teacher has been sent by them. Since the transfer of the East Coast fish-curing yards, the Fisheries Department has acquired a greater staff than the Labour Department has, in fishing villages of the coast. For units of purpose and policy, I have suggested that the socio-economic work among fishermen may be transferred to the Fisheries Department. The matter is under the consideration of Government.

190. (*a*) The curriculum and the time-table are at present drawn up by headmasters of the various schools, revised by the headmaster of the Fisheries Training Institute and approved by the

Deputy Inspector of Schools of the range in which the schools are situated as required by rule 13 of the rules made by Government under section 41 (1) of the Madras Elementary Education Act, 1920. I am revising and bringing up-to-date the curriculum and studies at the Fisheries Training Institute and Elementary schools. When the revision is over, it will be introduced in all the Fisheries elementary schools on the West Coast. Obviously it is impossible to have a common time-table because conditions in different schools differ. One school may require one teacher for each class, while for another one teacher for two or even more classes may suffice.

A pupil educated in a Fisheries school is by no means handicapped for work outside his caste occupation. The schools are duly recognized by the District Educational Councils as elementary schools. The pupils receive the grounding in the principles of the various subjects prescribed by rules framed under the Elementary Education Act. Only the illustrations used in Fisheries schools relate to the life and occupation of fishermen. As a matter of fact, many pupils who studied up to the IV or V standard in Fishery schools have joined ordinary schools for higher education and they do not feel any difficulty on account of their earlier education having been devoted more or less to special fisheries topics. The abstract principles are the same; only the concrete presentation differs. The advantages of using a concrete presentation that is familiar to the pupils is that their attention is easily attracted, that the facts (and hence the principles) impress themselves on the memory more deeply, that the pupils recognize easily the practical utility of attending schools, that a school course making use of fishery illustrations prevents the tendency to divorce the youths from their ancestral occupations and finally —and most important of all—that for the great majority of pupils, i.e., all those who actually take to fishing for livelihood in their later life, the information gathered at school is of direct value.

So far thirty day schools and four night schools have been opened by the department. Two of the schools are of the Higher Elementary grade. At the end of 1926–27, 2,440 children were attending these schools, of whom 703 were girls. The education given is *free*, and the poor children are supplied with books and slates *gratis*. Many of the teachers belong to the fishing community and the proportion is being steadily increased.

Similar work among the East Coast fishermen has hitherto been done by the Labour Department, but owing to a widespread desire on the part of the East Coast fishermen that the Fisheries Department should take over the socio-economic work among them, particularly education, the question of transferring the work to the Fisheries Department is being considered by the Government.

(*b*) The Government recently have been sanctioning only as few teachers as possible. The rule says :—"that there should be at least one regular teacher for every 40 pupils on the rolls and that it is very desirable that there should be a teacher for every 30 pupils." According to a Government Order of 1923, if the management employs one teacher for every 20 pupils in standard I, there is no objection to this course provided that the work and progress seen at the inspection justifies the employment of the additional staff, and still, additional teachers are not sanctioned if the excess over the prescribed number of pupils is small. This prevents the school from admitting as many pupils as seek admission and also militates against the efficiency. A more liberal policy, I recommend, should be pursued in sanctioning staff.

The headmaster of the Fisheries Training Institute has been on the scale of Rs. 75—150 for the last eight years and is naturally very disheartened. The scale in similar institutions elsewhere is Rs. 75—250 and the same scale, if granted, will enable the department to retain the headmaster's services. He has been specially instructed in courses given by the Fisheries Training Institute and it is not easy or convenient to replace him at short notice. The conduct and abilities of the present headmaster are extremely satisfactory and I recommend that every effort should be made to retain him.

For the proper technological instruction both to advanced students or apprentices in special branches of the industry and for training recruits to the department, the courses of studies will have to be supervised, amended and revised by the expert staff of the department. These will also form the Board of Examiners.

(*c*) The Fisheries Training Institute at Calicut is the only institution existing now ; it is far from being well equipped. If it is to be well provided with apparatus and fittings for instruction in various branches of the industry, an additional capital investment of at least Rs. 9,000 is required. I have submitted a scheme to Government for the investment of annual instalments as follows :—

		Rs.
1928–29.	A demonstration cannery, curing and oil and guano plant and construction of shed for same	3,000
	Extension of the present Scouts' room for stores and net	2,000
	Construction of a Museum hall with fittings and library	2,000
1929–30.	Construction of a small stone-built tank for students to study pond life	2,000
		9,000

Some important courses of studies in the new curriculum have not yet been started for want of equipment. If education for the fisher-folk of the East and West Coasts is to be conducted efficiently, three more training institutions for teachers, apprentices and recruits will be required, viz., one at Mangalore for Kanarese students, one at Madras for Tamil students and one at Vizagapatam for Andhra students. Proposals for the Fisheries Training Institutes at Mangalore and Vizagapatam, have already been submitted to Government and a site for the Madras Fisheries Training Institute has been proposed.

(*d*) Vide answers to (*b*) and (*c*) above.

191. Yes. Waiting on the fisher-community to sufficiently develop their industry and demand for training would not lead to any result in reasonable time. The method adopted is to enlighten the fisher-folk by elementary technical training so that they themselves will realize the need for more advanced training. Last year, the fishermen of South Kanara memorialized the Minister for a separate Fisheries Training Institute at Mangalore not merely for training teachers for elementary schools, but to impart technical instruction in special branches of the industry to youths and adults actually engaged in fishing and possessing special aptitude for such training. This is a direct result and a natural development of the working of the Fisheries Elementary Schools in the district.

I have proposed the establishment of a technological school at a capital cost of about Rs. 4,000 and a recurring cost of Rs. 9,338 which will provide not merely training for pupil teachers for elementary schools in South Kanara, but also training in special branches of the industry to fisher-youths and adults engaged in fishing. To be properly equipped, however, a final investment of at least Rs. 15,000 will be required for apparatus and fittings. The fishermen are willing to meet half the cost of technological courses and I have suggested that the other half should be met by the award of six scholarships to apprentices.

192. As I have already explained the Fisheries Training Institutes at Mangalore, Calicut, Madras and Vizagapatam, if fully equipped, will function not only as Training Institutes for Teachers, but also impart advanced technological instruction to apprentices in the trade and to the recruits to the department. The courses will be supervised and revised continuously by the experts of the department.

SECTION XV.—ZOOLOGICAL SPECIMEN SUPPLY.

Rao Bahadur J. A. Fernandez said that there was need for the supply of Indian biological specimens to schools and colleges, etc. He thought the Museum would be the most appropriate agency for this work.

Mr. S. T. Moses stated that the Madras Museum might be able to undertake the work of supplying specimens to schools and colleges.

Rao Bahadur Govindan stated that there was no need to maintain the zoological specimen supply section as a separate institution of the Fisheries Department, but that it should be amalgamated with the Madras Aquarium and placed under the same roof.

In reply to questions 193 *to* 195, *Dr. B. Sundara Raj stated as follows :—*

193. The nature of biological studies is such that students must have a practical and intimate knowledge of local animals and plants. There has been no institution for the supply of Indian specimens. Previous to the initiation of the supply section, Colleges throughout India were compelled to base their practical zoological teaching either upon text-books illustrations or on few foreign specimens obtained from European Biological stations. Biological teaching therefore was purely of a theoretical nature and was abstract and unreal.

194. The numerous fishing operations conducted or controlled by the department, particularly in chank and pearl oyster diving and the periodical dredging of pearl and chank beds, result incidentally in the collection of numerous specimens of animals and plants of considerable value to students of natural science. This department, therefore, could undertake the supply work much more readily than any other department.

195. It may be noted that the bulk of the specimens has been supplied outside the Presidency. The prices charged are calculated just to cover the cost of preparation.

Unfortunately, it is extremely difficult to cover expenditure as desired by Government as any increase in the rates charged will diminish the demand greatly; either the poorer colleges will try to do with lessened supplies, or they will revert to the outside sources from which they obtained their specimens previous to our attempt to cater for Indian Colleges with Indian material. Most of their material was previously obtained from the Naples Biological Station or from the Plymouth Marine Laboratory which are both heavily subsidized by Government and public bodies, and which run their supply departments from altruistic motives. The service is an educational one and should not be wholly commercialized, for this will lay an impossible burden upon it. What is

wanted is a small subsidy which will enable the supply to be carried on upon improved lines and meet any small deficit on working. Seeing that the supply is an All-India one, the Education Department of the Imperial Government might well be asked to provide the small sum that is necessary. Rupees 3,000 per annum would suffice.

SECTION XVI.—STAFF.

Dr. Natesa Mudaliyar wanted that each branch of the department should have an expert to do research work. He recommended the appointment of a bio-chemist.

Rao Bahadur J. A. Fernandez stated that Research and Administration staff should be entirely different. He said that the pay and prospects were not attractive enough even for the ordinary administrative needs.

Mr. S. T. Moses stated that administrative officers should not at all be entrusted with research work, if real research was to be done. He was of opinion that expert officers should be freed from administrative work. He suggested a uniform pay of Rs. 250—750 for the gazetted ranks and Rs. 125 as the starting pay of the Research Assistants.

Mr. R. Suryanarayana Rao suggested that administrative officers should have nothing to do with research work and *vice versa*. In his opinion, any person who had no knowledge of fisheries but was good in administration might do well as an administrative officer. He advocated the following scale to the officers :—

Sub-Inspectors	...	...	Rs. 60—4—100—5—125.
Inspectors	...	...	,, 150—10—250.
Assistant Directors	...	...	,, 300—40—500—50—850.

Rao Bahadur Govindan suggested that the administrative work should be separated from the expert staff. He was of opinion that the present pay and allowances were more than adequate for the majority of the staff. He said that the specialists should be engaged for any particular item of work and sent away when that work was completed.

Mr. Karunakara Menon wanted that the minimum pay of Inspectors should be raised from Rs. 70 to Rs. 120, and the pay of the Sub-Inspectors should be Rs. 60—120 and that of the Petty Yard Officers from Rs. 25 to Rs. 30.

Mr. E. Raman Menon recommended the following scales of pay to the Fisheries Training Institute staff :—

Headmaster	... Rs.	200—10—300.
Graduate Assistant	... ,,	75—5—100—10—150—10—250.
Secondary Grade Assistants	... ... ,,	40—2—50—4—100.
Carpentry Instructor	... ,,	40—4—60.
Drill Master	... ,,	30—1—55.

In reply to questions 196 *to* 205, *Dr. B. Sundara Raj stated as follows :—*

196. The experts of other departments cannot exactly solve the needs of this department owing to the peculiarity of the work and its volume. An attempt to carry out part of the research connected with a red discolouration at the Guindy Institute had to be stopped as the Director complained that he has neither the staff nor facilities for technological research on purely fishery questions. A similar attempt to analyse tin fish was very kindly undertaken by the Government analyst ; but it was clear that continuous research on more detailed lines could not very well be carried out by him. The Government ophthalmic hospital was approached for experiments with fish oil. They carried out the tests as far as they were able to do, but it led to no useful result and the test had finally to be made through the Imperial Institute at a heavy cost. While most questions could be referred to the Imperial Institute, the department must possess the requisite laboratories and staff for systematic research. So long as I continue as Director, I expect it will be possible for me to carry on the cultural and statistical work of the department in addition to my duties with a qualified subordinate staff. Should, however, work develop, a whole-time pisciculturist, statistician and economist may prove necessary. Vide also answer to question 5.

197. In the present social, political and industrial development of India, administrative duties form an essential part of a Fisheries Department. The experiments and researches of a decade at Tanur would have remained a closed book, but for the administration of the fish-curing yards by the Fisheries Department. An unappreciative market will never pay the fish-curer, for, improved method and stimulus on the part of Government are the only medium through which improvement in the industry could be effected and public taste educated. Another instance is the use of clean white salt for fish-curing ; before the intervention of the Fisheries Department, dark Bombay salt being the cheaper commodity was in extensive use in West Coast fish-curing yards. Even at a loss to the Salt Department then administering the yards, Sir F. A. Nicholson advocated the supply of clean Tuticorin salt. Fish cured by this salt has in its turn educated the consumer that

fish cured with dirty Bombay salt is no longer attractive and the West Coast curer will not now take Bombay salt even at a cheaper price. Administration of the industry by the State was therefore directly responsible for this measure of reform.

Research is also directly helped by administration—

(1) But for fish-curing yards, that intimate touch with the industry at all important points of the coast and the staff needed for making observations and collecting data and statistics regarding fish and fisheries in the 108 important fishing villages of the coast without additional cost and duplication of the staff, would have been denied to the department.

(2) Likewise, opportunities for observation and experiment in chank and pearl fisheries would have been denied to a very large measure, if the department did not administer these fisheries.

(3) The stocking and fishing of numerous rivers, tanks, lakes and reservoirs afford opportunity for studies which would otherwise not become available without considerable extra expenditure and duplication of staff.

(4) Much of the research being directly connected with economic questions, many experiments have to be tested by its effects on the trade and industry and the most suitable conditions for conducting experiments or observations will be denied to the department, if it did not control the trade and the industry. For instance, cultural operations with particular fish, if it is to yield results, should be accompanied by co-ordinated restrictions in fishing and exploitation in waters operated on and by close observation of results for a definite period. All these latter which are purely administrative measures could not very well be co-ordinated with research, if the same department did not control the administrative side of fisheries. Instances like these could be produced for almost every economic research conducted by the department. The most convenient, economical and efficient method of combining research and administration is to vest both in the one department of Fisheries as far as possible.

198 & 199. Administrative officers cannot very well be entrusted with research work except to the extent of collecting statistics or making observations or enforcing rules and regulations connected with experiments. For the future development of the department, I consider that the time has come for the separation of the administrative side from the purely research side and the appointment of whole-time experts for conducting research. In Captain Cribb and in the Fisheries Chemist when sanctioned, we shall have two experts for the department. We will need others. Almost immediately a fisheries biologist and staff are required. The appointment of a gazetted Personal Assistant to the Director

of Fisheries will relieve him of much of the clerical, account and administrative details and will enable him to devote his time to the more legitimate duties of his office and to the conduct of piscicultural and statistical work. There is no other expert officer burdened with administrative duties.

Vide also answer to question 5.

200 & 201. A larger administrative staff with definite territorial jurisdiction is needed.

Vide my reply to question 5.

202. No more than the absolute minimum of administrative staff exist. No retrenchment therefore is possible.

203. No. Vide answer to question 5.

204. No. The Assistant Director (Inland) and the Superintendent, Pearl and Chank Fisheries, should be granted the usual provincial grade. The Sub-Inspectors of Fisheries, for the most part, were Salt Department Sub-Inspectors before the transfer of the yards to this department. While the cadre in the Salt and Excise Departments rises up to Rs. 90, the scale in the Fisheries Department is limited to Rs. 80. Further, the chances of promotion to this grade of Inspectors are far less in the Fisheries Department as the number of Inspectors are strictly limited. The staff of Sub-Inspectors therefore as a body are discontended, and have memorialized Government. It has greatly hampered the introduction of reforms in fish-curing yards. I recommended that their grade of pay should be suitably improved.

The headmaster and staff of the Fisheries Training Institute should be given at least the pay of similar posts in the Education Department, if not, somewhat more attractive pay as special technical qualifications are required and there is no further prospects for the men.

The research staff attached to the *Lady Goschen* should be given adequate allowances to compensate for the continuous work at sea.

205. The training of experts is at present out of the question as there is no institution in the whole of India that provides courses in the higher branches of fishery science. If such existed, we could obtain men with a sound grounding in fishery science who, after training and experience in the department, would be capable of taking the position of experts. At present, experts with foreign training will almost certainly have to be selected. Several of these experts could be enlisted only on short term contract as the Assistant Director (Marine). The immediate Assistants under them will be Honours Graduates in chemistry or biology who, if they show sufficient aptitude, should be deputed to foreign Universities for special courses in the subjects in which

they deal. Their Indian experience, combined with foreign academical training, should fit them for the post of experts subsequently.

SECTION XVII.—FINANCE.

In reply to questions 206 *to* 209 *and* 211 *to* 219, *Dr. B. Sundara Raj furnished the following statement:—*

Question No.	Expenditure in 1926-27 (Latest available).	Receipts.	Average for five years.	
			Expenditure.	Receipts.
	Rs.	Rs.	Rs.	Rs.
206	7,76,224	8,07,016	5,83,366	5,68,610
207	30,502	31	28,740	7
208	65,671	129	37,963	146
209	1,08,227	1,05,255	99,887	1,10,705
211	* 43,487	21,341	* 46,006	39,381
212	46,264	457	43,249	375
213	3,20,306	3,26,562	3,49,079	3,62,257
214	27,387	6,543	28,609	22,075
215	16,001	14,798	17,397	17,305
216	6,923	9,360	6,693	9,058
217	5,622	3,989	4,903	4,054
218	1,07,158	2,90,691	50,328	1,06,351
219	22,383	41,854	37,336	70,324

* Represents total expenditure incurred on the Cannery and Tanur Experimental Station. The figures include expenditure incurred on Technological Research. No separate figures are available.

In reply to questions 210 *and* 220, *Dr. B. Sundara Raj stated as follows:—*

210. It is not sufficient.

220. No separate expenditure is incurred on co-operation. This work is done by the staff sanctioned for the fish-curing yards and fishery schools.

CHAPTER III.

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS.

SECTION I.—MARINE FISHERIES.

The main conclusion which has been brought home to us in the course of this enquiry is that the Department of Fisheries, in the course of its 22 years' existence, appears to have contributed nothing directly to touch the professional life of the sea-going fishermen. Not only so, it may also be fairly said that no concrete effort was made towards this end until the year 1925 when the scheme of departmental activities of which the purchase of the trawler *Lady Goschen* marked the inception, was inaugurated. This may appear, at first sight, to indicate some fundamental defect in the development of the department, since its foundations were laid under the able and disinterested labours of Sir Frederick Nicholson. But an examination of the facts chronicled in this Report in Chapter I under the History of the Department, coupled with the general trend of the oral and written evidence of witnesses, makes the situation intelligible. Sir Frederick was undoubtedly influenced in his ideas, when he first constituted a Department of Fisheries, by what he had seen of the fishing industry in Japan; and though he had a fairly good knowledge of the stage reached by that industry in England, he appears to have thought, and with reason, that the achievements in that country, rendered possible by slow growth through centuries, were not likely to provide as good a model for us as the rapid organisation of that industry in a country like Japan under the fostering care of her Government, which had saved itself considerable time and labour by borrowing the experience of older countries in the West.

We are, however, of opinion that this has unconsciously resulted in a certain inversion of departmental perspective by which, those departmental activities affecting directly the professional knowledge and methods of sea-going fishermen have been relegated to the background. In examining the origin of this department, the Committee noticed that in the commission given to Sir Frederick. the industrial processes which hinge on the actual catching of fish were mentioned on a par with the latter; and on the West Coast, even with old-time knowledge and old-time methods, the catches are at certain times of the year, considerably in excess of what existing markets are able to absorb economically. It was therefore natural to concentrate attention first on these allied industrial processes, rather than expend attention and money on investigations primarily calculated to enhance an existing super-abundance of fish-supply.

In the result, the Committee discerns as a perfectly natural sequel, the development of the fish-oil and guano industries on the West Coast as also that of canning, preserving, etc., at Chaliyam and Tanur. In stating this general impression, the Committee are fully aware of the facts chronicled in Chapter I, Section II *et seq.* above relating to the history of experiments in deep-sea fishing. It was indeed realised from the very beginning that " the future of the trade is with the catching " and Sir Frederick in quoting from Japanese experience has emphasized that " our experimental stations should take the lead in demonstrating the best build and rig (of boats) and the cost." But from the history of these efforts, from the experiments with Ratnagiri boats to the attempts made by the purchase of the *Lady Nicholson*, *Sea Scout* and other boats, the main impression that emerges is that they were directed mainly to improvements in methods of actual catching and only incidentally, to any detailed study of the fishing grounds and seasonal habits of fish. In any case, it is fairly clear that even in that series of experiments no results were achieved which filtered down, in any form, however modified, to the professional sea-going fisherman.

There is, however, an outstanding exception to these general remarks in the scheme which originated with the idea of constructing a steamer for the Fisheries Department. Here the scheme was however considered jointly with a plan for providing a steamer for the annual inspection of the Laccadive Islands. Though this use of such a steamer may easily be compatible with its use as a fisheries vessel, the point to note is that this use, instead of being subordinate to the main idea, really played a more important part. The reason for the inception of the idea was stated in the following terms in March 1914 :—

" Owing to the difficulty of procuring a vessel from the R.I.M. for the annual inspection of the Laccadive Islands, the Government are considering the advisability of purchasing a vessel which would be suitable for the inspection, and would for the rest of the year be at the disposal of the Fisheries Department. . ."

In commenting on this proposal, the Director of Fisheries remarks with great justice that he is not " suggesting this steamer as a model or example for commercial work; it is intended solely, and is a necessity, to enable our officers *to make the researches* upon which the future Indian deep-sea fishery may be founded." These papers were recorded in 1916 without any vessel being purchased. In 1919, after the termination of the War, this question was revived by the appointment of a Committee " to consider the question of constructing a steam trawler for the Fisheries Department." The Committee recommended its purchase and added, as the main grounds for its recommendations, the necessity for an accurate survey of the sea bottom round the coast, with a view to

ascertain "the quantity and trade value of the fishes found and fishable and the character of the ground . . . and for general fishery investigations." Even this did not materialise, as the Government considered the estimated cost, viz., £109,000 prohibitive. This was in 1922, and the subsequent course of events culminated in the purchase and present work of the trawler *Lady Goschen*—achievements for which the present Director of Fisheries is mainly responsible.

But, even in her case, she was not equipped for the main research work she was intended to do. It is only recently that estimates have been sanctioned to render her suitable.

From the foregoing facts the justice of the criticism that the Department of Fisheries has not achieved anything so far to improve the knowledge and methods of the fishermen round our coast is manifest; and if there is one thing that the Committee feel they should urge before Government, it is that this defect be rectified as quickly as means permit.

Captain Cribb, the master of the trawler is a North Sea fisherman, who, besides being one of the first organisers of trawling in Japan, has also had considerable experience of the waters round India and Ceylon. In his evidence, Captain Cribb contrasted with force the knowledge that was available to fishermen in the North Sea with the profound ignorance which prevailed on the same matter regarding our waters.

He was of opinion that, to compile a fisherman's chart for our waters, comparable with Close's chart for the North Sea, would be a thoroughly practicable proposition. Taking the coast line to be worked in this Presidency at about 1,700 miles in length, he considers that it would be possible for him to average about 80 miles each year. This, of course, really means that he will study successive sections of the coast in successive months of the year, and by repeating the process, altering the month and keeping the section the same, in 12 years about 1,000 miles of our coast line could be studied and charted in detail by one trawler. This would mean about 21 years for the whole coast from Ganjam to Canara, and, in view of the great delay that has already occurred in initiating these researches—a delay of over 20 years—the Committee are of opinion that the work may, with advantage, be taken up by two trawlers. Further, if intensive study of one half of the coast is completed many years in advance of that on the other half, it is likely to appear unjust to one half of the fishing population of the Presidency.

Further, even from the purely financial point of view, the investment of equal and successive doses of capital for 20 years, yielding a full return only from the 21st year, is not materially cheaper, if at all, than the investment of double the amount of capital each year for ten years, and yielding a full return from

the 11th year. For these reasons, the Committee would recommend to the earnest consideration of Government the purchase in due course of a second trawler for this work.

Reference has already been made to Close's Fishing Chart of the North Sea. A study of this map has been of great assistance to the Committee, and, in consequence, we have thought it essential to append * to this report a photographic reproduction of sections of it. This map gives a variety of detailed information directly useful to fishermen. In fact it is so complete that it is difficult to imagine how any useful addition could be made to it.

The depths are given, correct to a fathom, throughout. The times of the tide at various points on it, with tide-times at Dover as a standard are also noted. Detailed information of the bottom, both for purposes of trawling and for anchorage is also specified. Each fishing ground is demarcated accurately, with information as to the principal varieties of marketable fish found there, with the months in which they are found. In addition, a key is furnished to these fishing grounds, which are no less than 91 in number, and this gives complete information of the fishing potentialities of each bank for each month of the year. It would take us too far from our main task to discuss this map any further, but what has been said is sufficient to indicate the mass of observation which has been systematised in it. The bulk of this information is, no doubt, what has been gathered from British fishermen using these grounds, but there is no doubt that considerable work of a strictly scientific nature has supervened on it. With the aid of a similar map for our waters any fisherman who has any knowledge of his profession, will be able to utilise his time and effort to the best advantage possible. Not only so, the situation and potentialities of the grounds offering the best prospects at any particular time being known, it is easy enough to determine how far the boats and equipment now in use by our fishermen are suitable for the task in any particular area at a specified time.

Captain Cribb who is not merely familiar with the chart, but also with the actual labours which formed its basis, has informed us that such a chart could, without great difficulty, be compiled for our coast as well. This would involve working with a trawler over the same ground at various times of the year, over adjoining grounds in successive seasons, and a comparative checking of results achieved in one year by occasional observations in following years, etc. This work has been begun, though under grave handicaps, and the foundations of charting the sea have already been laid. But, as has been observed above, full work could not be done for lack of equipment. It is needless to add that the value of the fish caught during such research voyages is of minor importance, for the main purpose is to gain a knowledge of fishing conditions.

* Not printed.

Side by side with these labours, the department has been experimenting with nets and gear, not only nets and gear suitable for trawling, but also those suitable for use by smaller boats and catamarans. The Committee are of opinion that only the fringe of the area to be explored in this direction has so far been touched, and would commend to the attention of Government the advisability of taking advantage of the impending departure of Captain Cribb to England on leave, to grant him a fairly wide commission to study nets, tackle and boats there in the light of his knowledge of our fishermen's needs.

Coming more specifically to the suitability of the *Lady Goschen* for the work outlined, the Committee, which were fortunate enough to include among their members a retired Superintending Engineer of the Department of Public Works, after a careful inspection of the trawler and hearing Captain Cribb, are of opinion that the alterations already sanctioned are indispensable. They understand, however, that some difference of opinion exists between the R.I.M. experts and Captain Cribb as to the nature of the refrigerating plant suitable for the trawler. As this is not a technical matter normally falling within the competence of mere naval experts, but is one within the province of a practical trawling expert, they are of opinion that, subject to considerations of resulting sea-worthiness of the vessel, Captain Cribb's ideas should prevail. This officer's suggestion is to utilise the existing electrical plant of the vessel, which has an output exceeding by 3½ H.P. its present maximum need, for the purposes of the refrigerator, and to construct the chambers and install a refrigerating plant in accordance with this available power. This, besides being materially cheaper, obviates the loading of the vessel with still another power unit and a refrigerator rather in excess, according to Captain Cribb, of the purely research needs of the vessel.

With this addition and the alterations already sanctioned, it should for the first time be possible to commence serious and intensive research work. Captain Cribb's present staff however appears to us to be somewhat inadequate. Besides the Captain the vessel has a tindal in the person of an intelligent Indian Sailor born of sea-faring parents at Jaffna and with a very limited general education, which does not even extend to a knowledge of colloquial English. He is no doubt technically qualified, but it need hardly be mentioned, that he cannot possibly be expected to take charge of the vessel in an emergency. His first driver (Chief Engineer) is a Muhammadan who has learnt his business in the vessel, having started as a mere seaman. Under Captain Cribb's kindly interest and coaching, he has gained his technical certificates. The rest of the staff are men of inferior capacities and status.

If, therefore, the vessel is to be worked to its best usefulness, we consider that Captain Cribb should have the assistance of a

qualified and experienced mate—an officer capable of taking charge of the vessel by himself in the absence of Captain Cribb. This is a modest recommendation, as will be seen from the facts that the trawler of the Bombay Government was staffed by a captain, mate, engineer and boatswain—all Europeans, and that even in the recommendations of the Committee of 1919 a European mate was regarded as indispensable. As matters stand at present, the capacity of the trawler to do continuous work is limited by the ability of Captain Cribb to remain on duty continuously and, however willing he may be, human powers have their limits. In his case these limits are further narrowed by his being no longer young, and by reason of his being obliged to work in a tropical climate. As a trawler has to be out at sea for several days at a time, and put into port only for the purpose of reducing observations to a chart, we think her efficiency for work would be materially enhanced by the provision of a qualified European mate for the vessel. Captain Cribb's presence in England on leave from June to December this year may be utilised for the purpose of selecting a suitable officer for this post.

The Committee have learnt with considerable surprise from Captain Cribb that a marked difference of treatment by Port and Customs authorities is shown to the *Lady Goschen* as compared with the *Lady Nicholson*. The latter enjoys the full privileges of Government vessels, being neither obliged to take clearances in leaving ports nor to observe any formalities in entering Indian ports. On the other hand, the *Lady Goschen* is obliged to take formal clearances from port to port in India. The courtesy shown even to the fishery vessels of Foreign Governments in these matters—for instance, the *Nautilus* of the Ceylon Government—is not extended to the *Lady Goschen*. This is not merely a matter of prestige, but it causes very material inconvenience and delay. We understand that this differential treatment originated at a time when the *Lady Goschen* was engaged on Salt transport work, but we can see no reason whatever why this treatment should be perpetuated, when it has been definitely laid down that her main business is research. We emphasise that this is a matter deserving immediate attention and recommend to Government that necessary steps may be taken to ensure for the vessel the full privileges and rights of a steamship belonging to a Provincial Government and engaged on scientific research.

The Fisheries Boats.

The full history of the purchase of these vessels, and the work they have done hitherto, is contained in the chapter relating to them (Chapter I, Section II). The Committee have come to the following conclusions with regard to them:—

Lady Nicholson.—The cost of maintaining this vessel for the year ending 31st August 1928, was Rs. 6,272-15-9. The actual running of the engine during these 12 months was only for 214

hours, 15 minutes. This proves quite conclusively that she is a very expensive vessel to maintain and that she is of very little actual use to the department.

We therefore suggest that, considering her unseaworthiness and the consequent difficulty of selling her for an appreciable price, her engines and oil tanks should be taken out of her and sold, if possible, or scrapped. Her hulk may be utilised with advantage as a floating storehouse and office for trawler *Lady Goschen*. For this purpose, a crew of only two watchmen would be required. During pearl-fishery season, if required, she can be used as a depôt ship on the banks.

Sutherland.—She is no longer fit to be used as a motor-boat for the chank fishery. Her engines have already been removed. As she was originally designed as a fishing smack, she might be assigned to the Fisheries Training Institute at Calicut as a training boat for the students. No crew would be necessary in that case, except a temporary watchman when she is laid up during the monsoon at Beypore.

Pearl.—This boat may be fitted with a new engine of the Ailsa Craig Kid Type, which, according to Captain Cribb, costs about £65. She should then be stationed at the Krusadai Biological Station where such a boat is a necessity. A driver on Rs. 50 and a lascar on Rs. 25 per mensem should suffice as crew.

Leverett and Sea Scout.—These are necessary as chank fisheries take place in Tinnevelly and Tanjore at the same time. The crew should be reduced to a minimum in each case during the off season.

SECTION II.—INLAND PISCICULTURE.

This aspect of the department's activities received emphasis from the very commencement. Sir Frederick Nicholson was much impressed with what had been done in Japan in this direction. In paragraphs 196—212 of his note on the "*Fisheries in Japan*," he suggested certain piscicultural methods as capable of being copied from Japan, and these relate exclusively to inland fisheries. "Japan" he stated "suggests certain cheap and immediately possible methods, open to the poorest man who owns a patch of water, to every village which has a tank or ponds, to the owners of many thousands of acres of paddy-fields and to the controllers of thousands of acres of fresh water reservoirs and canals." The analogy of conditions was so manifest and the possibility of immediate imitation so clear that the inland piscicultural section early received a full share of attention to the extent of spreading its activities to such outlying spheres as the Nilgiri trout fisheries and the culture of oysters for a market, as select as it was restricted. But it must not for a moment be supposed that the main line of development of inland work was thereby neglected. The difference in natural conditions between India and Japan was realized and

studied and work was confined to such avenues as promised a scope for development on Japanese lines, but with full allowance for such differences as existed.

In the result the department has now six farms to serve as modest research centres, and for fish-breeding. In certain districts, notably in Chingleput and Nellore, Government tanks have been taken under the control of the department. These tanks do not, as a rule, hold water throughout the year, but, nevertheless, they are stocked annually with young fry. The fishery rights in them are leased, and the progressive increase in their rentals is a concrete proof of the success of the department's efforts.

Where the waters are perennial, as at Mopad, the stocking is done with a view to more distant ends, and it is hoped that, with a suitable form of lease ultimately, the rate of fishing can be controlled by the department and not entirely left to the discretion of the lessee. It will thus be possible to increase gradually the food fish supply from such waters to their natural maximum, so that they may provide fish uniformly throughout the year instead of fishing being confined to the periods when their waters run low. The difficulties of attaining completely to this ideal are obvious, but, on the evidence of the Director of Fisheries and considering the history of such efforts in Japan as well as the results we have ourselves seen at Mopad, it does not appear to us to be beyond the possibilities of realisation to a substantial degree.

As the fishery rights in such waters have to a great extent been assigned to local bodies, the transfer of their control to the Fisheries Department involves the payment of annual compensation to such local bodies, the amount being fixed on the average of the rentals realized by such bodies for five years previously. The Committee have noted with satisfaction that the rentals now realised by the Fisheries Department are substantially in excess of the compensation they have to pay. The figures for the past ten years are as below:—

Fishery rentals from rivers and tanks and channels and compensation payable.

Years.	Rivers: Cauvery, Coleroon.	Compensation.	Tanks in Chingleput District.	Tanks in Nellore District.	Tanks and Channels in other districts.	Total.	Compensation.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1918-19	58,324	34,898	12,569	356	5,044	17,969	10,049
1919-20	57,946	34,898	12,022	251	5,738	18,011	10,049
1920-21	62,222	40,906	14,799		13,463	28,262	21 036
1921-22	61,453	40,906	19,148		6,732	25,880	21,036
1922-23	81,551	40,906	16,103		13,963	35,287	21,036
1923-24	83,646	40,906	3,225	7,016	16,538	26,772	21,359
1924-25	81,225	40,906	2,203	10,194	13,420	25,817	21,359
1925-26	74,631	40,906	8,779	16,461	8,207	33,447	21,359
1926-27	75,215	40,906	7,543	10,828	8,077	26,448	21,359
1927-28	73,819	40,906	8,565	9,313	8,247	26,125	21,359

This sphere of work appears to us to offer great scope for development. There are tanks scattered throughout the Presidency capable of responding to such treatment, though only a small fraction of all existing tanks is, in the opinion of the Director of Fisheries, suitable. He estimates—and we see no reason to doubt the accuracy of his estimate—that if a full selection of such suitable tanks throughout the Presidency were made, the annual compensation to be paid for them would not exceed Rs. 2 lakhs at the present rates. It is of course likely that, as the fishing potentialities of these waters are progressively enhanced and rentals increase, the Local Bodies may, with some justice, claim corresponding increase in the compensation paid to them. The Committee are of opinion that, where such increased compensation appears due, the increase should be determined, after deducting from the average gross receipts of previous years, a full and proper share of administrative charges, cost of expert supervision, a reasonable charge for collection of the rentals of fisheries and risks of seasonal failure involved. As it is the aim of the department to work for public benefit rather than departmental profits, the balance after deducting such charges may be offered as compensation to the Local Board entitled to it.

We recognize in this sphere of the department's activities one further possibility which is likely to affect the future of Marine fisheries. These tanks being scattered throughout the Presidency offer a ready means of wide distribution of fish-food-supply to a great extent free from the difficulties of transport. And with their gradual development a much wider market, co-extensive with the Presidency, would *pari passu* be developed, so that when the time comes for Marine fisheries to reap the full fruits of the maritime researches now being conducted, they would not be hampered by the absence of an inland market for their catches. We are of opinion, and this conclusion is supported by the evidence of witnesses who emphasised the occasional glut in maritime markets even under existing conditions, that the opening up of such inland markets is an indispensable preliminary to the development of our Marine fisheries to anything like their full potentialities.

The Committee understand that some alarm has been raised with regard to the annually increasing totals of the compensations already referred to, and that the Finance Committee naturally regards it with some apprehension; but they would like to urge that this item of expenditure should not be regarded *per se* but only in connection and comparison with the income derived from such waters. The result would then be seen, even on purely financial grounds, to be overwhelmingly in favour of our recommendation for a progressive extension of this work throughout the Presidency. And when the unassessable public benefits of an increasing supply of fish-food to the people at large are considered, and the fact that such methods of stocking can easily be copied

on any scale, however modest, by private owners as in Japan, as well as the further fact of the pioneer work involved in fostering a wide market with which the increasing supply from marine fisheries can in due time establish immediate and profitable contact, the soundness of this proposal, they believe, stands fully vindicated.

In concluding this portion of their report, the Committee deem it necessary to refer to a matter of relatively minor importance. They understand that occasional differences of opinion have arisen in the past with regard to the relative importance of irrigation and fishery rights in some waters. After a full consideration of the matter, they are of opinion that in all such cases, the rights of irrigation should prevail and, where necessary, these should be duly protected by suitable provisions in the lease deeds granting fishery rights.

SECTION III.—PEARL AND CHANK FISHERIES.

The Committee are not in a position to make any definite recommendation with regard to improvements in the present method of fishing for pearl-oysters and chanks, that is, by what is known as naked diving. They are not in favour of dredging for pearl-oysters as they have reason to believe that the process is likely to damage the pearl-banks. Dredging for chanks is also not an economic proposal as they are scattered sparsely on the sea-bottom. They however believe that the difficulty so far encountered in commanding the necessary number of divers can be overcome if the experiment now under contemplation by the Director proves successful. The Committee understand that there is a simple diving-apparatus now in use in Japan by pearl-divers, consisting of a face-mask and a couple of cylinders of compressed air, strapped to the back of the diver, which will enable a diver to remain half an hour or more under water instead of the customary fraction of a minute possible with naked diving. This will improve his efficiency in proportion, and a few trained divers, equipped with this apparatus, should be able to do the work of a very much larger body of ordinary divers. This apparatus, of which a sample has already been obtained, costs Rs. 275.

SECTION IV.—RESEARCH.

The evidence on record including the statements of officers of the department, conclusively proves that this side of the department's activities has been almost entirely neglected. No doubt, in Marine biology, Mr. Hornell made sporadic efforts in the limited leisure which other departmental duties left him. Mr. Whitehouse was appointed Marine Biologist, with a view to develop Marine Fishery research, but, unfortunately, he was obliged to sever his

connection with the department before he had accomplished anything in this direction. Since that time, no officer has been appointed specially for research, and the little that has been done has been done either by the Director personally or, under such occasional direction as he could give, by subordinate executive officers of no higher grade than Inspector. The record of research in connection with inland fisheries is somewhat better, chiefly due to the labours of Dr. Sundara Raj before he became Director (1915—23). Since then practically nothing has been possible by reason of the heavy calls on his time entailed by the administrative aspects of his work, there being no one else with such training as would enable him to continue the work satisfactorily. It is evident to the Committee that research is urgently needed in every branch of the department's work before any further appreciable progress can be made.

It is clear from the remarks already made in Chapter I, Section II dealing with Marine work that the most important part of it which is immediately needed is intensive research of a two-fold nature—(1) relating to observations on which the preparation of a fisherman's chart could be based; (2) relating to the correlated biological observations.

The former to which ample reference has already been made will be the duty of the navigating officers (Captain and Mate) of the trawler, and the latter of a trained Assistant Biologist attached to the vessel working in conjunction with the Assistant Biologists at the Marine Biological Stations and under the direction of the Fisheries Biologist (*see* tabular statement, Appendix III).

It will be the duty of the Assistant Biologist attached to the trawler to study in detail the food, growth, spawning, distribution, migration, etc., of all South Indian Marine food-fishes and all biological and oceanographical problems connected therewith. His work will thus be dependent on the trawler which will have to adapt its work partly to meet his requirements. The Assistant Biologists at the Marine Biological Stations will make a record of the biological, hydrographical and meteorological observations in the neighbourhood and will, in addition, assist the work of the trawler by making their respective stations serve as bases of operation for it. The trawler, after each cruise, must, of necessity, put in at one of these stations, to land its collections for fuller investigation and to afford the navigating officers facilities for charting their results. In the opinion of Captain Cribb this will necessitate an interval at the station at least as long as the preceding cruise. The Committee understand that the research trawler *George Bligh* attached to the Lowestoft fisheries laboratory in England is, on the average, at sea for 180 days during the year, the rest of the time being taken up with charting results and working out collections. The duties of the Fisheries Biologist will be the general direction and supervision of all this work as well

as special investigations which it will be convenient for him to undertake himself. He will clearly have to be a man of outstanding qualifications and sufficient experience, able to train his assistants by initiating and guiding their research.

The work of the above officers will embrace all Marine branches of the activities of the department. In connection with the pearl fisheries, the crucial problem of their irregular periodicity, as well as minor problems are still unsolved. In chank fisheries we are still ignorant of the life-history and bathy-metric distribution of the mollusc. With regard to food-fish fisheries little or nothing is known regarding their occurrence, abundance, value, etc., even the exact species are indeed in some cases still unknown.

In addition to Marine work, the Fisheries Biologist already proposed will have to direct and supervise the entire inland biological work of the department the importance of which has already been touched upon in the section dealing with it (Chapter III, Section II). At present the department has six farms scattered over the central districts of the Presidency. This entails great expenditure of time and considerable difficulties in administration, especially as the only officer qualified to do this work has, since their inception under his special control, become Director.

The subordinate officers who alone are in residence at these centres are incapable, without constant expert supervision, of conducting the experiments which alone can give the requisite knowledge for utilizing these farms to the best advantage.

We therefore recommend the establishment of a fully equipped fresh water biological station and fish farm in or near the Headquarters of the Department in Madras. In making this proposal, we would point out that, for present purposes, Madras, in addition to the advantages of centralization, is sufficiently typical of the greater part of the Presidency to allow of the more important general problems being investigated there. With the advance of knowledge of these problems, it is likely that special studies will have to be made in special localities, probably those of the existing farms which should be continued as at present.

It has been brought to the notice of the Committee by one of its members that the southernmost districts of Tinnevelly, Madura and Ramnad which clearly offer great scope for stocking inland waters have not yet received any attention. We recognize the justice of this contention and therefore recommend the establishment of a second freshwater biological station and fish farm in or near Madura in the course of the next two years, as the fish fauna and conditions of this area differ widely from those of Madras. The next step in this direction will no doubt be the establishment of a similar centre in the Northern Circars.

To assist the Fisheries Biologist in this branch of his work he will need an assistant biologist in Madras and at each of the other

two stations when they are established. The Committee fully realize the magnitude of the expenditure involved, but as this branch of work has so far resulted in substantial profits to Government and as our proposals will tend at least to cover the entire cost of administering those stations, we have no hesitation in making the recommendation.

Turning to industries, from the history of the department, it is clear that most successful work has been done and the Committee would like to take this opportunity of placing on record their high appreciation of the pioneer labours of Sir Frederick Nicholson under whose able and disinterested guidance this branch of the department probably attained the highest success possible without expert technical assistance. If progress in recent years has been seriously retarded, the Committee feel that it is solely due to the fact that a stage had been reached where expert knowledge was indispensable. Our enquiries clearly indicate that a Fisheries Bio-chemist and a Fisheries Industrial Engineer are immediate necessities. If the qualifications of both can be combined in one man, as we are informed that they can, we recommend, on grounds of economy, the appointment of such an officer. Failing this, we feel that separate appointments should be made for each.

We realize that this will involve an expenditure of public money for which no commensurate financial return will ever be reaped by the department itself. But considering the public benefits that have already accrued from industries initiated by the department, such as the oil and guano industries, even in their present relatively crude and undeveloped state, and the enormous possibilities that are open to these industries by the further refinement of their products and the introduction of internal economies in their working, we feel that the resulting public benefit more than warrants the expenditure. On the chemical side, the work most immediately required relates to the refinement of fish oil, the improvement of the quality of guano, the conversion of fish-scrap into high grade fish meal for human and animal consumption and the whole field of utilization of bye-products in addition to advanced research relating to canning, fish-curing, refrigeration, etc. The engineering work will be the improvement of technical appliances in the light of increased knowledge from chemical and other research.

Research should, we consider, be carried only up to the point of commercialization and the practical problems that arise at this stage, being chiefly connected with markets and middlemen, should be tackled in connection with co-operative work.

As the sale of products resulting from experimental research has become one of the chief difficulties at Tanur, as it has always been at Chaliyam we recommend the appointment of a special officer to deal with it.

The Chaliyam Cannery.

The Committee were fortunate in having ample opportunities of investigating this industrial institution in great detail, and of seeing it at work. They are of opinion that it should be continued and improved. Among other things, they would recommend the grant of greater freedom to the Director for the purchase of stores, such as suitable tinsheets, etc. The above is however subject to the proviso that any offer of a satisfactory nature from any private agency for the lease of the factory. is worth considering, provided the lessee will agree to such conditions as will ensure proper departmental research being done there at the same time. These researches, as we have remarked elsewhere, should be pushed to the point of commercialization, for which, we believe, the work in conjunction with a lessee, affords the necessary opportunity, and then, if results are achieved which hold forth promise of success in competition with foreign canned fish of a similar nature, such may be handed over wholly to a private agency. In connection with this step, should the nascent state of the industry and its attendant pioneer difficulties warrant it, the Government may even give a gradually decreasing bounty, disappearing when the industry has found its feet and is able to look after itself.

Marine Aquaria.

In the preceding paragraphs, we have attempted to show the importance of biological stations to a Department of Fisheries. "The past decade has witnessed a great increase in the operation of the economic and the industrial motives for the establishment of biological stations. This shows itself in the increasing use of their facilities in medical instruction and research along physiological lines, and especially in the modern development of fisheries research. Prior to the present century much of the fisheries research was remote from practical significance, more of it was desultory and discontinuous, and all of it was utterly inadequate, to establish a scientific basis for the conduct of the fisheries and fish culture, which even now rest primarily upon an empirical basis. The utilization of machinery in fishing operations, the great improvements in transportation and marketing, and the increasing demand for the products of the sea for food have made imperative a scientific basis for aquiculture if the harvests of the sea are to be fully reaped and its resources maintained unimpaired for the future. . . The biological station of the future is thus coming to be a marine or fresh-water observatory with a broader basis and wider scope of action." *

An Aquarium marks the fuller development of such a station. Though the Madras Marine Aquarium was opened in 1909 without any necessary connection with fisheries, but as an adjunct of the

* Biological Stations of Europe by C. A. Kofoid, 1910, pages 1 and 2.

Museum, it has since 1919 come under the control of the Department of Fisheries. The change of management has more than justified itself, for measures were at once taken by the latter department to increase the number and variety of the exhibits, to remodel table aquaria and generally to make the institution more useful in research and, at the same time, more attractive to the general public. The number of visitors who passed the turnstyle rose in that first year from 95,957 to no less than 163,517.

The gate-collections for the ten years before and after the Aquarium came under the control of the Fisheries Department are given below:—

GATE COLLECTIONS.

Under the control of the Museum.

	Rs.
21–10–1909 to 31–3–1910	3,330
1910–11	5,223
1911–12	4,654
1912–13	4,758
1913–14	4,113
1914–15	3,309
1915–16	3,769
1916–17	3,795
1917–18	3,231
1918–19	3,005

Under the control of the Fisheries Department.

	Rs.
1919–20	9,380
1920–21	9,772
1921–22	8,384
1922–23	8,470
1923–24	8,435
1924–25	7,489
1925–26	8,532
1926–27	8,680
1927–28	8,813
1–7–1928 to 31–5–1929	6,952

The figures given above deserve a little notice. The average receipts for the first ten years amount to about Rs. 4,000 a year while the average receipts since the Aquarium came under the Fisheries Department is nearly Rs. 8,500 a year. And when it is remembered that the Madras Marine Aquarium was originally built at the moderate cost of Rs. 17,604, it will be realised how relatively large are the benefits, material and educative, which it yields.

The Committee have perused with considerable interest the orders of Government in which they have emphasised "the necessity of enlarging the scope of the Marine Aquarium in Madras and of providing additional facilities for research work in Marine Biology and allied subjects, to meet the growing needs of the Department of Fisheries," and had given practical effect to this view to the extent of sanctioning the construction of a new combined Marine Aquarium and Biological station at an estimated cost of Rs. 2 lakhs, with a recurring expenditure of Rs. 12,300 per annum. The present Committee, though they fully endorse the view that with the appointment of a Fisheries Biologist and an Assistant Biologist, Marine, Madras, the present Aquarium may, with advantage, be enlarged, do not recommend that this should be done on anything like as large a scale as was contemplated in 1913, and deferred by reason of the outbreak of the Great War. They would, on the other hand, recommend the development, in due graduation with the scheme outlined for the growth of Marine Biological Stations at other centres, Krusadai, Vizagapatam and Calicut, of Marine Aquaria in or near those centres. Such a scheme, they have reason to think, besides being cheaper in that it will be more modest, will enable full research to be carried on at a variety of centres, affording adequate differences of flora and fauna, tidal peculiarities and climatic conditions. And on the basis of the admirable work hitherto done by the Madras Aquarium in this direction, we may also emphasise the advantages of having several centres distributed throughout the Presidency for the dissemination of popular instruction and stimulation of interest in biological science.

In particular, the Committee have been much impressed with the suitability of Rameswaram, and the scheme already submitted to Government for the establishment of a Marine Aquarium there in connection with the biological station on Krusadai Island. As regards natural facilities, the wealth and variety of fauna and flora that flourish in the sheltered coral reefs and shallows of Palk Bay are said to be unique on the South Indian Coast. One of the best known and most valuable chank-beds lies opposite Rameswaram, where an important chank-fishery already exists. There is also a pearl-bank in the neighbourhood. Further, Rameswaram is visited by pilgrims from all over India (180,377 in 1924–25) and is therefore likely to be of unusual service on the purely educative side. We understand that the capital cost is estimated at Rs. 19,500, with a recurring annual expenditure of Rs. 5,100. It is also estimated that an income of about Rs. 9,000 may reasonably be expected from visitors in a year.

Vizagapatam and Calicut are centres for consideration in this connection in the still further future, and the Committee do not wish to say anything more specific about them beyond remarking that the site proposed for an Aquarium at Vizagapatam seems most suitable, and that, if possible, it should be reserved for that purpose.

Research and Administration.

It will have been seen from the opening paragraphs of this section that research has hitherto been done only by administrative officers, with other duties always pressing upon them. As the only satisfactory means of changing this state of affairs, we have proposed the appointment of special research officers already enumerated. On the administrative side, the present Assistant Directors will continue with such additions as may become necessary, except the Assistant Director of Fisheries (Marine) who is a research officer and whose designation had better be changed to Captain (Lady Goschen) to avoid confusion. The pay proposed for the research officers and Assistant Directors will be as follows:—

	Per mensem. Rs.	
Fisheries Biologist ...	750—50—1,500	
Fisheries Chemist ...	750—50—1,500	
Captain (Lady Goschen).	750—50—1,000	
Fisheries Engineer ...	300—25— 650	
Mate (Lady Goschen). ...	500—50— 650	
Assistant Biologists ..	300—25— 650	efficiency bar at Rs. 450.
Assistant Directors ...	250—25— 500—50—750	do. „ 500.
Personal Assistant ...	250—25— 500	do. „ 375.
Research Assistants ...	150—10— 250	do. „ 200.
Inspectors	150—10— 250	do. „ 200.

SECTION V.—SOCIO-ECONOMIC ACTIVITIES.

A.—Fishery Schools.

In this respect the Department of Fisheries occupies a unique position. We do not know of any other expert department of Government similarly saddled with the responsibilities of elementary education. The history of this aspect of its work explains fully the sequence of events which have led to this department being now in charge of 33 elementary schools for the children of fishermen, and if the principles so far followed in this matter should continue to be rigidly adhered to, this number would have to be increased by the transfer of no less than 110 schools on the East Coast at present under the management of local bodies, not to speak of numerous others which will become necessary, should elementary education become compulsory.

There is a remarkable consensus of opinion among the witnesses we have examined on this point, and all of them are definitely of opinion, that this is a responsibility which the Fisheries Department is best suited to discharge. Arguments in favour of this system have been advanced by comparison with other departments of Government, such as Forest and Agriculture, but this analogy is rather beside the point, inasmuch as these departments do not deal with children, but with youths and adults, and, what is more

significant, the education they impart is not general, but purely vocational. Labour schools may appear at first sight to offer a better example, but here again, the Labour Department exists to improve the general condition of the depressed classes committed to their care. They are not an expert department, in the strict sense. Hence the care of Elementary education of these classes would seem to be as much within their province, as the provision of any special vocational schools would be outside their scope.

The Fisheries Department, on the other hand, does not exist to improve the general condition of fishermen as a class so much as to improve their strictly professional methods, in so far as they ply their caste-profession. It may be true that the people of fisher villages generally being on the periphery of Local Board jurisdiction, badly served with communications and practically without votes, are not likely to be looked after by such bodies, even if their social status does not result in any lack of sympathy, as it undoubtedly does, on the part of the higher classes. It has also been argued by some witnesses—and not without force—that the Fisheries Department can establish through such schools a much more intimate contact with the life of a fisher village, and that, as a result, the present supreme indifference to improvements in professional methods, can, to a great extent, be overcome. Further, it has been argued by witnesses that the Elementary education imparted in such schools has, and should continue to have, a professional bias, and, as such, it is best administered by the expert department.

Our inspection of fishery schools, coupled with our own knowledge and experience fully bear out the contention that the ordinary agencies discharging the responsibility for Elementary education have not been just to the fisher community in the past and that, until a very substantial change in social attitude takes place, are not likely to deal fairly by them in the future. We have also the conviction that the efforts of the department in this direction have borne admirable fruit in the past. At the same time, we are aware that vicarious adaptation of means to immediate ends is not always wise. As has already been indicated, if the Fisheries department is to take over all existing schools it would at once increase its work in this direction five-fold and the enormous possibilities of expansion of responsibility under this head alone cannot be viewed with equanimity.

It must be conceded that this work is not legitimately in the natural line of development of the department. The chief aim of these schools is elementary education, and such vocational bias as is introduced, is but a subordinate element. We know of no system of vocational education which stops with the child, as it must necessarily do in this case; and to class such schools as vocational in any sense of the term, would, we feel, be rather unwarranted.

The Committee have given this matter their most earnest consideration. We feel that a distinct case has been made out for delegating the responsibility of elementary education in fisher-villages to a special agency, which will bring to the task that element of sympathy which is unfortunately lacking in the ordinary agency which now exists, to discharge that duty. We further consider that the element of vocational bias which now exists in the curriculum of the few elementary schools under the management of the Fisheries Department may be retained with distinct advantage. But in view of the general principle involved as to how far a purely expert department should divert its attention to matters only incidental to its main purposes, we have come to the conclusion that an attempt should be made to improve upon the present system. In view of these findings, and as the only solution which appears possible under the circumstances, we would recommend that the responsibility for elementary education in fisher-villages may, as an experimental measure, including the 110 schools on the East Coast already mentioned be transferred to the Labour Department, which is now discharging that duty with regard to other communities suffering under exactly similar disabilities. The curriculum may still be determined in consultation with the Department of Fisheries which may also share some of the responsibilities of periodical inspection of these schools.

With regard to the Fisheries Training Institute, Calicut, as it is a fishery school in the full sense of the term, it should be retained in the Department of Fisheries, and when the time comes for the starting of purely vocational fishery schools for adults, as it will be before long, this institute will, in addition to its present functions, serve as an indispensable source of supply of teachers for such schools. We may add that, in making this recommendation we have the support of the Japanese models referred to in paragraph 24 of Sir Frederick Nicholson's report. It has been pointed out to us by several witnesses, including an officer of the Education Department, that, unless the Fisheries Training Institute can train a larger number of teachers than it is called upon, at present, to do, it can neither be truly efficient nor economically sound. We are convinced that this is true. In spite of this, however, we strongly feel that it would be an undesirably retrograde step to close the institution. As at present organized, the Fisheries Training Institute imparts a full three years' course of training to Malayali pupils and a one year's supplementary course in fishery technique to Kanarese pupils, who have already undergone the ordinary two years' course of teacher's training. It has been suggested to us that the training at the Fisheries Training Institute may advantageously be limited to a single year's course in fishery technique to Malayali and Kanarese students alike. Those with the most intimate knowledge of the institution point out, however, that a single year is insufficient to develop that corporate feeling needed

if teachers are to be inspired to press forward socio-economic work generally so as to fill the "rôle of the schoolmaster and parish priest in European and Irish villages; a man of influence not so much by his position as a Government servant, as by his attainments and knowledge; he would assist, probably as secretary, the existing or form the new co-operative society, would lecture in the hall, and incessantly, by conversation and argument, inculcate the new ideas; he would be the sanitary critic and adviser, and, it is hoped, take the place as guide and true friend which the toddy shop-keeper or the interested capitalist too often fills evilly at present. As agent of the department he would be the channel of communication, and would, in the first place, make the inquiries which any requests for Government takavi or pecuniary aid might require. As schoolmaster his duties with those of his assistant would be somewhat difficult, for he would have to suit his hours to the needs of the fisherfolk whose boys are necessarily employed during many, if not most ordinary school hours; the hours would be unusual, and elastic according to the character of each day's fishing. His teaching, moreover, based on his work at Tanur, would involve such matters in nature-study as the reasons why fish should be properly treated and the methods of the same, and such manual work as the various odd jobs of carpentry such as are useful to fisherfolk."

"Utopian or exaggerated? Not at all; difficult, but in no way impossible if the matter be tackled systematically, with knowledge; without haste but also without rest. The men would not be isolated units—and here is the supreme suitability of this department as the organizers—but closely in touch with us, through specially selected sub-assistants, through frequent personal visits, and through correspondence; the teachers while personally influential, would be the channels of communication from and to the department; beginning as we should in only a few villages at the outset, they could be thoroughly supervised and made successful object lessons for other villages; indeed, it is mainly the first start, the selection and training of the first men that will be difficult and for that we are prepared." (Sir Frederick Nicholson's letter, dated 14th December 1917.) We agree with him. To enlarge the Fisheries Training Institute at Calicut, by giving a full three years' course to all pupils alike, is unfortunately impracticable, as it is essential that their practical training in the art of teaching should be conducted with children speaking the teacher's own vernacular. We therefore consider that, as soon as sufficient schools are called for to make it practicable, additional F.T.Is. should be established in each of the four main coastal language areas. As a transitional measure, we recommend that the Malayali students continue to be trained as at present so as to provide a nucleus of pupils with stable interests in the wider aspects of their vocation, that pupils from other language areas who are of the S.S.L.C.

standard be given one year's training, as in the case of the Kanarese pupils at present and that this training be, for this reason, given in English. It will be seen from the tabulated programme of development that we recommend the provision of a similar institution on the East Coast in 1932–33. The staff to man this institution should naturally be trained sufficiently in advance and this will need immediate attention.

The proposed temporary expansion of the F.T.I., Calicut, by the addition of students from the East Coast should be sufficient to raise the strength to a level of economic and practical efficiency for the three years before it is proposed to open the new F.T.I. in Madras.

By that time we feel that sufficient Malayalam schools will have been opened to maintain it at this level. In 1919, Sir Frederick Nicholson had indicated the programme this school was to follow.

Though this programme was apparently approved by Government without qualification the rate of progress outlined was not adhered to and it is on this account that the strength of the F.T.I. is underisably low. This neglect, the Committee feel, should be remedied without undue delay.

If the above proposals are accepted the F.T.I. will need additional class-rooms as well as hostel and museum accommodation and playground already urgently needed. This conclusion was forced upon us in our inspection of the institute. We recommend that, to provide space for these and for the research station with which the F.T.I. should work in the closest possible association, the ground between the latter and the road immediately to the south of it be acquired, together with a sufficient area for the playground along the whole length of the eastern boundary as thus extended. There are, as far as we could see, no expensive buildings yet on this site and, although the extensions will cost more than it would cost to remove the F.T.I. to West Hill, the latter alternative is impossible as no fisher-children would be available at West Hill for the model school.

B.—Co-operation.

The evidence on this point has been remarkably definite and consistent. Although the fishermen community are perhaps more in the hands of rapacious middlemen than any other class of workers, and credit co-operation has great scope for beneficial work among them, all efforts in this direction hitherto, through the ordinary agency, may be described as disappointing chiefly on the East Coast. In the case of Credit Societies worked through the ordinary co-operative agency, one difficulty has been that fishermen, as a rule, have no immovable assets to offer as security for loans. Further, their villages lie away from the beaten track and caste

officials of the Co-operative Department cannot very well be expected to visit such villages and wait indefinitely, often till nightfall, for the return of fishermen from the sea, to transact necessary business. Even, after his return, the fisherman is too tired to take much interest in such matters. The fruits of his labour are at best uncertain and to recover from him payments either of principal or of interest on loans is much more difficult than with other classes of persons whose incomes are more certain. Even in those rare cases on the East Coast in which Credit Societies did take root, the fishermen often had to pay penal interest by reason of their being unaware of the due date of payment and in consequence they themselves asked for the Societies to be wound up. A contrast to this is to be found in two non-credit Societies formed among them by the Department of Fisheries. In the latter case, Government advanced necessary funds to Societies formed of groups of fishermen at Blangad and Palapatti in the Ponnani taluk, for the purchase of boats and nets, on condition that the working of the Societies should be supervised by the Fisheries Department. The loans are being repaid fairly regularly from profits and no difficulty has so far occurred.

The success of the venture indicates that such co-operative work is best done through the agency of the department which alone has the necessary intimate knowledge of this class of people. This view is supported by the evidence of several witnesses, and is also endorsed by the Co-operative department [*see* paragraph 33 (6), page 52 of the Report of the Committee on Co-operation in Madras, 1927-28]. We would therefore support the recommendation contained in the paragraph above cited, but would add the qualification that all co-operative work among fishermen on either coast should be done by the Fisheries Department. This would necessitate some system comparable with that already in vogue in the Labour department by which Co-operative Inspectors work under the latter department, the Co-operative department being saddled with the responsibility of supplying and adequate number of trained men from time to time on requisition and of auditing the work of societies.

SECTION VI.—FISH-CURING YARDS.

"The attention of Government having for some time past been drawn to the improvement of the fisheries of this Presidency, which are capable of affording so vast and valuable a supply of food for the people, the Governor in Council considers it desirable to ascertain how far the existing resources are practically wasted by the prohibitive effect of the salt duty; much fish being now thrown away, or imperfectly cured, in consequence of the inability of the fishermen to use good salt in sufficient quantities for the purpose,

and being reduced to the use of salt mud, which must often be deleterious, or salt water, which is certainly not efficacious." With these words begin the first proceedings of the Government of Madras, available to us, on the subject of fish-curing and the price of salt. They are dated 22nd April 1873. The first two statements contained in them constitute in substance two of the main grounds for the constitution of this Committee, while the third analyses one aspect at least of the question of the propriety of the present issue price of salt.

But what is more important to us in the above record is the explicit recognition of the customary right of the fishermen to make, what would otherwise have been contraband, salt, for the purpose of curing their fish. The next communication on the subject is in the form of a letter from Dr. Day, Inspector-General of Fisheries to the Government of India, under date 25th June 1873, on what he considered to be the actual and probable effect on the Indian fish-curing industry of an increase of the duty on salt. This is of more specific interest to us, for not only does it deal with one part of the identical question which has been referred to us for examination, but also the empirical material on which Dr. Day's conclusions are drawn related to this Presidency, and chiefly to fish-curing on the West Coast.

"In 1868," he says, "it was decided that *the manufacture of salt in Malabar and Kanara was not illegal.* This was originally intended for home consumption only, but now it is largely used for the curing of fish . . . The Tahsildar of Negapatam . . . having stated that a great increase in the salt-fish trade had taken place since the opening of the rail, I at once wrote to the Traffic Manager, who sent me the following reply: During the last 12 months the weight of salt-fish received at stations on the Company's line from the Western Coast was 288 tons. During the same period the quantity forwarded from the Eastern Coast, Negapatam Station, was 16½ tons. Thus the increase of fish was due to . . . importation from the West Coast, where salt earth is collected *duty-free* and employed for curing fish.

"Of course, if this is a correct explanation of the marine salt-fish trade, the exports from Malabar should have increased since the salt-tax was raised in other districts, and the replies I have received entirely bear out this view. I have been favoured with a return from Tellicherry, which gives the following:—

			cwt.
Export of salt-fish for five years ending		1857–58 ...	18,621
Do.	do.	1862–63 ...	50,004
Do.	do.	1872–73 ...	2,92,311

Note.—The duty was raised in other districts by 2 annas in 1861–62."

He then proceeds to compare the conditions in Travancore, and finds that the facts observed there lead to the same conclusions. He then concludes as follows:—

"Thus Ceylon, with a salt tax of 4*s.* 8*d.* per cwt., and in Madras, where it is 5*s.* 5½*d.* show that either country will be importers of fish cured with "duty-free salt." He then appends a few observations on the general conditions of the fishermen on our coast, which are of some interest.

"The same state is observable amongst those people all along the coast of the Bay of Bengal to Cape Comorin, except where there are large towns or communities that will purchase the capturer's fish whilst fresh. Up the Malabar Coast, so long as one continues in the Madras Presidency, fishermen are well off, although the salt-tax is identical with that obtaining elsewhere. The cause, however, is easy of explanation; irrespective of fish-oil, they may collect salt-earth free of tax for the purpose of fish-curing. Immediately one steps over into Bombay Presidency, this miserable state of the fishermen again comes into sight; *no salt-earth may be collected; the salt-tax has destroyed their trade, except at the large towns.* But in Sind, without a salt-tax but one on the fishing, he is doing a thriving business."

On this letter, the Government of India made a reference to the Government of Madras, asking them whether they were desirous of trying the experiment of a Government salting enclosure, *where salt would be supplied at only a little above cost price, etc.*

The Madras Government referred the question to several Collectors of Sea Coast districts, as also the Sanitary Commissioner. As a result the Board of Revenue reported as follows:—

"The Sanitary Commissioner is strongly of opinion that the use of semi-putrid fish is a frequent cause of sickness, and that the amount of salt employed in the process of fish-curing in vogue, both on the Eastern and Western Coasts, is insufficient to preserve the animal matter from decay. He further states that salt-fish as an article of diet is undoubtedly wholesome, and that *any measure which can be devised for the improvement of the supply cannot but have a beneficial effect on the public health.*

The Collectors were however not very sanguine of success, the chief reasons for it being—

A.—The improbability of inducing the fishermen, who now pay nothing for the salt-earth and salt-water with which they cure their fish, to pay even the lowest rate at which it may be possible to offer salt . . .

B.—The impossibility of starting any enterprise such as that proposed without prohibiting the use of salt-earth for fish-curing, and insisting on *all* fish-curing being done within the limits of the Government enclosure."

The Board of Revenue considered it, however, doubtful whether "fishermen will, of their own accord, resort to Government curing yards, at some cost and greater inconvenience, *merely to be enabled to produce a better article* . . ." They added that "if it can be demonstrated that the improved methods hold out prospects of larger profits than the primitive methods in vogue, it may fairly be presumed that they will in time give in their adherence thereto."

The Government then decided to start one curing yard in each Sea Coast district and directed that—

"The price at which salt is to be sold should be sufficient to cover the charge (which the experiments will involve), including the cost price of the salt."

This was in the year 1874, and the price of salt issued to such yards was fixed at six annas a maund in the East Coast districts, where the manufacture of salt is easy and transport charges therefore less but fishing not so good, and at 12 annas a maund in the West Coast districts of Malabar and at eight annas in South Kanara, in both of which salt-manufacture is more expensive and difficult but catches of fish are very much greater.

Though these curing yards had been established by Government, there was still complete freedom to the fishermen to cure their fish with salt-earth. Apparently the improved methods of curing in the yards did not, as was anticipated, result in larger profits to those who resorted to them—a fact testified to by more than one witness during the sittings of this Committee—and in 1882, when Act I of 1882 came into force, prohibiting all collection, storage and use of salt-earth as a penal offence, the fishermen on the West Coast petitioned Government to permit the duty-free collection of salt-earth by framing rules under section 27 (*a*) of that Act. In reporting on this petition, Mr. H. W. Bliss, who was then Commissioner of Salt, said as follows:—

"No rules for the duty-free collection of salt-earth, likely to be satisfactory to the fishermen, while affording sufficient protection to the revenue, have as yet occurred to me. Even if such rules could be devised, which I very much doubt, I consider that the expediency of enacting them would at least be questionable. Fish cured with salt-earth is at best stinking and unwholesome stuff, which it cannot be to the interest of the consumer to allow

to pass into the market. I think that the proper course to adopt is, to greatly increase the number of fish-curing yards, at which *salt will be sold at a low price;* and, at the same time, absolutely to prohibit the use of salt-earth, the retention of stocks of which on the pretext of fish-curing is, and always must be, a fertile source of loss of revenue, since there is no guarantee that they will not be used to make earth-salt. On the contrary, it is practically certain that they will be . . ."

"I trust, therefore, that the fishermen, whose case I admit is a hard one, will have no further cause for complaint . . ."

The Board of Revenue concurred with the Commissioner, and the Government, in passing orders on the petition, took pains to explain to the petitioners that "efforts are being made to minimise any hardship that may result from the operation of the Salt Laws." This was in October 1882.

From the foregoing it is perfectly clear that the establishment of fish-curing yards was solely in the interests of the public, namely:—

(*a*) To provide them with more wholesome dry and salt fish as an article of diet ;

(*b*) Subsequently also to save Government the trouble, expense and risk of devising and administering measures against the use of salt-earth ostensibly collected in pursuance of an immemorial right to cure fish with, but which could, in the absence of careful preventive measures, be easily converted into earth-salt.

There was, no doubt, at the beginning, a vague theoretical idea that the better article, manufactured under the more sanitary and scientific conditions of the yard, would be appreciated by the public at large, and in consequence command a better market at the expense of the fish cured in the primitive way, but this anticipation never materialised, and for very obvious reasons. The bulk of the consumers of dry or salt-fish do not possess even that modest degree of enlightenment, essential to appreciate the value of the difference. Moreover, it has also been represented to us that even now some markets do actually prefer the so-called "stinking and unwholesome article" as a food to the more modest virtues of flavour in the products of the curing yards. For similar reasons of taste do, perhaps, Gorgonzola cheese and the Doorian command very selective markets ! Whatever this may be, by the year 1892, when there were no less than 108 curing yards in the Presidency, these initial ideas which underlay the very founding of curing yards, appear to have been forgotten,

and a new policy begins to be enunciated. In Resolution No. 160, dated 17th March 1892, the Board in advising Government on the question of opening a new yard, says as follows:—

"The Board is unwilling to address Government in the matter because, on reconsideration, it is of opinion that the erection of a fish-curing yard is *not a purpose* for which the Land Acquisition Act need be put into force. When the industry was in its infancy, it was probably desirable to encourage it by all means available, but now that it has been placed on a firm basis, it can be well left to take care of itself. The Board considers that the future policy of Government in regard to the opening of fish-curing yards should be, that the curers should provide the site and the necessary buildings, upon which Government would provide an establishment, and would sell the salt at a reduced rate."

The Government approved of the policy suggested by the Board. The Committee wish to invite attention to some aspects of this enunciation of policy, and the grounds urged in justification of it. The Board does not go so far as to hold that the Land Acquisition Act cannot in law be applied to such cases, but the view appears, by necessary implication, to be that, though there is an undeniable element of public interests served by the establishment of such yards, yet the interests served in the main are those of the curers, and therefore predominantly private. It is scarcely necessary to add that there is nothing to warrant this view, and if the crucial test of an offer to existing curers to choose between a reversion to the primitive methods of curing their fish with duty-free salt-earth in their own homes and the more hygienic and scientific methods of curing their fish in the yards, were to be made now, the issue, we feel certain, would not for a moment be in doubt.

The reference to the infancy of the industry appears to us to be even less defensible. In a country whose sailors visited remote shores in search of trade even at the very dawn of civilisation, fishing and the primitive industries allied to it, could not possibly have been new in historic times. It is certain, at any rate, that the salt-fish industry was never in its infancy in British or even Muhammadan times. The dragooning of that industry into habits less dangerous to public health was certainly only a decade old by 1892, but the industry itself was probably co-eval with agriculture, weaving and other ancient industries of India. And if the reference be to the age of the restraints that had, in social interests, been put on it in the 20 years immediately preceding the statement under discussion, it is open to an even more serious criticism, in that, to urge the fact that the curers are bearing these restraints with patience, born of habituation, as a ground for ignoring the private sacrifice involved, is so manifestly at variance with the ideals that have so far, from the very earliest times,

inspired the British Government in India. We note, however, that these sacrifices do find explicit recognition in the orders issued on this letter, for it is provided there that the salt should be sold to these men at a reduced rate. But this element appears to have been regarded as a temporary palliative rather than a permanent principle, and it may be said broadly that, in the next 15 years, the idea of Government was to be generous to the curers, *but only in so far as such generosity did not result in any loss to Government beyond the duty on salt.*

In 1906, at the instance of Sir Frederick Nicholson, the issue price of salt to yards in Malabar was reduced from one rupee to ten annas, leaving the rate in South Kanara at six annas eight pies. Another concession granted to the industry at the time was, that Government agreed to construct, in the first instance, the buildings required and to carry out improvements to the buildings, if the curers agreed to the recovery of such advances by means of a small cess added to the issue price of salt in that yard. In 1917, the rate in South Kanara was also raised to ten annas, as it was found that the industry could bear normal treatment in that district too.

A financial statement showing the results of the working of the yards since 1896 is appended (Appendix V), as also three graphical records of these figures. In the first, which deals with the years 1896 to 1907, the profits are seen to increase progressively and then decline steadily to the year 1908. From the following year, there is a loss, which increases progressively up to a maximum in 1922. This is shown in the second figure. The third shows the quantity of salt consumed in these years, and, as there is on the whole a fixed ratio between weight of salt and weight of fish cured, the salt-curve may be taken to be parallel to the fish-curve, and therefore to indicate the variations in the quantity of fish cured in these years. It is fairly clear from these that the loss is not due to any variation in the quantity of fish cured, but to causes entirely outside it. As a matter of fact, we know it is due to increased cost of transporting the salt, chiefly to yards on the West Coast and the increase in the cost of establishment. Whatever it may be, the loss is a fact, and from the material before us we are not able to see any means of reducing this cost, except perhaps in the item of transport, of which, however, we propose to make separate mention later.

The Committee, further, do not see any grounds for differing from what they understand to be the view of the Finance Department, that not only the cost of the actual staff employed on the yards, but also some proportionate cost of the superior supervising staff, and all pensionary and other contributions, are a legitimate charge in calculating the actual cost of running these yards. Any

commercial concern maintaining a system of accounts to show the relative costings of different departments would do no less.

In 1921–22, the loss on the yards amounted to no less than Rs. 1,37,244. By apportioning this loss among the total quantity of salt issued, the loss per maund of salt was found, and this loss was added to the issue price of salt in order to cover this deficit. The result was that the issue price of salt was increased from ten annas to double, namely, Rs. 1–4–0, and since then there has been no loss, or we might even say a doubtful profit—doubtful because the apportionment of relative costs of superior establishment is a matter of approximation. In any case, there is no loss at present. The Committee do not think it essential to go into the matter of examining the question as to whether the apportionment of such charges is equitable or not, or as to whether certain items, such as the charges on account of the supply of clothing and equipment to the staff, should be omitted in whole or part. We consider it more proper to leave these questions for decision by the expert department, whose function is to deal with accounts. Nor do we think that the main issue is best decided on minor considerations of this kind. We, therefore, propose to approach the question entirely from considerations of a general nature.

It is not merely a matter of inference, but has been the subject of explicit declaration by Government on more than one occasion that—

I. Fish-curing yards were not established for the benefit of the curers so much as in the interests of public health.

The anticipation that an improvement in the quality of the salt-fish would lead to a greater demand for the article on the part of the public, as in more civilised countries, has not yet been realised. This was the only way in which the curer could have benefited by these yards and so we may say that at present, and up to the present, the yards have only profited the public. It may be that under existing laws any unwholesome fish, cured in the old way, would have been subject to seizure and destruction by the public authorities, and to this extent the fisherman would have been a loser. But the fact remains that his market lies in remote villages, and consists of a public which refuses to recognise that kind of salt-fish as noxious. For a public health department to combat and prevent the production and sale of the salt-fish under these conditions would have been an impossible task. The Committee therefore feel that some portion of the cost of maintaining these yards is a fair charge on general revenues, much in the same way as the free distribution of quinine, the provision of public parks or the installation of free taps in the streets of towns to supply wholesome water, free of charge, to the poor. Is it ever contended that the licence-fees of slaughter-houses are intended

to cover all expenses of supervision, assessed in the same manner as those charges are, in the case of curing yards? These instances may be multiplied indefinitely, but we feel that enough has been said to show that our suggestion has a great deal to warrant it in actual practice.

The Committee have reasons for holding that the connection between salt-earth and earth-salt or salt is no more intimate than that between unfermented sweet-juice and ordinary toddy from palms, and yet we do not think that it would be seriously suggested that the sweet-juice tapping industry should be saddled with the cost of its supervision by officers of the ordinary Excise and Police departments. It has been fairly clear throughout the early history of the curing yards, and the fact has been explicitly stated in the letter of the Commissioner of Salt in 1882—Mr. H. W. Bliss, a distinguished member of the Madras Civil Service—that these yards represented an easy means of preventing the use of salt-earth for the purpose of fish-curing, a use which was in the nature of a very ancient customary right, which, if not for its connection with the manufacture of salt for ordinary domestic consumption, would have been recognised much in the same way possibly as the right to water in the case of *mamul* wet inams. Thus these yards have also served—

II. To save Government the trouble and expense of devising and administering measures against the use of salt-earth, ostensibly collected in pursuance of an immemorial right to cure fish with, but which could, in the absence of careful preventive measures, be easily converted into ordinary salt.

The Committee consider that, in equity, the curers are entitled to some portion of the saving thus effected, at their expense, for the Public Exchequer.

The Committee realise that it is a more difficult matter to assess the exact proportion in which the cost of administering the yards should be divided between Government and the curers, but before making any specific suggestion on the point, it would be as well to remember that the concession is to a class of people, the fishermen, for whom, as has already been observed in the chapter on education, the Government does relatively little. Their villages lie away from communications: they are scarcely served with schools; the Agricultural Department scarcely knows of their existence; no veterinary assistant probably ever visits the bulk of their villages, and even ordinary medical relief is rarely conveyed to them at public expense. They are ignorant and helpless, and have for generations struggled on the very verge of a mere subsistence-economy. And what has been done for them in the past? The Government of India is prepared to give duty-free salt to any industrial concern for industrial purposes, and the wealthy

Buckingham and Carnatic Mills of Madras get salt from the Wall Tax Road Depôt duty-free in exactly the same way as a fish-curer in a Government yard now does. There is perhaps this difference, that the fish-curer has no control over cost of its transport, but has to pay it as billed for, while a big commercial concern has an opportunity of arranging its own economies in the matter. And nothing in the way of supervision is, we believe, charged to such a concern holding bonded salt for industrial purposes, while the curer has to pay such charges as well. The Committee feel constrained to recognize the disability under which the curers have been suffering in the recent past, ever since the price of salt was raised to Rs. 1–4–0 a maund, and would urge that some restitution is due to them for this specific disadvantage, in addition to what their poverty, social status and civic disabilities entitle them to.

It has been urged before the Committee in their discussions that the curer is often a middleman, and that any remission in the issue price of salt is likely to result in a benefit which stays with him, or is possibly in part transmitted to the purchaser of the product. But this does not appear to us quite a comprehensive statement of the case. The fact is in evidence—fishermen do not, as a rule, go out to catch fish for salting. What they are not able to sell fresh from the daily catch for a fair price, or sometimes not at all, they are constrained to sell to the curers. The supply of the raw material to this industry is therefore inelastic, and the supply has to be disposed of at that price which will absorb it. The remission of the issue price will, no doubt, in the first instance, enhance the profits of middlemen-curers, but these are an enterprising commercial class, and the fact of unusual profits from the trade cannot very well be hid from them for any length of time. This will stimulate competition among them, with the result that the fisherman is likely to command a better price than hitherto for such portion of his fish as he is constrained to sell for curing. Thus the benefit of the remission is certain in due course to reach him to an appreciable extent, and what is more, the increased production will lower prices, and besides conferring a boon on the consumers, who are as a class among the poorest in the land, will also increase the percentage of the population living on a fish-diet.

It has been also argued that doubling the issue-price of salt in 1924 has not affected the amount of fish offered for curing in the yards. This, we consider, merely supports the view above given, namely, that whatever the market demand for fresh fish for salt-curing may be, the fisherman has no choice but to accept it or to put the fish to some other use less remunerative. These other uses are so unremunerative—manure possibly—that any price however low for fresh fish is better. Again, the price of salt used in curing contributes but about 15 per cent to the value

of the cured fish, and so if its price is doubled, the price of the raw fish, which is about 75 per cent of the whole, has only to be reduced by one-fifth to keep the total cost of the salt-fish at the old level. There are no exact figures available as to the quantity of salt used and the value of the raw fish varies with different varieties, but we may safely take—

Cost of salt	...	about 14 per cent at most
Cost of raw fish	...	,, 76 ,,
Other charges	...	,, 10 ,,

The Committee therefore think that any remission in the issue-price of salt is likely to reach the fisherman either directly or by stimulating the salt-fish industry to the extent of raising the price of the raw fish.

The Committee thus believe that a definite case for the reduction of the issue price of salt has been made out, though the difficulty of determining it exactly still remains. They would however recommend to the consideration of Government their unanimous opinion that it would be fair to charge to the curers something over a moiety of the total cost of the yards, salt and supervision, as assessed on the basis of the calculations of the Finance Department. Accepting Rs. 1–4–0 per maund as this total cost, at the present rate of consumption, they would suggest that 60 per cent or 12 annas would be a charge comprehending the generosity the community and the trade deserve at the hands of Government.

The transport of salt to the yards appears to be effected in the following ways, namely:—

A.—By schooners hired to carry it under their own sail, the charge being according to the total quantity conveyed.

B.—By hired schooners, which, after being loaded, are towed by a steamer at Government expense; hire being by the month.

C.—By trains.

Of these, the first (*A*) is the cheapest, but it has one serious disadvantage. The process is slow, and being dependent on wind, weather and the limited skill of navigators of local training, there is great indefiniteness about the durations of their trips. This by itself is bad enough, but its gravity is materially enhanced by the fact that even in the big curing yards on the West Coast, there are no storing sheds of capacity commensurate with the demand on them. If therefore a fishing season commences earlier than is anticipated—and in our present state of ignorance of our coastal fisheries, this is often the case—this system naturally breaks down, and has to be supplemented by either or both, of the other two.

(*B*) Depending as it does on towing, this method presupposes the availability of the Government trawler for the purpose. This is a very prompt and ecnomic means, but when an industrial equipment is provided for one main purpose, it is economically unsound to utilize it for a subsidiary and far less important purpose

on the ground, that its efficiency in that use for that limited time covers both its prime and supplementary costs. It is manifest that, had towing been the main work of the trawler, its purchase would have been an unsound proposition, for its capacity for use in that connexion is so limited, that taken over the year, it certainly would not have paid more than a fraction of the interest on its capital cost and depreciation. It appears to us beside the point to urge that it was not fully equipped for its main work, the remedy for that defect is not indulgence in subsidiary uses but direct and prompt removal of such defects. We therefore concur, in passing, with the ruling of the Finance Committee, that its use for the purpose of towing salt-schooners is, on principle, wrong. If, however, when doing its proper work with full equipment for it, the nature of such work necessitates periods of enforced idleness for the trawler, as when hydrographic, fishery or biological observations made on the previous cruise have to be worked out or charted, and such periods can, without the least interference with its legitimate work, be used for transport work, that will no doubt be a desirable means of reducing the transport costs of salt to yards, and thereby of reducing the public burden of such costs. For, if our previous recommendation is accepted no share of such savings is legitimately due to the curers. After hearing Captain Cribb, the Committee are of opinion that such economies are possible, and in recommending them for consideration, we do so with an emphatic proviso that this should be merely an incidental use in times of enforced idleness, and should not be permitted to interfere in the least with the trawler's more legitimate duties. In the event of these conditions not being satisfied, when an unexpected call for salt from yards comes, or in the season when salt has to be rushed to several big neighbouring yards at about the same time, we can at present see no other alternative but the use of (*C*)—Transport by rail—a most expensive method, and one to which recourse should never be had except when absolutely unavoidable.

SECTION VII.—THE DIRECTOR OF FISHERIES AND HIS OFFICE STAFF.

The Director of Fisheries is a distinguished graduate in Zoology of the University of Madras, and his service under Government is as below:—

Zoological Assistant, Government Museum, Madras	... 1912—14
Assistant to the Piscicultural Expert	... 1915–16
Officiating Piscicultural Expert ...	... 1917–18
Assistant Director, s.p.t.	... 1918
Piscicultural Assistant	... 1919
Assistant Director, Inland Fisheries	... 1920—23
Director of Fisheries	... 1923 onwards.

From 1908 onwards he carried out a series of valuable researches on the life-history of Indian fishes.

In 1921 he proceeded to the University of Liverpool, where as a result of his work, as embodied in an original thesis on the Irish sea deposits and their drift, he was awarded a Doctorate of Philosophy. On return, he was appointed Director of Fisheries in the year 1923, and he has occupied that position ever since.

During the time he has been Director, he has travelled extensively in Great Britain, Germany, Denmark, Holland and America with a view to study the organization of Fisheries in those countries, their methods of research and their achievements both in pure fishing and in the allied questions of cold storage, transport and industrial applications. He is a Telugu by birth, and has lived a considerable time in Tamil-nad and Ceylon, and is thoroughly familiar with the languages, habits and life of all the inland and maritime fisher-folk of this Presidency. He is therefore able to bring to his duties, a trained intellect, an experienced official mind and a fund of knowledge comprising not merely local conditions, but also of the fishing industry in all parts of the civilized world. The Committee feel that they owe a great debt to the Director for his services to them.

They would further like to bring to the special notice of Government his achievements in connexion with the Pearl Fisheries of 1926—28 off Tuticorin, the success of which they are led to conclude by the records of the fisheries that they have read, and such evidence as they have heard, was in the main due to his organizing capacity, expert knowledge and ability to work. It appears to the Committee therefore unfortunate, quite apart from all other considerations of status and prestige, that his pay should have been fixed at so modest a scale as 750—30—1,200 and permitted to remain there. There is no precedent for it, for, his predecessor, by no means a distinguished scientist though an expert Fisheries Officer, was on a higher scale. We have in consequence the strange situation in the department, that the Assistant Director, Marine, is on a higher pay than his own Director. The Committee understand that the former appointment was made on the strong and specific recommendation of the Director himself, and from what they have seen of the work and personality of Captain Cribb, the Assistant Director, Marine, they are strongly of opinion that the department is fortunate in having the services of such an officer on the pay now given to him. They would, however, like to point out that the present pay of the Director of Fisheries is not commensurate with his qualifications, his past record of service, the status and prestige of the head of any department of Government or the responsibilities of his present office. The Director, in their opinion, should be paid a salary on a par with other heads of departments of equal status. They

would therefore recommend to Government that the scale of his pay may be increased to Rs. 1,250—50—1,500, the scale now attaching to the office of the Director of Veterinary Services (but which we understand is shortly to be increased), and that this be given effect to from the next financial year.

The Committee understand further that in common with the Director of Veterinary Services, the Director of Fisheries is not given the full powers of a Head of a Department under the provisions of the Fundamental Rules, Chapter II, paragraph 9 (32) ii. They consider that this is apt to handicap the administration, and do not quite see why an officer of the experience and service of the present Director should not be entrusted with the powers now vested in the Director of Agriculture or Industries. They recommend this point also for the consideration of Government.

In conclusion, and for reasons recently discussed in full for the appointment of a purely ministerial officer as Personal Assistant to the Director of Veterinary Services, and a few years ago to the Director of Agriculture, they recommend the appointment of a similar non-expert officer, preferably with Revenue and Accounts training, as Personal Assistant to the Director of Fisheries. This is in addition to the expert Personal Assistant he now has. This will serve to relieve him of much of his routine duties, and afford him the necessary time for the performance of his more important duty of directing the expert work of his department. We suggest a scale of Rs. 250—25—500.

SECTION VIII.—MISCELLANEOUS.

Larvicidal fish.—The history of this branch of work has been already dealt with in the Chapter on Inland Pisciculture. The main branches of work are threefold, namely:—

(*a*) the selection and breeding of good strains of larvicidal fishes in fish farms for supply to local bodies;

(*b*) the periodical stocking of pools and water holes in specially malarious tracts, such as the Nallamalais;

(*c*) the conversion of mosquito-invested sheets of water in places where malaria is endemic into fish-breeding ponds thereby rendering the area free from malaria—conspicuous work in this direction has been done in the Fort moats at Vellore and Chingleput.

The department makes a nominal charge covering only primary costs in the case of supplies made to local bodies. In the case of (*b*) and (*c*), the work, though legitimately within the province of the Department of Public Health, is gratuitous, though no doubt some profit is made out of fish-breeding referred to in (*c*). The Committee are of opinion that the cost incurred in these activities should, to some extent at least, be borne by the Department of

Public Health in the form of a contribution. We are of opinion that, in the interests of Public Health, this work should be steadily developed throughout all malaria-affected tracts of the Presidency.

Industrial.

Scholarships.—The Committee wish to invite the attention of Government to the scholarships now awarded in the Department of Industries to Indian Students for the study of Industrial subjects abroad. We need hardly point out that fishing is an industry in the full sense of the term, as defined in Part I, Rule 2 of the rules for the grant of State Technical Scholarships and, from what has already been said in preceding paragraphs, an industry of paramount importance. They would therefore recommend to Government that subjects connected with this industry should also be included among the subjects for which such scholarships may be awarded. We may mention, as suitable subjects of such study—Bio-chemistry of fish-oils and fats, Bio-chemistry of preserved fish and by-products, the industrial and scientific aspects of refrigeration and cold storage, and even methods of capture, such as trawling, seining, lining, etc.

If this view is accepted, it follows, as a necessary corollary, that the Director of Fisheries should also be on the Board of Selection (Rule 7, Part I of rules for the grant of State Technical Scholarships).

Administration Report.

In reading the portions of the Presidency Administration Reports relating to this department for the years 1924—29, chiefly 1928, the Committee have noticed that, in reviewing the work of this department, the income is balanced against the expenditure and a conclusion drawn in terms of profit and loss as in the case of a purely commercial concern. The Committee are at a loss to understand the basis for this differential treatment. The findings of the Committee in the preceding paragraphs, no less than the repeated statements of Government, afford no justification whatever for judging its work by its receipts. Far from being a mere profit and loss concern it is as much a scientific and expert department as that of Agriculture, the main results of the work of which are in the form of public benefit.

We therefore recommend that, in this respect, the department be accorded the position due to it.

Cold Storage and Transport.

The Committee have had the advantage of hearing two distinct varieties of evidence on this subject; one, from the fisher-folk themselves, who complained of the difficulty they had in preserving their fish from taint, especially when they had a good catch and the ordinary market was not able to absorb it all, and there was no fish-curing yard within reasonable distance, and the other, from

persons who, though not necessarily fishermen themselves, were engaged commercially in transporting and selling fish in distant markets.

It has already been incidentally mentioned in another connection that fishing villages were on the whole very much worse served by roads than the rest of the Presidency and this in a country in which, broadly speaking, communications are still undeveloped. Seeing that we are to a great extent guiding our future development on English models, it is as well to realise adequately the part played in that country by improvements in roads and means of transport. "Thus," says a contemporary authority, "during the latter nineteenth century, the dominant factor in the Englishman's increased capacity to obtain almost every important commodity was one and the same, namely, improved transport; for, a main part in what improvements in manufacture accomplished was to cheapen means of transport." These improvements are available to us for use, provided the means of communication are ready. There is a real defect in this direction, but it is a most encouraging sign that local bodies are now taking a much livelier interest in the opening up of communications than hitherto. We have therefore reason for hoping that with the development of our fisheries a material development in communications will occur, so that production will not be crippled by disproportionate difficulties in distributing the produce to markets.

With regard to cold storage, two notable attempts have been made by private enterprise in connection with the cold storage and transport of fresh fish in ice. The first of them, on the West Coast, was started and is being conducted, with the expert advice of the Department of Fisheries, while the other, on the East Coast, appears to have been on a more modest scale. The former is doing good business, while the latter appears to have been closed recently for reasons the Committee have not been able to ascertain.

Mere artificial ice, transported from outside, is both expensive and troublesome, especially in the absence of a central storage depôt of special construction in the fishing centre. We have had some expert evidence on the subject of refrigerating plants, from a witness interested in the subject purely as a commercial proposition. The witness himself was optimistic on the point, but the Committee are unable to pass any opinion on the subject. It is however of interest to note, that in the kind of refrigeration advocated, carbon dioxide is said to be the chief agent, and this gas is a by-product in more than one industry of great promise in this Presidency—we refer to the Sugar Refining and Magnesite Industries.

Conclusion.

The various recommendations contained in the foregoing have been collected together in a tabular statement, submitted as Appendix I to this report. It will be observed that we do not

propose that they should all be given effect to at the same time, but that they should be spread over a series of years. Merely for the purpose of indicating the relative importance of the various proposals and their sequence in time, which, in our opinion, is called for on the results of our enquiries, we have spread them over ten years. This period is not intended to be a hard and fast one, but may be extended or curtailed as administrative exigencies and future experience suggest. The statement sets forth in a clear form what we have been led to think is a proper perspective of the future growth of the department.

We would like, however, to emphasise that the recommendations included in the programme for the first year should be given effect to with as little delay as possible. We feel that the changes indicated there are indispensable to bring the organisation and personnel of the department to the minimum pitch essential for full efficiency.

In bringing this report to a close, the Committee wish to place on record their deep appreciation of the great help rendered to them by the witnesses, who, at considerable personal inconvenience and expense, appeared before them to give evidence on the subjects included in the terms of reference relating to this enquiry.

(Signed) S. Kumaraswami Reddiyar,
President.

(,,) F. H. Gravely.
(,,) S. K. Abdul Razack Sahib.
(,,) S. Arpudaswami Udayar.
(,,) P. V. Manicka Nayakar.
(,,) R. S. Nayudu.
(,,) A. McG. C. Tampoe, *Secretary.*

APPENDIX I.

QUESTIONNAIRE.

I. Aims of the Department.

1. What were the objects with which the Fisheries Department was inaugurated?

2. To what extent, in your opinion, were all or any of those objects achieved?

3. To what extent, if any, do you think there was failure in achieving such objects?

4. Can you assign any reasons for such failure?

5. If you consider that such objects are worth being achieved, what general remedies would you suggest?

6. In view of your answers to the above, what should, in your opinion, be the main objects of the department?

7. Please give the order in which you would place those objects according to their importance.

II. Fish Food Supply.

8. In your opinion, is sufficient quantity of fish caught for local consumption?

9. Is fish food cheaper than other kinds of non-vegetarian food?

10. Is there any effective demand for more fish food?

11. Can greater supply create such a demand?

12. Is there any reasonable probability that any material increase in the supply is likely to be absorbed without difficulty?

III. Improved Methods of Fishing.

13. Are the present methods of catching fish effective?

14. What improvements, if any, have been effected in recent times in this Presidency in—

(*a*) fishing craft,
(*b*) gear and tackle, and
(*c*) fishing grounds.

15. If none have been effected, what are the reasons?

16. Can you suggest any improvements?

IV. Deep Sea Fishing.

17. How many vessels are there, including boats, in the possession of the department?

18. Is there need for all such vessels?

19. Can their number be reduced?

20. Is any retrenchment of expenditure on these vessels possible?

21. If so, to what extent?

22. When was the trawler taken possession of by the department?

23. What work in detail has it done since its arrival?

24. How far has its work been consistent with the original purpose for which it was purchased?

25. How often has it been used—

(*a*) for transport of salt,
(*b*) as a pearl fishery schooner, and
(*c*) for other purposes?

26. Was the original purpose in any way defeated by the trawler being used for other purposes?

27. Is the trawler useful and efficacious for the purpose for which it was meant?

28. Is it fitted with the apparatus necessary for research work?

29. What kind of research work was expected to be done by the trawler? Is it of a purely scientific nature, such as biological or hydrographical investigations, or is it of a practical and technological character, such as better methods of capturing fish?

30. Was the necessary staff appointed for the purpose?

31. When was Captain Cribb employed?

32. How long has he been in service?

33. What is the work turned out by him?

34. Has he been given the necessary assistance and afforded the necessary facilities?

35. Is anybody being trained under him?

36. What is the annual expenditure of maintaining the trawler?

37. Has any investigation been made regarding the existence of fish in deeper waters?

38. What is the ordinary line (distance from the shore) up to which fishermen go?

39. Why do they not go beyond that line?

40. Is it the distance or the depth that prevents them?

41. What is the longest distance from the shore which the trawler has ever covered?

42. What is its capacity for deep sea fishing?

V. Fish-curing Yards.

43. What was the main consideration which led to the transfer of the fish-curing yards to the Fisheries Department?

44. How far have results justified the transfer?

45. What further changes in their administration would you suggest for more efficient work and for the production of improved kinds of salted fish?

46. Shall the issue price of salt in the curing yards be further enhanced, left as it is, or reduced?

47. Can salt be supplied cheaper and more efficiently?

48. Who shall supply the salt—the Madras Government or the Government of India?

49. If the issue price is reduced, who will be benefited mainly—the fishermen, the curers, the consumers or the middlemen?

50. Can you suggest any reasons why the Government should reduce the issue price of salt and whether there are any considerations which should, in your opinion, induce the Government to lower the price?

51. Have you any idea of the quantity of fish salted?

52. Is there demand for more?

53. If so, what suggestions would you make in order to meet such demand?

54. Can the maintenance of the fish-curing yards be cheapened?

55. Are the fish-curing yards in the Presidency kept in the same way and under the same conditions as they are kept in other civilized countries?

56. If not, would you suggest any improvements?

57. Are the hygienic conditions and methods of curing satisfactory?

58. If not, what improvements would you suggest?

59. What would be the cost of effecting such improvements?

60. How is the cost to be met?

VI. Fisheries Cannery, Chaliyam.

61. Are you acquainted with the working of the cannery at Chaliyam?

62. How far has the cannery served its purpose?

63. Was the institution used for the purpose of training outsiders?

64. Are any persons so trained employed anywhere in the canning business after their training?

65. Are there any canneries started on the model of the Chaliyam Cannery, and if so, what is their present condition?

66. Is it a fact that canned fish from Malabar does not find a ready market in competition with imported canned fish?

67. What in your opinion are the reasons?

68. Can you make any suggestions to popularize Indian-canned fish?

69. Have you any idea of the extent of foreign-canned fish imported into India as a whole and into the Madras Presidency in particular and by whom such fish is consumed?

VII. Experimental Station, Tanur.

70. Are you acquainted with the working of the Tanur Experimental Station?

71. What was the purpose with which that institution was started?

72. How far has that object been achieved?

73. Can you suggest any improvement in the working of the station?

74. How far, in your opinion, were the results of the experiments conducted in that station availed of—

(*a*) in fish-curing,

(*b*) in oil extraction,

(*c*) in guano preparation, and

(*d*) manufacture of fish meal,

by fishermen and businessmen in the trade?

VIII. Inland Fisheries.

75. What is the present line of operation?

76. What is the policy of Government?

77. What, in your opinion, is the relative importance of inland fisheries and sea fisheries in this Presidency?

78. What is the work hitherto done to improve the rearing of fish in

(*a*) rivers,
(*b*) tanks,
(*c*) fresh-water lakes, and
(*d*) reservoirs?

79. Are any statistics available to show the extent of fish supply from these sources?

80. Are any figures available to show the number of fishermen professionally engaged in this business?

81. Is any research work done in finding out what kind of fish grow in these waters with greatest facility.

82. How many tanks are taken over from local boards and in how many districts?

83. What is the annual compensation paid to these local boards?

84. What is the revenue realized from leases?

85. Is the expenditure justified? How much does it amount to?

86. How many fish farms are there?

86-A. What is the nature of the work done there and with what results?

87. How far do results justify the expenditure on the fish farms?

88. Would you suggest any improvements in the methods of working?

89. How far is the department empowered effectively to prevent the indiscriminate destruction of fish in inland waters stocked by the department?

90. Under whose charge is each farm at present?

91. Is such officer specially trained for the work required of him in that position?

92. Will you please suggest any methods by which officers can be trained, say, under a specialist to be appointed, to take their places in the various fish farms conducting minor researches pertaining to particular classes of fish?

93. In how many places are larvicidal fish reared and at what expense?

94. What use has been made of these fish?

95. How far is the expenditure justified by results?

96. Can you suggest any methods of improvement?

IX. Kinds of Fish.

97. What are the kinds of fish that are of economic importance in your district which, in your opinion, should receive attention?

98. Have you any problem which you consider should be solved by the Fisheries Department in connexion with fish or fisheries?

X. Pearl Fisheries.

99. Can you give us a history, as briefly as possible, of the pearl fisheries in this province?

100. Can you tell us the more important problems connected with this industry?

101. Are the operations so far conducted efficacious?

102. Can you suggest any improvements in these operations?

103. Can the present cost of working be reduced?

104. Can you suggest any improved methods of pearl fishing?

105. For instance, can mechanical appliances be utilized, thereby dispensing with diving?

106. Should the department continue to manage pearl fisheries directly?

107. Is it desirable or profitable to lease out the fishing rights to contractors?

108. What are the labour problems connected with pearl fishing?

109. Can you make any suggestions to improve labour supply or labour conditions?

110. Is any research work done in connexion with pearl fisheries?

111. If not, would you recommend any research?

XI. Chank Fisheries.

112. Can you give us a history, as briefly as possible, of the chank fisheries in this province?

113. Can you tell us the more important problems connected with this industry?

114. Are the operations so far conducted effective and efficacious?

115. Can you suggest any improvements in these operations?

116. Can the present cost of working be reduced?

117. Can you suggest any improved methods of catching chanks?

118. For instance, can mechanical appliances be utilized for catching, thereby dispensing with diving?

119. Should the department continue to manage chank fisheries directly?

120. Is it desirable or profitable to lease out the fishing rights to contractors?

121. How far is it, in your opinion, a legitimate function of the department to work, on lease, fisheries which are not the property of Government?

122. Does it amount to interference with private enterprise or competition?

123. What are the labour problems connected with chank fishing?

124. Can you make any suggestions to improve labour supply or labour conditions?

125. Is any research work done in connexion with chanks?

126. If not, would you recommend any research?

XII. Research.

127. What section of the staff is capable of doing research work at present?

128. What is the kind of work they have been doing till now and with what result?

129. Are the results of such research published and, if so, on what subjects?

130. Has the investigation of any particular kind of fish been undertaken?

131. If so, in what cases and with what results?

132. How far is equipment provided?

133. Is it a fact that Sardine and Mackerel have disappeared altogether on the West Coast and, if so, in what places?

134. Is it not a fact that they appear only in particular seasons of the year?

135. Have they disappeared to any large extent in recent years?

136. Do you consider this abnormal?

137. If so, what investigation or research has been made to find out the causes?

138. Are they capable of investigation?

139. What other kinds of fish in your opinion require investigation in this line?

140. Is the present research staff sufficient for this purpose?

141. If not, what recommendations would you make for increasing the staff?

142. What is the policy and programme of the existing research section?

143. Has any research been conducted in exploring further fishing grounds?

144. Did the problem of exploring fishing grounds beyond the 100 fathom limit arise?

145. Is the problem pressing just now?

146. Do you think it is worth the while of the department to investigate the possibility of discovering new fishing grounds and of determining suitable craft and gear that will enable fishermen to go beyond their present limits?

147. What, in your opinion, is the exact scope of research to be undertaken by the department, say within the next ten years, and what research staff and equipment do you consider necessary for that purpose?

148. Are you acquainted with the working of the trawler "Lady Goschen"?

149. Was any research work done by her? If so, with what results?

150. How far is she equipped for research work?

151. What other equipment is needed on board the trawler for such investigation?

152. Is any marine biological research carried on at present?

153. If so, how far has this a bearing on the question of—

(*a*) marine fisheries,
(*b*) pearl fisheries, and
(*c*) chank fisheries?

154. In what other directions, if any, would you recommend that marine biological research should be undertaken?

155. Which line of marine biological research do you consider of greatest urgency at present?

(*a*) *Research on Inland Fisheries.*

156. On what lines has research been undertaken with regard to Inland Fisheries?

157. Do you consider that all or any of these can be dropped for the present? Are there any others of greater importance?

158. Do you consider the present staff enough for the work involved?

159. If not, what recommendations would you make?

(*b*) *Technological research.*

160. What do you consider is the relative importance of technological research and biological research in connexion with fisheries?

161. How far is this proportion borne out by existing staff and work?

162. What alterations, if any, would you suggest?

163. What work has hitherto been done in effecting improvements in boats, nets and methods of capturing fish?

164. How far do you consider this work should be continued?

165. What improvements over existing methods are, in your opinion, necessary in the keeping, landing and otherwise handling catches?

166. What research has hitherto been done in connexion with—

(*a*) oil contents of various classes of fish,
(*b*) refinement of oil, medicinal value thereof,
(*c*) fish meal,
(*d*) guano,
(*e*) hygienic methods of fish-curing,
(*f*) canning, and
(*g*) other methods of fish preservation including refrigeration?

(*c*) *Aquarium.*

167. Do you consider an aquarium a necessary adjunct to marine biological research?

168. Besides research, do you consider that an aquarium will be the means of providing popular education?

169. Do you think the aquarium at present at Madras should be developed and, if so, in what directions?

170. Do you consider that more acquaria should be established in other places and, if so, where?

XIII. Transport.

171. What transport facilities do you consider necessary for the development of the fishing industry?

172. How far are they already available and what improvements would you suggest?

XIV.—Socio-Economic Work.

(*a*) *Co-operation.*

173. To what extent is the co-operative movement introduced among fishermen and in the fishing industry?

174. Would you suggest any modification in organization, extent or other development?

175. Have any benefits accrued or are they likely to accrue from the present arrangement by which officers of the Fisheries Department assist those of the Co-operative Department?

176. Would you suggest any modification?

177. What attempts have hitherto been made to organize co-operative societies of fishermen—

(*a*) for catching fish, and

(*b*) for sale of fish caught?

178. What success has attended such attempts?

179. Would you make any suggestion for development in those directions?

180. Do you consider that special concessions in the form of bounties or advances are necessary for the purpose of promoting co-operative societies, either catching societies or selling societies?

181. Is it a fact that the work of the Fisheries Department with co-operative societies has up to the present been confined to the West Coast?

182. If so, do you recommend that this work should be extended to the East Coast as well?

(*b*) *Education.*

183. How far is the present general system of elementary education in the country suited to the needs of the fisher-folk and how far has it influenced them?

184. Do you consider that a modified system of education is required for this community?

185. If so, how should it be directed and controlled and by whom?

186. What is the number of separate schools now maintained for the benefit of the fisher-folk?

187. How far have they served their purpose?

188. Should the system be continued and developed?

189. Should it be extended to the East Coast?

190. What recommendation are you prepared to make in

(*a*) the curriculum,

(*b*) the staff,

(*c*) the equipment, and

(*d*) means of providing the staff for these schools?

191. Do you consider that the fishing industry has developed sufficiently to require technological instruction and training of apprentices in the several branches of the industry?

192. If so, what means would you suggest and what centres would you propose for such work?

XV.—Zoological Specimen Supply.

193. Do you consider there is need for the supplying of Indian biological specimens to schools, colleges, etc.?

194. If so, should this work be undertaken by the Fisheries Department and, if not, by whom should it be undertaken?

195. Have you any suggestions to make in connection with this work?

XVI.—Staff.

196. How far can the various experts required on the research staff of the Fisheries Department be combined?

197. How far is fisheries research dependent on the administrative duties now performed by the department?

198. How far, in your opinion, can administrative officers be entrusted with research work?

199. To what extent can the expert officers in the department be relieved from administrative duties?

200. Is there any need for modification of the existing administrative staff?

201. If so, what modifications would you recommend?

202. Is there any possibility of retrenchment in staff?

203. Is the staff, research and administrative at present working, sufficient for the present requirement? Does it require any additions under the modifications which you may recommend?

204. Do you consider that the present pay and allowances are attractive enough? If not, what modification would you suggest?

205. Assuming that you recommend the appointment of a Specialist, for instance a Bio Chemist, would you have him as a permanent officer of the department or would you recommend his engagement on a high salary for a limited period? What facilities in such a case would you recommend for training Indians under such an officer?

XVII. Finance.

206. What are the total receipts and expenditure of the department under the main heads?

207. What is the expenditure on the staff including pay and allowances and on stores, stationery and office expenses?

208. What is the expenditure on sea fishing and research?

209. What is the expenditure on inland fishing and research?

210. Do you consider that the expenditure on research in comparison with other heads is sufficient?

211. What is the expenditure now incurred on technological research?

212. What is the expenditure incurred by the department on the education of the fisher-folk?

213. What is the expenditure now incurred by the department on fish-curing yards?

214. What is the annual expenditure on the Chaliyam Cannery?

215. What is the expenditure on the Tanur experimental station?

216. What is the expenditure on the acquarium?

217. What is the annual expenditure in connection with the supply of biological specimens?

218. What is the annual expenditure on pearl fisheries?

219. What is the annual expenditure on chank fisheries?

220. Is any expenditure incurred by the department at present on co-operation among the fisher-folk?

In answering the above questions, please give the corresponding receipts also. The latest figures available for any year may be given.

Please also give the average figures for the last five years.

APPENDIX III.

—	1930-31.	1931-32.	1932-33.	1933-34.	1934-35.	1935-36.	1936-37.	1937-38.	1938-39.	1939-40.
Fresh Water and Marine Research Section.	FISHERIES BIOLOGIST.									
	Assistant Biologist, Marine (Madras).	Assistant Biologist, Marine (Trawler).		Assistant Biologist (Calicut).	Second Trawler and staff.	Assistant Biologist (Krusadai Island).		Assistant Biologist (Vizagapatam).	Assistant Biologist, Inland (Vizagapatam).	
	Laboratory in Madras.	Assistant Biologist, Inland (Madras.)		Equipment and Laboratory.	Assistant Biologist, Inland (Madura). Equipment.	Equipment.		Equipment.	Equipment.	
	One Research Assistant and staff.	Central Fresh Water Biological Station (Madras). (Equipment).								
	Mate (Lady Goschen).									

Progressive acquisition and organization of district tank fisheries at an average rate of two districts per year.

Industrial Section.		Fisheries-Chemist Fisheries Engineer, Laboratory, (Equipment and staff).								
Education and Socio-Economic Section.	Fisheries Training Institute, Calicut.				Fisheries Training Institute (Tamil area).			Fisheries Training Institute (Telugu area).		Fisheries Training Institute (Kararese area).
	(Reorganization.)									

Progressive increase of Co-operative Staff initially of Co-operative Inspectors and in due course of Assistant Registrars.

Administrative Section.	Uniform grading of all gazetted officers excluding Director as Assistant Directors.	Regrading of the Fish-curing Yard staff.	Creation of a Northern circle with an Assistant Director and staff.			Creation of a Southern Circle with an Assistant Director and staff.				
	P.A. to Director (Non-expert).	Increase of Establishment of Fish-curing Yards staff.								

Progressive construction of salt storage sheds in West Coast Yards.

APPENDIX IV.

FINANCE DEPARTMENT (CENTRAL REVENUES).

NOTIFICATION.

SALT.

Simla, the 1st October, 1927.

No. 28.—In exercise of the powers conferred by clause (*b*) of section 7 of the Indian Salt Act, 1882 (XII of 1882), and in supersession of all previous notifications on the subject, the Governor-General in Council is pleased to remit the duty imposed under clause (*a*) of the said section on salt manufactured in the Presidency of Madras when such salt is used within the said Presidency for any industrial purpose other than the preparation of refined salt or as an ingredient or preservative in any article of food or drink, subject to the following rules:—

1. Any person intending to use salt in an industrial process (hereinafter referred to as the manufacturer) and wishing to be admitted to the concession shall make an application to the Assistant Commissioner of Salt of the division in which his works are situated (hereinafter referred to as the Assistant Commissioner). If he wishes the concession to extend to more than one factory or works, a separate application must be made for each such factory or works. Each application shall contain a statement of the estimated monthly quantity of salt required, of the salt factory or depôt from which it is desired that it may be issued, and of the purpose and manner for and in which it is intended to be used, as well as a declaration that the salt applied for will be used solely for such purpose and in such manner; and it shall be accompanied by a fee of Rs. 100: Provided that if the concession is granted after six months of a financial year have expired, the fee payable for the said year shall be Rs. 50 and that if the full annual fee of Rs. 100 has been paid and a concession is surrendered before the expiry of six months, of a financial year or in the case of a new grantee within six months of the grant, Rs. 50 shall be refunded.

2. If the Assistant Commissioner is satisfied, from his previous knowledge of the manufacturer or from inquiries or otherwise, that he is a person to whom the privilege of the duty-free issue of salt may be allowed without danger to the revenue, he shall then inspect the works, or shall depute an Inspector to do so, and shall satisfy himself that they contain a secure store-room for the custody of the salt. If the Assistant Commissioner finally approves the application, he shall require the applicant and one approved surety to execute a bond in Form I annexed hereto which he shall forward to the Collector of Salt Revenue (hereinafter called the Collector) for signature on behalf of the Secretary of State in Council and shall at the same time issue an order for the delivery of the salt from the factory or depôt named by the manufacturer. The concession shall expire on the 31st March each year, but may be renewed

if the Assistant Commissioner sees no reason to the contrary on payment of a fresh fee of Rs. 100 for each financial year.

3. When the delivery of the salt is required, the manufacturer shall give not less than twenty-four hours' notice, exclusive of Sundays and of sanctioned holidays, to the officer-in-charge of such factory or depôt, at the same time remitting to him the price of the salt at such rate as the Collector may, from time to time, prescribe.

4. The salt shall be removed from the factory or depôt in gunny bags, to be provided by the manufacturer, and to be approved by the Collector each of which shall contain two maunds of salt and shall be sealed by or under the orders of the Collector.

5. The manufacturer shall be bound to convey the salt direct with unbroken seals from the factory or depôt to his works. He shall there keep it in a store-room approved by the Assistant Commissioner in the bags in which it was removed from the factory or depôt. The bags shall not be opened before the salt is actually required for use nor shall the seals be broken or removed except in the presence of the manufacturer or his manager, who shall be a person approved by the Assistant Commissioner.

6. The key of the room in which the salt is kept shall be in the personal custody of the manufacturer or his manager who shall execute an agreement in Form II annexed hereto and who shall maintain an account in Form III annexed, showing the quantity of salt received, the quantity expended from time to time with the purpose for which, and the manner in which, it has been used and the daily balance in hand. He shall also maintain any other accounts which the Collector may prescribe in connexion with the issue of salt for any particular trade. These accounts and the salt in store shall, at all reasonable times, be open to inspection by any magistrate or by any officer of Police not below the rank of Inspector or by any officer of the Salt Department not below the rank of Sub-Inspector, or by any person whom the Assistant Commissioner or other superior officer of the department may at any time specially empower to inspect the same.

7. Save with the written permission of the Assistant Commissioner or in unavoidable circumstances such as the occurrence of a fire or the like, salt shall be removed from such store-room only for use for the purpose and in the manner specified in the manufacturer's application. All salt so removed for use shall be at once so used.

8. The Government reserve to themselves power to impose a preventive establishment on the manufacturer at his expense whenever the Collector considers it necessary for the protection of the revenue to do so.

9. In case of any infraction of these rules, the permission to use salt duty-free in the manufacture will be liable to be withdrawn, and all salt remaining in store will be liable to be destroyed

under the orders of the Assistant Commissioner. No refund will be made on account of the price of salt so destroyed.

10. If any salt issued under these rules is not duly accounted for as having been used for the purpose and in the manner stated in the manufacturer's application, the manufacturer shall, on demand by the Assistant Commissioner, be bound immediately to pay to Government duty on all salt so unaccounted for at double the rate of duty on salt for the time leviable under the Indian Salt Act, 1882, or other law for the time being in force and relating to the salt revenue.

The above condition does not prejudice the liability of the licensee to prosecutions under section 9 of the said Indian Salt Act or other law for the time being in force relating to the salt revenue, if it shall appear that such salt so unaccounted for has been otherwise used by him or with his consent or connivance so as to defraud the salt revenue.

11. After the Assistant Commissioner has once given permission for the duty-free issue of salt to any manufacturer, it shall not be necessary so long as that permission remains unrevoked for the manufacturer to apply to the Assistant Commissioner for the issue of such further supplies as he may require in the conduct of his business for use for the same purpose and in the same manner in the same official year. It will be sufficient for him to apply to the officer-in-charge of the factory or depôt from which the first issue was made. The manufacturer shall be bound to remove and keep the salt issued on the second and all subsequent occasions in bags bearing a distinctive mark differing from that borne by the bags in which the salt issued on the first or any previous occasion was issued and kept, and not to use any of it until the whole of all previous issues has been expended and entered as expended in his account.

12. The permission to remove salt duty-free under these rules may at any time be cancelled and withdrawn by orders of the Collector without cause being assigned, in which case the manufacturer shall be bound to deliver up to the Assistant Commissioner or to such person as he may, in writing, appoint to receive the same, all salt removed under these rules which may then remain unexpended in the custody of the manufacturer who shall be entitled to payment therefor at the rate at which he paid for it, but to no other payment or compensation whatever.

FORM I.

Form of Bond (see *Rule* 2).

KNOW ALL MEN by these presents that we of and of are jointly and severally bound to His Majesty's Secretary of State for India in Council in the sum of Government Rupees * to be paid to the said Secretary of State in Council for which payment we jointly and severally bind ourselves and our legal representatives.

* Here enter double duty on the salt allowed to be removed.

Dated this day of 19

Witness to the signature of the said (Signed)

Witness to the signature of the said (Signed)

The above bounden (hereinafter called the manufacturer) having been permitted to remove from time to time from the salt factory or depot at such quantities of salt as he may require not exceeding Indian maunds at a time for use in his manufactory of at for the purpose and in the manner below stated without payment of duty under the rules, of which a copy is hereunto annexed.

Purpose of use. Manner of use.

The condition of this obligation is that if the manufacturer and his legal representatives and his or their servants employed in the said manufactory shall at all times well and truly observe and keep the conditions of the said rules, then this bond shall be void; otherwise, the same shall remain in full force.

Signed on behalf of the said Secretary of State in Council by Collector of Salt Revenue, on the day of 19 .

Witness to the signature of the Collector of Salt Revenue.

Collector of Salt Revenue.

FORM II.

Form of Agreement (see *Rule* 6).

I of being appointed by to be manager of his manufactory at for use in which for the purpose and in the manner below set forth the duty-free issue of salt has been permitted by the Assistant Commissioner of Salt Revenue, Division, under the Rules, a copy whereof is hereunto appended, do hereby declare that I will faithfully observe and keep all the conditions of the said Rules and will, so far as in me lies, cause all servants employed under my orders in the said manufactory so to observe and keep them.

Purpose of use. Manner of use.

I understand that in the event of any portion of the said salt being used otherwise than for the said purpose or in the said manner, so as to defraud the public revenue, by me or with my connivance or consent, I shall be liable to fine and imprisonment under section 9 of the Indian Salt Act, 1882 (XII of 1882), or other law for the time being in force and relating to the salt revenue.

Signed on the day of 19 in the presence of

FORM III.

Daily account prescribed under Rule 6 of the Receipts and Expenditure of Salt issued duty-free for use in manufactures at the _____ Manufactory at _____

	Receipts.				Expenditure.					
Date.	Date of bond under which received.	Quantity received.	Factory from which received.	Total received.	Purpose for and the manner in which used.	Quantity used.	Total used.	Balance in hand.	Signature of the Manufacturer (or his Manager or the Officer-in-charge).	Remarks by the Inspecting Officers.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
		I. MDS.		I. MDS.		I.MDS.S.T.	I.MDS.S.T.	I.MDS.S.T.		

N.B.—This account should be closed and the balance of salt in hand be carried forward to a new account on the 1st day of April in each year.

A. TOTTENHAM,
Joint Secy. to the Govt. of India.

From the Secretary to the Collector of Salt Revenue, to the Secretary to Government, Development Department, dated the 30th May 1929.

Ref. your T.M. of date

The information called for is furnished below :—

(1) Yes. Salt is issued duty-free for industrial purposes, vide copy of Government of India Notification No. 28, dated 1st October 1927, sent separately (Appendix III).

(2) Yes. Commercial concerns that were supplied with duty-free salt in 1928–29 were the following :—

(*a*) Karim Omar, Ahmed Ali Sahib and others, Skin Merchants of Bezwada.
(*b*) Indian Chief Tobacco Co., Chirana.
(*c*) Buckingham Mill.
(*d*) Carnatic Mill.
(*e*) Chrome Leather Co., Pallavaram.
(*f*) Modi Abdul Tasur Co.
(*g*) Stanes & Co., Coimbatore.
(*h*) Hajee Abdur Rahiman Sahib & Co.
(*i*) A. S. Rathnamudali & Bros., Chittoor.
(*j*) Messrs. Parry & Co., Ltd., Ranipet.
(*k*) Gordon, Woodróffee & Co.
(*l*) M. N. A. V. S. Muhammed Sahib & Co., Tinnevelly.
(*m*) Ferok Tile & Co., Malabar.
(*n*) Md. Mian Rowther, Trichy.

(3) Yes. The Buckingham and Carnatic Mills draw supplies of duty-free salt from the Madras Depôt at annas 5-6 per maund exclusive of certain incidental charges for weighing and packing.

APPENDIX V (1).

Year. (1)	Mds. of salt issued. (2)	Cost of salt. (3)	Establishment charges. (4)	Maintenance of yards. (5)	All other charges. (6)	Total expenditure. (7)	Total expenditure *minus* col. (5.) (8)	Price realized. (9)	Profit. (10)	Loss. (11)	Progressive total. (12)
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Progressive gain to Government up to the end of 1895-96.											+ 9,414
1896-97 ..	149,025	26,389	33,272	2,711	59,955	1,22,327	1,19,616	1,24,327	4,711	..	+ 14,125
1897-98 ..	157,722	30,063	33,691	1,456	63,277	1,28,487	1,27,031	1,29,488	2,457	..	+ 16,582
1898-99 ..	138,655	25,413	32,332	3,036	52,636	1,13,417	1,10,381	1,09,077	..	1,304	+ 15,278
1899-1900 ..	191,984	36,060	32,865	3,530	69,964	1,42,419	1,38,889	1,52,455	13,566	..	+ 28,844
1900-01 ..	202,238	34,499	35,226	4,707	76,269	1,50,701	1,45,994	1,60,494	14,500	..	+ 43,344
1901-02 ..	248,878	23,728	37,547	4,812	120,190	1,86,277	1,81,465	1,91,502	10,037	..	+ 53,381
1902-03 ..	180,863	26,884	38,558	5,858	75,072	1,46,372	1,40,514	1,49,525	9,011	..	+ 62,392
1903-04 ..	192,726	35,905	41,143	7,202	69,762	1,54,012	1,46,810	1,56,815	10,005	..	+ 72,397
1904-05 ..	199,835	35,526	39,887	5,244	52,808	1,33,465	1,28,221	1,48,738	20,517	..	+ 92,914
1905-06 ..	157,865	27,246	38,928	5,424	54,880	1,26,478	1,21,054	1,20,895	..	159	+ 92,755
1906-07 ..	150,824	19,830	39,795	5,744	31,254	96,623	90,879	1,14,414	23,535	..	+ 1,16,290
1907-08 ..	205,275	30,562	40,374	5,539	55,283	1,31,758	1,26,219	1,16,428	..	9,791	+ 1,06,499
1908-09 ..	197,135	32,421	42,298	2,020	60,224	1,36,963	1,34,943	1,13,503	..	21,440	+ 85,059
1909-10 ..	179,914	33,666	42,509	7,006	56,305	1,39,486	1,32,480	1,01,512	..	30,968	+ 54,091
1910-11 ..	222,075	40,870	41,910	6,904	66,021	1,55,705	1,48,801	1,25,211	..	23,590	+ 30,501
1911-12 ..	203,835	33,142	41,548	6,357	65,463	1,46,510	1,40,153	1,15,130	..	25,023	+ 5,478
1912-13 ..	214,815	34,523	41,298	5,548	66,224	1,47,593	1,42,045	1,22,335	..	19,710	— 14,232
1913-14 ..	181,391	30,182	39,577	5,869	56,639	1,32,267	1,26,398	1,04,468	..	21,930	— 36,162
1914-15 ..	159,025	23,712	39,147	7,368	54,053	1,24,280	1,16,912	89,619	..	27,293	— 63,455
1915-16 ..	151,297	27,046	38,227	6,299	44,444	1,16,016	1,09,717	85,814	..	23,903	— 87,358
1916-17 ..	210,458	39,890	39,321	6,755	63,993	1,49,959	1,43,204	1,20,590	..	22,614	— 1,09,972
1917-18 ..	245,276	48,700	39,902	6,315	93,818	1,85,735	1,82,420	1,42,954	..	39,466	— 1,49,438
1918-19 ..	236,554	38,732	51,378	6,792	1,49,310	2,46,212	2,39,420	1,47,846	..	91,574	— 2,41,012
1919-20 ..	252,826	..	52,050	6,778	..	..	..	1,58,018	..	98,721	..
1920-21 ..	296,157	67,996	61,803	8,446	1,68,542	3,06,787	2,98,341	1,85,099	..	1,13,242	..
1921-22 ..	257,530	58,277	74,264	10,722	2,13,963	3,57,226	3,46,504	1,60,956	..	1,85,548	..
1922-23 ..	230,825	49,429	74,780	8,303	1,86,389	3,18,901	3,10,598	1,44,461	..	1,66,137	..
1923-24 ..	279,462	..	70,564	8,477	..	3,27,000	..	1,74,664	..	1,38,523	..
Fasli years. 1924-25 ..	204,306	29,502	90,454	10,413	1,11,677	2,42,346	2,31,933	2,59,938	28,005	..	..
Fasli years. 1925-26 ..	226,289	29,206	96,113	15,312	1,31,318	2,71,949	2,56,637	2,88,475	31,838	..	..
1926-27 ..	1,83,625	19,483	97,369	13,621	46,659	2,27,132	2,13,511	2,31,499	17,988	..	..
1927-28 ..	2,75,306	30,149	1,03,606	19,551	2,07,682	3,60,988	3,41,437	3,50,813	9,376	..	..

QUANTITY OF SALT IN MAUNDS

COST OTHER THAN COST OF SALT IN RUPEES

PROFIT IN RUPEES.

LOSS IN RUPEES.

OFFICIAL YEARS.

Reg. No. 639
Copies 808

Vandyke., Survey Office, Madras.
1929.