

(c) A note on "Some Biological problems of Marine Zoology in South India" for the Madras Handbook prepared for the meeting of the Indian Science Congress in February.

(d) Two papers read at the Science Congress, one of which embodied the results of my twenty years' experience of the problem of pearl formation.

Besides these, I revised and partly rewrote a long and exhaustive report which I made to the Government of Madras in 1905, on the history and effective management of their pearl banks in the Gulf of Mannar. This had never been published and as it seems desirable that the mass of facts collected should be brought up to date and published, Government gave their sanction and the report is now in the press.

6. Other fishery reports published during the year were—

(a) A manual on "Fish-oil and Guano Manufacture" by Sir F. A. Nicholson, K.C.I.E.

(b) "Notes on the Fauna and Fishing Industries of the Laccadive Islands" by Mr. S. Ramaswami Ayyangar.

(c) "The Grey Mulletts of Tuticorin" by Mr. R. H. Whitehouse, the late Marine Biologist.

All of these are of much practical value, particularly the first named, for which we are most grateful to the author.

7. Extensive tours were made to the south in connexion with the chank fisheries, and to the West Coast chiefly to organize the research work on sardines and mackerel at Calicut, and to supervise and guide the canning operations at Chaliyam. Lengthy tours to Ganjam, the Colair Lake and the Lower Anicut were also made in the interests of the piscicultural operations. A comprehensive scheme for the acquisition of all useful tanks and channels in Ganjam is now before Government.

8. My technical advice on fishery matters has as usual been sought by several other Governments, and a consignment of the Pearl-spot (*Etroplus suratensis*) was sent in January to the Mauritius at the request of that Government, and arrived there safely. Two students deputed by the Travancore Government were given instruction in the theory and practice of fish-curing, oil and guano manufacture and fish-canning, while the Government of Bengal deputed a fishery officer for a period of six months for instruction in all branches of work as carried out in Madras.

9. *Health of the staff.*—When the question of improving the general efficiency of Government establishments was under consideration last year, I strongly urged that the most useful measures would be those that would ensure general good health. Judging by analogy it seemed probable that much of the lassitude and poor

work often noticeable among the lower ranks of office establishments is due not so much to innate laziness as to ill-health due to ankylostomiasis—the disease due to heavy infection with hookworm. I recommended that the Surgeon-General be consulted. Government approved of this and eventually the Surgeon-General arranged with Dr. J. F. Kendrick, the Officer in charge of the Ankylostomiasis Campaign in Madras, for the examination and treatment of the whole of my headquarters staff. Forty-two men were examined. Of these thirty-nine were found to be infected with hookworm and eighteen of these also harboured the round-worm, *Ascaris*. Only three were free from hookworm; six were heavily infected and three of these were connected with the Aquarium. I have no doubt that the good effects of the treatment given will be apparent before long in better health and greater energy. As it is, one of the sub-assistants, who was one of those heavily infected, tells me he feels very much better already and I notice a distinct improvement in his appearance, coupled with a brisker manner.

10. Particulars of the personnel of the staff will be found in statement No. I appended. The headquarters office continued to be located as in the previous year, and suffered grievously in consequence. Government orders have now been received sanctioning removal to commodious rooms in the old Engineering College on the Marina.

11. The conduct of the staff has been generally satisfactory, often under circumstances of much personal discomfort when conducting operations in dreary stations without those amenities of life that men of education are accustomed to. Those whose work during the Mappilla rebellion lay within the disturbed areas behaved admirably; their loyal service reflected credit on the department.

12. I wish also to record my personal satisfaction that Government have recognized the long, faithful and intelligent service rendered by Mr. J. A. Fernandez, who acted as Assistant Director (Marine) in the absence on leave of Lieut. Allan, O.B.E., by conferring upon him the title of Rao Sahib.

The services of my Personal Assistant, Mr. Karunakara Menon, have been invaluable, and I take this opportunity to record my high appreciation of his integrity, ability and devotion to duty.

13. The usual financial statements, etc., are appended.

I.—INDUSTRIAL SECTION.

A. THE DEMONSTRATIONAL CANNERY, CHALIYAM.

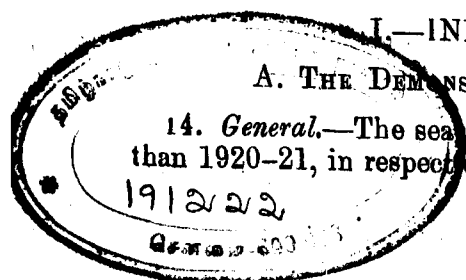
14. *General.*—The season 1921-22 was but little more favourable than 1920-21, in respect of the available supplies of fish. Mackerel

were more numerous relatively to sardines, which once again were abnormally scarce. In spite of this difficulty, a notable increase both in output and in sales took place; I believe that with the economies introduced, particularly in the utilization of labour-saving devices, the corner has been definitely turned, for a fair profit on the year's work has accrued, and sales are at last keeping pace with production. Prawns were as usual scarce at Chaliyam; to meet the local deficiency, supplies of specially prepared partially dried prawns were obtained from Tanur whenever large quantities were available there; these proved welcome in the absence of cannable fish, and satisfactory both for canning in the whole condition as well as for manufacture into paste.

15. To effect a reduction in the supervision charges, Mr. H. L. Prager, whose services were borrowed from the Salt Department in order that he might act as business manager, was permitted to revert at the end of April 1922. Since then the Cannery has been carried on directly under the Director, with the Sub-Assistant Mr. T. P. Baratan in working charge. I wish to express my appreciation of Mr. Prager's energy and capacity while Manager of the Cannery, and regret that financial conditions precluded his continuance in that post. Mr. Baratan has done well in difficult circumstances and I believe he is now capable of conducting operations successfully under the new arrangement.

16. The present premises have become inadequate alike for existing requirements and for further development; the store-rooms for finished products are congested and unsatisfactory if the goods are not to deteriorate, the processing and machine room will become too crowded to permit of economical working when the new closing machines arrive and the higher staff are put to great discomfort for want of quarters. Hence a decision upon the proposals to remove the Cannery elsewhere and effect considerable enlargement, is desirable at an early date. No great improvement upon the present output can be expected till these drawbacks are remedied.

17. The output for the year was fairly satisfactory under the adverse conditions enumerated above, being 70,510 tins against 67,524 in the preceding season. Of these, sardines accounted for 54,000 tins. Special success attended the experimental canning of mackerel in oil upon lines which I prescribed, and as a consequence this description of goods has become our most popular production outside of our sardine specialities; the container employed being a hand-soldered one, clumsy in appearance, new dies have been ordered, suitable for automatic closing without the use of solder—this improvement besides providing a more attractive container, will reduce the cost and eliminate the troubles incidental to the use of solder, whereof carelessness on the part of the solderers is not the



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least important. Of the larger fish, seer was the only kind obtained and canned in any appreciable quantity.

18. *Sales*.—At last the difficulties experienced during the two preceding years appear to have been surmounted as seen below :—

	1919-20	1920-21	1921-22
Sales	40,729 tins.	35,092 tins.	67,612 tins.

Last year's sales were therefore within 3,000 of the production. The two chief factors in this increase were the appointment of Messrs. McDowell & Co. as wholesale selling agents for Madras, and a vigorous advertising campaign through the medium of the newspapers, particularly in the north of India. Had not railway and postal rates been greatly enhanced, sales would have been much greater. In regard to these particular goods, this factor is a deplorable restraint upon trade. Stocks of foreign canned goods are still heavy, and continued during the past year to be put on the market at prices frequently considerably less than those at which they were imported. With the gradual elimination of such stocks, and the enhancement of the import duties, our products should find a readier market in the immediate future.

19. Samples of our canned sardines have been examined by experts at Home, who have expressed a generally favourable opinion. Larger samples have now been sent, which will be further examined with a view to interest some of the large importers in England of this class of goods. Without an export trade, a large production in India is not feasible, for few Indians are yet numbered among the purchasers of canned fish.

20. At exhibitions held at Bangalore and Pudukkottai, the usual medals for excellence of quality were awarded to our products.

21. *Labels*.—Until the middle of last season the commonplace inartistic character of our labels handicapped the sale of our goods in competition with foreign productions. To overcome this I obtained a series of original and artistic designs and had a supply of labels printed at the Government Press. They were a great improvement on the old ones, but for want of suitable paper and other causes, they proved on the whole a disappointment; a new supply of improved quality, and of the same general design, which has been registered with the Madras Chamber of Commerce, is now on order. When the new labels come, I anticipate that they will go far to increase the sales, so attractive and distinctive are they.

22. *Finance*.—The profit on working, calculated on the same principle as in 1920-21, amounts to the extremely satisfactory total of Rs. 7,081 as against a recorded loss of Rs. 1,879 in the previous year. In addition to the running expenses, the sum of Rs. 3,771 was expended on capital account and Rs. 1,500 as an

honorarium to Sir F. A. Nicholson for his kindness in writing a valuable manual on canning, which has been published in Fisheries Bulletin No. XIII.

23. Had it not been for the Mappilla outbreak, which frightened a number of our workpeople away for several weeks, and the general disorganization of fishing operations in the neighbourhood, a considerably larger output would have been attained and a larger profit shown. As it is I consider the staff worked conscientiously and well, and that the results should be considered as highly satisfactory and promising under the difficult circumstances experienced during the year from a variety of causes.

B. THE TANUR EXPERIMENTAL FISHERY STATION.

24. The fishing season of 1921-22 was slightly better at Tanur for mackerel and some of the larger kinds of fish, but shoals of sardines continued to be scarce and were caught in quantity only for a few days in the early part of the season. Besides the scarcity of fish, operations were hampered for several months by the unrest consequent upon the Mappilla rebellion. Tanur is near the locality where the trouble first came to a head and some alarm was felt for the safety of our staff during the few days the rebels had the upper hand. Fortunately the fisher Mappillas for various reasons are less fanatical than their brethren inland; they appreciate too the value of railways and the facilities the Government give them to conduct their trade profitably. Hence in spite of some molestation and threats by outside Mappillas, no serious interference occurred. The staff of our station and of the public fish-curing yards deserve however great credit for their loyal and steadfast conduct in the face of alarms and excursions.

25. Another most satisfactory feature of the year's working is the fact that the station has shown a net profit on the year's working. The gross profit amounted to Rs. 2,759; the running charges were Rs. 1,689; hence the net balance (profit) is Rs. 1,070, as against a small loss of Rs. 136 in 1920-21. This result is due partly to the high prices ruling for our products which gave a higher percentage of profit, and partly to the fact that no expensive experiments were necessary. The work was largely routine and commercial, carried out on standardized lines.

26. Two students from Travancore and one from Bengal received instruction in the improved methods of fish-curing and oil and guano manufacture as practised at the station.

27. The total quantity of fish purchased for curing was rather greater than in the previous year, being 100,817 lb. costing Rs. 3,018; the sale-proceeds were Rs. 5,917. The market for the various cures prepared at the station continues steadily to expand,

largely to regular customers. Supplies were also made to the jails at Cannanore, Coimbatore, Trichinopoly and Vellore. The moist curing of mackerel with korrapuli (*Pithecolobium dulce*) proved most successful. Over 10,000 fishes were cured in this manner and they were sold at Rs. 16-4-0 per 1,000, whereas the price of similar fish cured in the ordinary manner did not exceed Rs. 10 per 1,000.

28. *Oil and guano operations* were again restricted, but on a few occasions from September to December, large catches were made. The total weight of sardines dealt with was 50.5 tons as against 27.4 tons in 1920-21, and 260 tons in 1919-20, a comparison which gives a rough idea of the general relative abundance of sardines in these years. From this, approximately $4\frac{1}{2}$ tons of oil and $8\frac{1}{2}$ tons of guano were obtained. The entire output of guano was supplied to co-operative societies for distribution amongst their members. Of the oil expressed 431 gallons were graded as first class and 592 gallons as second class. The proceeds plus value of the stock on hand totals Rs. 2,160; as the cost of material was but Rs. 316, an average of Rs. 6-5-0 per ton, and the expenses of boiling and pressing are low, these figures show how profitable this industry is if supplies of fish are obtainable; even with considerably increased catches, prices are not likely to decrease greatly, as the demand is out of all proportion to the supply and is steadily increasing. The highest price realized was Rs. 130 per ton for guano f.o.r. and Rs. 3 and Rs. 2 per gallon for first and second-class oil respectively, ex-factory. The proportion of oil in the sardines treated was particularly great, reaching at the maximum to 18.9 per cent about the middle of November. In September it was however only 4 per cent. The general average was about 9. In the previous year the maximum of oil expressed was 6.3 per cent in December 1920. The second-grade oil was sold almost entirely for use by leather tanners.

29. Unfortunately much of the first-class oil, of which a considerable quantity is always earmarked for the use of the Cannery, proved unsatisfactory, owing to careless handling. Such oil, if properly prepared, need not contain even one per cent of free fatty acid (*vide* analysis given in the Annual Report for 1920-21). In the present instance analysis of a sample gave an acid value of 16.1, an amount rendering it unfit for human consumption. The officer responsible is no longer in Government service.

30. In the report for the previous year mention was made of the possibility of the best quality of sardine oil becoming a useful and cheap substitute for cod-liver oil. The results obtained by the Superintendent of the Tuberculosis Institute do not confirm this, so far as regards the quality supplied to him for experiment, which was oil obtained by steaming at a high temperature in an open

boiler. Such an empirical test is however not conclusive of the absence of vitamin A which is believed to be the essential therapeutic agent in such oils. It is nevertheless possible that the mode of preparation employed is not suitable for the conservation of this vitamin as it exposes it to the danger of reduction through oxidization. Further experiments of a more precise character which Lieutenant-Colonel M'Carrison kindly promises to arrange for will be tried next season to determine whether vitamin A is actually destroyed by our ordinary method of preparation. I am also directing that methods of oil extraction not hitherto practised at our station shall be carried out next season with a view to obtain if possible oil richer in vitamin A. I am inclined to believe that sardine oil properly prepared (cold-drawn or otherwise) does contain this invaluable constituent in considerable quantity, for most oils obtained from marine animals have a local reputation for the cure or amelioration of tuberculosis, e.g., pilehard oil in Cornwall and turtle oil in the Seychelles. (I have to thank Mr. Dupont, the Director of Agriculture in the Mauritius, for the latter item of information). If the results of our improved methods of extraction be successful, this will be of the greatest possible benefit to this country, as a cheap and efficient local substitute for expensive cod-liver oil would then become available in large quantity.

31. A manual dealing with the manufacture of fish-oil and guano, based largely upon experiments and results obtained at Tanur, was completed by Sir F. A. Nicholson; it was published as Report No. III of Volume XIII of our Departmental Bulletin at the price of Re. 1-4-0. An honorarium of Rs. 1,000 was paid to the author.

32. *Guano drying*.—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 Dr. Marsden, Industrial Chemist and Dyeing Expert, kindly gave his advice and obtained alternative designs and estimates from an Indian firm. The objections against all proved to be their comparatively high initial cost and the need involved of providing considerable motive power, with its attendant drawbacks of requiring the employment of skilled mechanics and a large amount of fuel. Considering how seldom wet weather prevails in Malabar from October to March and the smallness of the capital at the command of the vast majority of the guano manufacturers, the conclusion finally reached was that on the West Coast of India, sun-drying under present conditions of manufacture cannot be replaced economically by any artificial method. A small portion of the initial cost of a drier would provide ample barbecue space, and a sufficiency of mats and

tarpaulins to protect the material at night and during showers; the labour requisite in sun-drying is no greater than in artificial drying.

33. *Fish meal*.—The manufacture of this product has come to the front rapidly in other countries, notably in England and America, as an alternative to the utilization as fertilizer (guano) of superabundant and unsaleable fish during gluts; economically it is a sounder policy and commercially it is of great advantage to the manufacturers as it gives them a second market outlet. Accordingly increased attention was given to it during the past year, and every effort was made to interest those who could utilize it in large quantity for the feeding of cattle, pigs, dogs and poultry. Both sardines and mackerel were utilized; the meal made from the latter (*Scomber microlepidotus*) is whiter and contains a smaller proportion of fat and therefore more suitable for meal manufacture. On the other hand it is considerably more expensive to produce, the cost being in the ratio of 4 to 2½ as compared with sardine meal. Consumers have different needs in respect to the composition of such meal, so I will give here the results of analysis as made by the Government Agricultural Chemist in January 1922 of samples supplied from Tanur—

					Mackerel meal.	Sardine meal.
Moisture	..	..	..	..	8.75	7.74
Ash	..	..	..	..	4.90	17.50
* Crude protein	..	..	..	..	77.44	59.29
Crude fibre	..	..	..	..	Nil.	Nil.
Ether extractives	..	..	..	..	8.80	13.45
Unestimated	..	..	..	..	0.11	2.02
					100.00	100.00
					72.19	57.14

* Containing albuminoids or true protein.

The protein value in mackerel is particularly high; it is marked out in consequence as an excellent food material for combination with other foods rich in starch and sugar (carbohydrates) but deficient in protein. The percentage of phosphate of lime is also high in these fish meals, an average sample recently analysed giving a value of 7.74 per cent of phosphoric acid, equivalent to 16 per cent of phosphate of lime. With improved pressing such as will be practised next season, a considerable reduction in the percentage of oil will be obtained; this at present is the only respect in which these meals do not attain the highest standard recognized in the manufacture of fish-meal.

34. Sample consignments have been reported on most favourably by persons using them for the feeding of cattle, poultry and dogs. Amongst others, the Manager of the Government Cattle Farm at Chintaladevi has stated that he cannot point out any defects in the

fish-meal supplied; he finds it a nice material and suitable for cattle feeding. It is also specially satisfactory for poultry rearing as vouched for by one of our foremost local poultry breeders. In the course of time, as its value becomes widely known and appreciated, a considerable part of the material now turned into fertilizer will be diverted to this new use to the benefit both of the producer, who should get enhanced prices, and of the cattle raiser who will find in this material a means to reduce substantially the cost of feeding his stock.

35. *Private oil and guano factories*.—The total number of these, all situated in Malabar and South Kanara, decreased from 646 in 1920-21 to 542, owing to the continued dearth of sardines over two successive seasons. This decrease bespeaks the ephemeral character of many of the concerns, so cheaply constructed that the owners prefer to let them go to ruin if sardines be not available. Of the 542 still existing only 284 took out licences from the taluk boards (the fee, Rs. 10 each per annum). Besides these licences, the municipalities of Cannanore and Tellicherry also licensed 21 factories situated within three miles of their limits as permitted by law, these additional fees varying from Rs. 4-3-8 to Rs. 44-9-3 each for one-half year. The Calicut municipality have decided similarly to levy a special fee of Rs. 20 on each of such factories. This double licensing at these high rates is not conducive to the continued existence of a large number of small factories. Commercially it may be economically sound to crush out the small men—the big factories can afford these fees—but it is always regrettable from the human standpoint. A few prosecutions were instituted for failure to comply with rules.

36. In South Kanara so scarce were the sardine shoals that none of the factories there conducted any operations. On the Malabar coast though sardine shoals appeared early in the season, they disappeared suddenly after a short stay, hence only a limited number of factories were able to work and these only for a few days. The total output of fish-guano for the whole coast for the season did not exceed 1,000 tons. As there was no old stock on hand, prices rose high and reached the handsome figure of Rs. 130 per ton.

The supply of oil was insufficient to meet the demand. Officers of this department inspected all the factories in Malabar, but no systematic inspection of those in South Kanara was made as they were all shut down.

37. A demonstration plant was taken to some villages where this industry is not yet established and the method explained and demonstrated.

38. *The public fish-curing yards* under the control of this department now number 10, including two new yards opened at Madapalli and Meladi. The construction of three others has been sanctioned.

39. The total quantity of fish brought into these yards was 389,674 maunds and their cured weight 220,701 maunds as against 422,811 and 239,504 maunds respectively in 1920-21. The decrease was due partly to the unfavourable character of the season, and partly to the disorganization following on the Mappilla rebellion. At Malpé phenomenally large catches of mackerel continued to be made, as in the previous year. (An unusually good mackerel season not infrequently coincides with a dearth of sardines.) The largest quantity cured in one day was 8,755 maunds on 10th November 1922. The lowest price on the beach was 6 annas per 1,000, Rs. 2-4-0 per 1,000 for cured. The total quantity of salt issued was 57,403 maunds as against 72,065 in the previous year. Part of this decrease is due to the fact that 16,883 maunds of fish, as against 4,424 in 1920-21, were treated with filtered brine, and for which very little fresh salt was issued. Had this quantity been treated entirely with dry salt, it would have required 2,412 maunds of salt. This, at ten annas a maund, would have cost the curers Rs. 1,507-8-0, so a notable saving has been effected. This has not been effected at the expense of quality; actually the brine-cured fish is generally preferred to the salt cured by those who have tried the former.

40. During the year the curing sheds in the Calicut yard have been reconstructed with cemented floors and masonry salting troughs, a great improvement on the old style cadjan sheds, dark, unventilated and foul. This improvement has been effected by means of loans granted to the ticket holders. Several of the Tanur and Kalayi curers have also begun the construction of permanent sheds after the new design. It is hoped that the rest of the curers in the Tanur yard will be able to follow suit during the coming year. They are now reconciled to the idea of improving their sheds and are saving up money for the purpose by deposits in the local post-office savings bank. The Malpé, Thannirbhavi, Madapalli, Meladi, Calicut and Mangalore yards are now all reconstructed on the new lines, so at last real progress has been accomplished. Now that the conservatism of the curers has been broken down in this all-important particular, further progress should be easier.

All the newly appointed yard officers underwent training in improved methods of curing at the Tanur Experimental Curing Station.

C. THE OYSTER FARM AT PULICAT.

41. The oyster season or rather the two part seasons of the year ending 30th June 1922, were characterized by unusual climatic conditions, which shortened them so considerably that oysters were available for supply for two months and seventeen days only. The 1921 season was brought to a premature close on 9th August by exceptionally heavy and early rains, whereas in 1920, the season, being dry, extended until 24th October. Similarly the 1922 season did not open till 8th May as against 19th March in 1921, owing to the seaward opening of Pulicat lake having become so remote (about two miles) from the beds that the water over them remained of low gravity for long past the usual time, so retarding them from coming into a marketable condition. As the experiments made the previous year to purify Ennore oysters from any possible contamination had proved successful, resort was had to this expedient while awaiting the conditioning of the Pulicat beds. Oysters were suspended in bags for a minimum of ten days in clear tidal water close to the bar; bacteriological examination carried out upon samples sent to the King Bacteriological Institute at Guindy for the purpose, showed them to contain no injurious or disease-causing bacteria.

42. Demand increased satisfactorily, but owing to the shortness of the season, only 95,875 could be supplied as against 167,000 in 1920-21. Considering that the season was but one-third the duration of that of the latter year, this quantity is evidence of a steady increase in popularity.

The finance of the work is shown below :—

		1920-21.	1921-22.
		RS.	RS.
Receipts..		2,290	1,617
Expenditure ..		1,807	1,608
Profit ..		483	9

D. THE PEARL AND CHANK FISHERIES.

43. For the first time in the history of these fisheries since the Department of Fisheries took over their charge an apparent loss has been experienced of Rs. 9,306-14-3. But in this statement only 50 per cent of the supervision charges has been debited, so if the whole amount of the salary and allowances of the Assistant Director (Marine) be charged, as they ought, as he had no other duties of any consequence to perform, the loss would be increased by Rs. 6,091-2-6; this with a further item of 25 per cent of the running expenses of the "Lady Nicholson" also not charged

(Rs. 3,372-13-5), brings the adverse balance on the running of the section to a grand total of Rs. 18,770-14-2. The primary reasons for the unfortunate state into which this section of work has fallen are (a) a great decrease in the number of chanks fished, (b) lack of any revenue from the pearl fishery, and (c) increased cost of supervision charges. Complete reorganization and drastic retrenchment are immediately necessary and proposals to that end will be submitted forthwith.

44. *The Chank Fisheries—Summary of general results.*—The details of the revenue and expenditure for the various chank fisheries during the past season are shown below, annas and pies omitted—

	Expenditure.	Revenue.	Profit.
	RS.	RS.	RS.
Tinnevelly fishery	11,412	14,896	3,484
Ramnad	24,989	27,643	2,654
Sivaganga	287	307	20
Tanjore	..	4,466	4,466
South Arcot	..	1,933	1,933
Chingleput and Nellore	..	1,250	1,250
Miscellaneous	150	700	550
Total	36,838	51,195	
	Gross profit ..		14,357
Deduct supervision charges [50 per cent of the pay and allowances of the Assistant Director (Marine)]	..	..	6,091
	Net profit ..		8,266

The small profit of Rs. 8,266 on the conduct of these fisheries is the culmination of a downward tendency which began three years ago. Prior to that there were fluctuations, but no continuity of decrease, as is apparent from the following figures for the past six years, viz:—

	Profit.	Number of shells fished.
	RS.	
1916-17	53,938	418,314
1917-18	57,122	391,137
1918-19	86,611	435,262
1919-20	46,029	339,805
1920-21	36,537	283,869
1921-22	8,266	228,198

45. *Tinnevelly Chank Fishery—Details.*—The year's catch amounted to 68,383, as against 109,434 in the preceding season. This result is the more disappointing in view of the fact that the rate paid by Government to the divers was increased at the

beginning of the season from nine pies to one anna per shell. This rate now prevails at all the important chank fishing centres except Tirupalakudi, where, on account of the poor quality of the shells, half an anna is the current rate. The proportion of undersized shells brought ashore at Tuticorin was again too great, being 8,013; of these only 175 were returned alive to the sea. Difficulty is found in persuading the divers to abstain from tearing off the opercula of these small individuals, as they regard these as their perquisite for which they can find a market. In the present parlous state of the fishery, the Assistant Director (Marine) did not consider it judicious to take any strong action against this practice. Four crews, comprising 28 divers were all that could be recruited as against 43 divers in 1920-21. The fishery began on 9th November 1921 and ended on 4th May; the number of non-working days was 75 as against 59 in the previous year. An attempt to recruit outside divers was a failure. Nine hundred and five shells were collected at Idinthakarai as against 775 in the previous season.

During the year tenders for the purchase of the shells fished during the two seasons 1921-23 were called for; the successful tenderers were the Dacca Conch Shell Workers' Co-operative Society, Limited, who offered Rs. 210-5-0 per 1,000. This agreement means that the actual workers now receive their raw material without the intervention of the middleman. For years past the workers in Dacca have complained of the exorbitant rates charged to them by dealers, which entailed hardships on these men as well as being a restriction upon trade. It is to be hoped that this new arrangement will long continue to the mutual benefit of the chank workers and of the Madras Fisheries Department. The price paid is, in my opinion, satisfactory to the department and a fair market rate.

46. *Ramnad Chank Fishery.*—Excluding the heavy charges under the head of supervision, this fishery, leased from the Raja of Ramnad for fifteen years from 1913, gave a gross profit of Rs. 2,654. If 25 per cent of the salary and allowances of the Assistant Director (Marine) be included in the charges, as may justly be done, this profit becomes a loss of Rs. 392, the first occasion since the first year of the lease that Government have failed to realize a profit. This unsatisfactory result is due in the main to lack of success in recruiting a sufficiency of labour for the main section of the fishery, that off Rameswaram. With the greatest difficulty 102 divers were obtained from Kilakarai and Periapattanam, as against 144 in 1920-21; with such a small contingent it is impossible to make satisfactory headway with the fishery within the six weeks from 20th February to about 7th April which constitutes the effective fishing season. The other sections of the fishery showed relatively better results than that of Rameswaram, due to the divers at these

other places being chiefly local men who have not to be specially recruited.

47. The sectional results are shown below in comparison with the totals for the previous two years :—

	1919-20.	1920-21.	1921-22.
	Shells.	Shells.	Shells.
Rameswaram	122,880	101,026	86,452
Tirupalakudi	15,735	35,641	37,542
Kilakarai and South Vedalai	10,188	13,879	11,845
Pillaimadam	29,055	21,228	20,941
Total ..	177,858	171,774	156,780

The rapid decline in the catch at Rameswaram is the salient feature in recent years' operations, the one bright spot being the great increase in the catch made at Tirupalakudi during the past two seasons. The officer in charge at Tirupalakudi, Mr. B. Chinna-swami Nayudu, is deserving of particular commendation in controlling and organizing the local divers to such good effect; his work is specially commendable during the past season, as an epidemic of virulent cholera caused a cessation of work during two of the best fishing months. I commend his good work to the attention of Government.

48. The three years' contract for the Ramnad shells (at Rs. 215 per 1,000 for the Rameswaram quality) expiring on 30th June 1922, tenders for another period of three years were duly called for. The highest offer received was Rs. 210-4-0 per 1,000 for the Rameswaram quality made on behalf of the Dacca Shell-Workers' Co-operative Society and this has been recommended to Government for acceptance.

49. *Advances.*—A total of Rs. 1,500 was outstanding with the Ramnad divers at the close of the 1920-21 season. During the past season a further sum of Rs. 928 was advanced, making a total of Rs. 2,428 outstanding. The bulk of this amount was recovered before the end of the season, the balance outstanding being now reduced to Rs. 1,100 which I consider satisfactory.

50. *The small Sivaganga Fishery*, controlled by the officer stationed at Tirupalakudi, produced an average yield of 3,035 shells.

51. *The leased chank fisheries.*—The leases of the three fisheries of (1) Tanjore, (2) South Arcot and (3) Chingleput and Nellore, terminated during the first half of 1922; fresh tenders were duly called for, but owing to alleged losses suffered by the

recent lessees, comparatively poor offers were received; eventually the fisheries were rented respectively as follows :—

Tanjore	Rs. 2,750 per annum for a term of 3 years.
South Arcot	Rs. 900 for the year 1922-23.
Chingleput and Nellore	Rs. 750 „ „

Experience seems to show that the rates paid per annum by recent renters, e.g., Rs. 4,467, Rs. 1,933 and Rs. 1,250 respectively for these three fisheries, were unduly high and such as did not leave a reasonable profit to the lessees.

52. *Bechê-de-mer Fishery.*—During the season under review a lot of 1,008 lb. of this product was despatched to Singapore for sale; this amount compares favourably with the failure of this fishery in 1920-21. The sale-proceeds amounted to Rs. 439, giving a net profit of Rs. 41. The work is carried on mainly to provide the chank divers of Tirupalakudi with a market for the bechê-de-mer found when fishing chanks.

53. *The Pearl Fishery section* continues to be a heavy drain on the resources of the department. During the year 1921-22, it cost the comparatively large sum of Rs. 24,043 as compared with Rs. 8,488 in 1920-21. Out of this total, Rs. 6,000 represents 75 per cent of the expenses in installing new engines in the inspection vessel "Lady Nicholson." The expenses of running this vessel and of carrying out pearl inspections are now very greatly enhanced over what they were when she was obtained; it becomes an urgent question whether such heavy expenditure is justifiable under present financial conditions, and in view of the fact that there are no indications of the early occurrence of another pearl fishery on our coast. Proposals for a curtailment of this expenditure will be submitted at an early date; all reductions must however be judicious, and means must be found to ensure that pearl oyster deposits be not missed through any false economy in respect of inspection.

54. In Ceylon the last inspection showed a very extensive area covered with young oysters that should be fit to fish in 1925 or 1926. We generally get a fishery on the Indian banks within two or three years from the date of a Ceylon fishery,* hence I anticipate the possibility of a pearl fishery off Tuticorin in 1927 or 1928; I do not consider one possible before the former date.

55. *Fishery vessels.*—During the past year new motor engines were installed in the "Lady Nicholson." They consist of a pair of 75-90 b.h.p. Gleniffer 4-cycle engines, running either on petrol

* Historical and other evidence for this inference are given in my *Report on Madras Pearl Fisheries* now in the press.

or kerosene. The installation cost Rs. 8,217 and was made by the South Indian Railway, Marine Engineering Department, on their slip at Kundegal, the work being completed on 13th May 1922. The engines have proved most satisfactory. On the trial trip a speed of 8.2 knots was obtained with both engines and of 5.4 with one only. In actual work, a speed of 7 knots can be relied on with the two engines, or 5 knots with one only. Fuel consumption also is economical, being $13\frac{1}{2}$ gallons per hour. From recent experience aboard the vessel, I am also satisfied that her stability is now greatly improved.

56. The motor launches "Leverett" and "Pearl" continue to do invaluable work in the chank fisheries, chiefly in towing the divers' boats to and from the fishing grounds. The "Leverett" has been considerably altered during the year to fit her to encounter heavier weather and the result has proved satisfactory. The "Sutherland" also does towage work, but the engine aboard is becoming worn out and should be replaced at an early date. The hull continues in good condition and is worth the cost of re-engining.

E. EXPERIMENTAL SEA-FISHING.

57. *Inshore experiments at Madras and Negapatam.*—These experiments initiated by Rao Bahadur V. Govindan, Assistant Director (Coast), have unfortunately proved failures. Since my last report, the Madras experiment carried on for a further period of six months, was no more successful than previously in inducing any Madras capitalist to take up sea-fishing with Malabar canoes. Consequent on this failure, the canoes and crews were despatched to Negapatam to demonstrate the Malabar methods there. Unfortunately the demonstration has proved that the fine catamarans at this port, sometimes exceeding 32 feet in length by a width of 7 feet, are actually better adapted to local fishing conditions than the dugout canoe of Malabar; not only are the canoe catches most meagre, not nearly covering the outgoing expenses, but the canoes themselves have not the weatherly qualities of the local catamaran. On a recent inspection of the condition of the experiment, it was obvious that the catamaran can sail ever so much closer to the wind than the canoe—indeed the study I have made of the Tanjore catamaran convinces me that unless capitalists come in with motor boats, no sailing craft can compete with the local craft in utility for general fishing purposes. And if motor boats were introduced they would have to be based on ports where they could lie in safety during bad weather; the number of these is very limited on the Coromandel coast, and all have little water on their bars at low tide. The catamaran is independent of such refuges; it costs little in upkeep, sails well, is safe, and eminently adapted

for use with the nets employed on this surf-beaten coast. I consider that the experiment should be abandoned forthwith.

The cost of the experiment during the past year is shown as under:—

						RS.	A.	P.
Receipts ..	::	::	::	::	::	2,154	4	10
Expenditure ..	::	::	::	::	::	5,494	12	8
Net loss ..						3,340	7	10

58. *Drift-netting with Ratnagiri machwas.*—One of the machwas belonging to the department worked from the end of November till the middle of March. The weight of fish caught was 3,632 lb. sold for Rs. 231; expenditure was Rs. 516. Financially this experiment was a failure but it provided facilities for the instruction of the Training Institute students, both in drift-netting and in the use of a small beam trawl which was successfully operated on several occasions. A local fisherman is negotiating for the loan of the boat, with a view to try drift-netting further from the coast, using his own nets.

59. *Introduction of the Danish seine.*—Upon my recommendation Government have sanctioned the purchase of a powerful sea-going fishing launch to be equipped with Danish seines with a view to test the suitability of this method of fishing in Indian coastal waters. A contract has been placed with Messrs. John I. Thornycroft for a launch, 48 feet 6 inches long, 9 feet beam and 3 feet draft. It will be fitted with a 3-ton fish hold, a net-hauling winch and a rope coiler, to be worked off the engine, which will be a Thornycroft 30 b.h.p. marine motor. The total cost delivered in Tuticorin will be about £3,000.

The actual working of the experiment will be in the hands of the Assistant Director (Marine). This launch will be extremely useful for other work, particularly for boat towage at a big chank or pearl fishery and in pearl bank inspection, as her running expenses will be very materially less than those of the "Lady Nicholson."

II.—MADRAS MARINE AQUARIUM.

60. The Aquarium on the Marina well maintained its great position during the past year as one of the foremost popular resorts in Madras. A considerable reduction took place however in the attendance of country visitors, particularly from the Telugu districts. How far this may be due to repercussion from local political unrest and how much to restriction of travelling brought about by the enhancement of railway fares it is impossible to say. Both probably had their effect upon the attendance which dropped to 125,161 as

compared with 161,699 in the preceding year. Fortunately the revenue did not drop proportionately, the total amount received from all sources being Rs. 9,111. Strict economy in expenditure reduced this item to Rs. 4,795 as against Rs. 4,993 in 1920-21. Hence the net sum, Rs. 4,316, by which revenue exceeded income, under the adverse conditions noted, compares not unfavourably with the total profit of the preceding year, Rs. 5,141.

61. The record attendance was on Kannu Pongal (16th January 1922) when 4,022 persons paid for admission. The next day the Aquarium was honoured by a visit from His Royal Highness the Prince of Wales, who was graciously pleased to express his admiration of the brilliant colouring and quaint forms characterizing many of the fishes.

62. For the benefit of those who do not read English, an illustrated Tamil edition of the guide book was placed on sale in July 1921. Seven hundred and forty-nine copies of this vernacular edition were sold during the year. The balance of the second English edition, 1,349 copies, was sold out by the end of January 1922, when a third edition, revised and enlarged by the Director and illustrated with several new illustrations, was placed on sale. In the five months ending 30th June 1922, 997 copies were sold. Arrangements have also been made to issue a number of coloured post cards, reproductions of certain water-colour sketches of the more beautiful and curious of Madras fishes. The three-colour blocks necessary have been obtained.

63. The improvements effected during the year comprised additions to the number of table aquaria, the exhibit of further wall cases containing prepared specimens of sea-life to advertise the work of the biological supply section, and the provision of substantial fencing around the building. The filter well was completed but has not yet been brought into use.

64. *Statistics of fish supply in Madras.*—The Sub-Assistant in charge, besides his routine duties was engaged during the past year upon the collection and tabulation of statistics relating to the fish supply of Madras, taken up on the direct initiative of the Hon'ble Rai Bahadur K. Venkata Reddi Nayudu Garu, Minister for Development. Nothing of this nature has before been attempted, in spite of the public importance of having an accurate knowledge of the amount of fish landed and consumed in Madras, the species of chief economic importance and their seasonal abundance. Owing to the lack of any central landing place for the local fishing craft, and to the large number of markets, over 21, to which fish is taken for sale direct from the catamarans, the work proved extremely arduous and troublesome as each of 21 markets, scattered over a wide area, had to be visited twice daily. A report will shortly be submitted; it

will prove of great value when considering how best to proceed with the further development of the local fish supply. Besides this work the Sub-Assistant was responsible for the supervision of the Pulicat oyster farm and for the preparation of specimens of the larger crustaceans required for biological supply. The permanent incumbent Mr. S. T. Moses, M.A., was in charge during the year, except for a leave period extending from 27th September 1921 to 19th January 1922, when Mr. K. Unni Nayar acted for him. Both carried out their exacting duties to my entire satisfaction.

III.—FISHERY RESEARCH AND BIOLOGICAL SUPPLY.

65. *Fishery research.*—The services of the Marine Biologist, Mr. Whitehouse, were dispensed with on the termination of his two years' engagement, on August 31st, 1921 for the reasons given by Government in their comments on the report for 1920-21. On my representation of the urgency and great practical value of an intensive investigation into the life histories of the oil-sardine (*Clupea longiceps*) and of the Indian mackerel (*Scomber microlepidotus*), Government were pleased to sanction my proposals to this end. It is obvious that Calicut is the best location for work, being our fishery headquarters on the West Coast, and with all needful facilities for obtaining material for study. Accordingly the ground floor of the Fisheries bungalow on the sea front, was converted into a laboratory and two sub-assistants, Mr. Ramaswami Nayudu, B.A., and Mr. Jayaram Nayudu, B.A., were posted to the duties, the former to concentrate on the sardine, the latter on the mackerel. They began work in November 1921; so a full year's cycle has not yet been completed. I undertook the direction and scientific supervision of the research, visiting Calicut on frequent occasions for this purpose. It is perhaps premature as yet to say anything definite about results, but I am able to state that substantial progress has been made, notably in the correlation of the movements of inshore shoals with the abundance or otherwise of certain food organisms. Scale study is difficult owing to tropical conditions, but progress has been made, and I think it will soon be possible to state definitely the age of any sardine from examination of the scales; this obviously will be a great advance, as hitherto we have had no knowledge whatever of the age to which sardines live. The spawning of mackerel and sardines is found not to occur in the inshore waters, and indications have been noted that should be of practical value when fishing exploration is undertaken in search of the shoals that have moved seawards, or which have failed to migrate shorewards at the proper season. The offshore location of shoals will be one of the duties of the motor fishing-launch now on order. The keenness and thoroughness of the investigators is beyond praise and

their efforts will, I am sure, redound ultimately to the material advancement of the Presidency as well as add a fresh chapter to biological science. The investigation is being conducted with great economy, which however will not, I believe, adversely affect the results.

66. *Breeding habits of flying-fish.*—An important seasonal fishery on the Coromandel coast, especially off Tanjore and South Arcot, is for the smaller of the two flying-fishes common in Madras waters. Some years ago I published certain particulars of this fishery obtained from fishermen. Recently (July 15th) I was at last able to watch the actual methods employed, and thereby to amplify and correct the former account. But the most valuable result is that the inquiry has enabled us to understand the reason for the curious method employed, and incidentally to learn the most important facts characteristic of the breeding habits of the species in question. Described shortly the method consists in floating bundles of leaves (shrubs) at the ends of long ropes, to a distance from the fishing craft; to wait till a shoal of flying fishes have congregated around these bundles, and then to haul them alongside and dip out the fishes which are too occupied with their own affairs to take fright. Examination afterwards of the leaf bundles showed the leaves to be tangled up in a thick cobweb of gelatinous adhesive threads mingled with masses of tiny eggs. From this it is clear that the fishes resort to the floating bundles in order to deposit their eggs thereon and we may infer that naturally they do so upon floating sea-weed, of which sargasso weed is the commonest kind in our seas.

I have submitted separately a detailed account of the observations which are important both because of their novelty (nothing was known previously concerning the breeding habits of these fishes), and because of their practical bearing on the fishing experiments to be made when the new motor fishing launch becomes available. The particular species of flying-fish concerned appears to be undescribed and I propose that it be called *Cypsilurus coromandelensis*.

67. *Biological supply.*—Owing to the abolition of the Marine Biologist's post, it became necessary for reasons of economy to move the headquarters of this section from Tuticorin to Ennore. This caused a temporary set-back owing to the interruption caused by the removal. The value of the specimens supplied dropped in consequence to Rs. 2,541 as compared with Rs. 3,131 in 1920-21. The running expenses inclusive of the pay of the Sub-Assistant in charge and of the whole establishment but excepting the cost of transfer to Ennore, amounted to Rs. 2,567. Had work not suffered two months upset a credit balance would assuredly have been shown as numerous orders were on hand at the end of June of this year.

68. As previously the bulk of the orders come from Teaching institutions in the north of India. The following list of all supplies sent out during the year makes this clear, viz. :—

					RS.	A.	P.
Government College	..	..	Lahore	..	166	14	0
Punjab Veterinary College	..	..	"	..	353	4	0
Agra College	..	..	Agra	..	31	0	0
St. John's College	..	..	"	..	5	0	0
Hindu College	..	..	Delhi	..	86	8	0
Ramja's College	..	..	"	..	236	5	0
Canning College	..	..	Lucknow	..	490	6	0
Muir Central College	..	..	Allahabad	..	163	0	0
Hindu University	..	..	Benares	..	112	8	0
Calcutta University	..	..	Calcutta	..	132	4	0
Agricultural Department of Bengal.	..	..		..	50	8	0
Baroda College	..	..	Baroda	..	2	0	0
Gujarat College	..	..	Ahmedabad	..	10	12	0
Victoria Museum	..	..	Karachi	..	47	8	0
Hislop College	..	..	Nagpur	..	41	6	0
Maharaja's College	..	..	Vizianagram	..	170	12	0
Central College	..	..	Bangalore	..	156	12	0
Presidency College	..	..	Madras	..	46	0	0
Government Entomologist	..	..	Coimbatore	..	33	0	0
State Museum	..	..	Pudukottai	..	25	0	0
Total ..					2,360	11	0

This list shows conclusively that the educational service rendered is an Imperial one; the Madras Government might with propriety suggest the justice and advantage of a small Imperial grant to aid in extension and development of the work; the Local Government cannot be expected to carry on indefinitely the duty of zoological supply to the whole of India, without some recognition from the Central Government.

69. During the year a lengthy popular account of the common shells of South India was written by the Director, well illustrated, and published as part of Fisheries Bulletin No. 14. This was primarily designed to meet the requirements of the Director of Public Instruction, who wished to provide Madras Secondary School museums with wall cases of our common shells, provided a descriptive handbook be provided. A large series of beautiful and interesting exhibits is already in course of preparation for the exhibition that is to be held in London in 1924.

70. Mr. Ramaswami Ayyangar deserves special commendation for the energy and interest he takes in the conduct of the difficult work of zoological preparation. Some of the specimens preserved by him are extremely beautiful, and such as few Museums can boast of; especially successful has he been in the preparation of

the soft corals (*Alcyonarians*) with the polyps expanded. A large series of these has recently been ordered for Glasgow University.

IV.—INLAND PISCICULTURE.

71. During the past year's operations several exceptional difficulties threatened to hamper work and therefore I am extremely pleased to record that all were successfully surmounted, that distinct progress can be recorded, and that this section was able to contribute a substantial sum to revenue. The receipts received from fishery rentals and other sources totalled Rs. 88,235 whereas expenditure as shown in Statement II was Rs. 74,594, giving a profit on the operations of Rs. 13,641 as against Rs. 22,613 in 1920-21. From 13th September Mr. Chakrapani Ayyangar, B.A., was in charge, Mr. Sundara Raj, the Assistant Director, being permitted to proceed to England on my urgent representation in order to undergo a two-years' course of training under Professor James Johnstone at Liverpool University. I understand that Mr. Sundara Raj is making rapid progress with his studies and that he is at present on a tour to the chief fishing centres in Northern Europe. I am glad to say that Mr. Chakrapani Ayyangar has acquitted himself remarkably well in his onerous duties, the proof being seen in the excellent financial results obtained in tank rentals in spite of a determined boycott on the part of influential non-co-operators.

72. During the year the training of the Assistant Inspectors and Overseers in the methods and technique of pisciculture was completed, chiefly at our Ennore Fishery Station, and all passed at the final examination. They have since been usefully employed in tank stocking and related operations.

73. *Tank acquisition and stocking.*—During the year, a detailed scheme for the acquisition of a large number of tanks and channels in the Ganjām district was laid before Government. Hitherto the department has been unable to devote much attention to the northern districts, so it is earnestly to be hoped that the scheme put forward will receive sanction at an early date, especially as the conditions for successful development of these inland fisheries are peculiarly favourable in Ganjām.

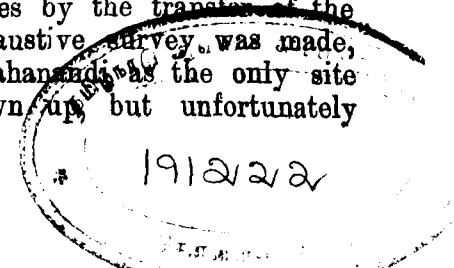
74. Tank stocking generally was more efficiently carried out than in the preceding year as the officers are now better trained, and as untrained temporary assistants need no longer be employed. The fishes used for stocking were as usual chiefly quick-growing carps, together with the pearl-spot (*Etroplus*) bred in the various fish-farms, *catla* and mullet fry. No planting out of gourami was possible, as suitable perennial ponds are not available till the Chingleput and Vellore moat-farms be handed over to the department.

75. *Fishery rentals.*—The total revenue derived from the sales of fishing rights for the year amounted to the handsome sum of Rs. 87,333, as against compensation payable by the department to the former owners of Rs. 56,135, as per Statement VII annexed. This is a slight drop in revenue of Rs. 3,151 from the 1920-21 figures. Had it not been for the violence of the non-co-operation movement, particularly in Nellore, a considerably higher revenue would have been obtained, hence the officers concerned deserve high praise for the excellent result obtained in the face of this exceptional obstacle to good financial results. So great was the influence exerted against the department, that in numerous instances no bidders dared come forward. Several tanks had to be put up for sale twice and even thrice before any bid could be obtained; in some cases the opposition balked every effort and no offer, however low, from any quarter was obtainable.

76. In the Gudur taluk of Nellore, the Vakkada and Yeragattipalli villagers refused to bid in spite of all persuasion and so with a view to teach them a lesson these tanks were fished departmentally realizing a sum of Rs. 164 against the compensation of Rs. 9 payable to the District Board. The villagers there and elsewhere have now realized that the department is not helpless in face of their boycott. In future, if similar circumstances recur, it is intended to extend this system of departmental fishing to all cases where such a measure is necessary in view of the obstructive tactics of village politicians. In Chingleput district several tanks received wholly inadequate supplies owing to the local failure of the north-east monsoon. This conjoined with the usual local combinations attempting to get the fishing rights for an old song, caused difficulty in several instances. Patience and resales effected wonders, and eventually the fisheries of 143 tanks in Chingleput and Nellore were sold for Rs. 10,235 as against Rs. 10,704 in 1920-21, most satisfactory in view of the immensely more difficult conditions that prevailed in 1921-22.

77. *The fish-farms.*—These consist of one at Sunkesula (Kurnool district), one at Ippur (Nellore), one at Perambur (Madras) and a larvicidal farm at Praema in Kurnool district. They all worked satisfactorily during the year and helped effectively in tank-stocking operations.

78. The *Sunkesula farm* continues to be beset with difficulties owing to the inadequate water-supply from the Tungabhadra during the hot weather and the high cost of pumping water to the ponds. With a view to overcome these difficulties by the transfer of the farm to a more suitable site, an exhaustive survey was made, resulting in the recommendation of Mahanadi as the only site wholly suitable. A scheme was drawn up, but unfortunately



Mahanandi is a most sacred Hindu shrine, so religious opposition arose. The Hon'ble the Development Minister visited the site and eventually he decided against the scheme. Praema was then carefully re-examined as it is the only possible alternative site; the result was adverse and so we are compelled to remain at Sunkesula in spite of all drawbacks. A scheme is now being drawn out for the substitution of a smaller and more economical pumping engine and it is hoped to reduce the cost of pumping thereby, by 50 per cent. Gourami, pearl-spot and tench, bred in the ponds which are maintained in a healthy condition. A long stretch of the Kurnool-Cuddapah canal and several tanks in the Ceded districts were stocked from Sunkesula with carp and pearl-spot. Carp and murrel reared in the Edurur swamp were supplied to Kurnool market, 1,938 lb. of carp and 480 lb. of murrel, realizing Rs. 338 as against Rs. 206 last year. A further 500 lb. of murrel remain on hand for disposal, worth about Rs. 100.

79. Again this year the *Ippur farm* is passing through a critical time, owing to the Surveyepalli reservoir running dry once more. If no rains come before the level in the ponds is greatly reduced the stock will have to be removed elsewhere for safety. The pearl-spot (*Etroplus*) in this farm breed prolifically and have been used for stocking several tanks. The gourami also bred.

80. The *Perambur farm* is small but curiously enough the gourami breed here more freely than elsewhere, the smallness of the ponds being appreciated by these very domesticated fishes. It is a pity that the people of this Province do not evince that pleasure in breeding fishes in ponds that is such a notable and useful characteristic of the people of Bengal, Java and China. In the gourami they would have an ideal fish for small ponds in their compounds. The pearl-spot also bred freely as usual and the fry were useful for stocking purposes. Large numbers of larvicides were supplied from here to private persons and public bodies. No progress could be made during the year with the proposal to convert the ponds at the old Madras brickfields into a fish-farm.

81. The *Praema larvicidal ponds* continued to furnish a large supply of mosquito-larvæ-eating fishes for the stocking of the Nallamalai waters. Nearly 20,000 were put into water-holes in eight of the forest ranges. An extension of the ponds is urgently needed, but is held up for financial reasons.

82. *Acclimatization*.—The fishes of which the range in South Indian waters is being extended comprise the pearl-spot (*Etroplus suratensis*), the gourami, *Catla catla*, certain species of grey mullet, and the English tench. The first named is an undoubted success, flourishing in all waters wherever introduced. It is bred at Sunkesula, Ippur and Perambur and has been established as far

inland as the Kamalapuram tank in Bellary, and the Barur and Penukondapuram tanks in Salem. The Kurnool-Cuddapah canal was stocked from Sunkesula, and tanks in Nellore and Chingleput from the Ippur and Perambur farms. A consignment of 250 was also sent in December of 1921, to the Mauritius via Colombo at the request of the Government of the Mauritius; it is satisfactory to know that over half of the consignment arrived there safely. This fish was not known before in that island.

83. Our stock of gourami obtained from Java and the Mauritius breeds freely at Sunkesula and Perambur, but at Ippur it did not till last year; a young one of $2\frac{1}{2}$ inches long was caught there in November 1921, so evidently spawning has in one case been successful. Further experiments in making this locality more suitable for breeding are being tried; as I remarked last year I believe the ponds are too large and too bare of large water plants. Not till the fish-farms of Chingleput, Vellore and Mopad be completed can we deal adequately with the accumulated stock of gourami now on hand.

84. The English tench introduced into the Ootacamund lake years ago continue to thrive exceedingly. When the lake was netted in November 1921, to obtain English carp to send to Kodaikānal, tench fry were found to be abundant. The tench taken from Ootacamund to Sunkesula have not given such good results. This is not surprising, considering that this place is only about 1,000 feet above sea level. However, in September of last year (1921) when the pond was examined, a large number of tench fry measuring from 1 to 2 inches in length were found. This opens up great possibilities in the way of acclimatizing this valuable fish in the plains of India. Arrangements are being made to get other consignments of tench and distribute them to other waters. The fry at Sunkesula will be kept to breed from.

85. The stocking of inland tanks with mullet fry is progressing most satisfactorily. Their growth is surprisingly rapid under favourable conditions; for example, in the Oratti tank in Chingleput district large numbers have been taken measuring up to 18 inches in length, all fat and healthy and relished immensely by the villagers.

86. The range of another fish, the valuable and quick-growing carp *Catla catla* (Telugu, *Kistna botcha*), is being steadily extended southwards in this Presidency. Its fry is found in enormous quantities in the Gōdāvari and Kistna canals, more especially in the former, from August onwards. Taking advantage of this, large numbers have been planted in the newly acquired Mopad reservoir, the tank in Nellore near Christ Church and in several non-deltaic

tanks also in Nellore. It is intended to attempt the introduction of this fish into the Cauvery in the coming season. Study has been given to the idiosyncrasies of this fish under transport; the practical data obtained are most valuable and will probably be issued in the form of a leaflet for the benefit of any one wishing to obtain supplies for stocking purposes.

87. At the request of the Palni Hills Game Association, 480 English carp and 162 mahseer fingerlings were supplied, the carp from Ootacamund lake, the mahseer from Kurnool. Not a single death occurred during transport. I understand that some of the carp were put into the Bryant Park pond and the remainder of the consignment into the reservoir.

88. *The Hilsa Hatchery* at the Lower Anicut was used for demonstration purposes in August, for the benefit of the Assistant Inspectors undergoing training. Ova were artificially hatched and a large number of larvæ were hatched out successfully and turned into the Cauvery.

89. *Incomplete schemes.*—The three great schemes at Mopad, Vellore and Chingleput are nearing completion but the farms have not yet been handed over by the Public Works Department. An Assistant Inspector has however been posted to each to carry out preliminary operations. At Chingleput these consist of stocking the completed sections with larvicidal fishes to combat the mosquito plague which is the bane of the place. At Vellore two sections are dry and in the remaining ones the many predaceous fishes are concentrated. To facilitate their destruction fishing licences are being granted at a small fee and angling and cast-netting are now popular and profitable pastimes with many of the local people. At Mopad departmental fishing is being carried on, and a sum of Rs. 126 was realized to the end of June.

90. *The Kanigiri-Duvvur* scheme is held up owing to financial considerations.

91. *Economic improvement of fisherfolk.*—The co-operative society of the fishermen of Hampapuram to which the lease of certain sections of the Cauvery was granted under G.O. No. 797, Development, dated 10th May 1921, continues to work satisfactorily and to be a boon to the members. The society has been regular in paying the rental and in consequence the lease has been extended for a further year. This system of leasing direct to societies composed entirely of fishermen is so desirable, that strong efforts are to be made to extend it; if the Ganjām tank acquisition scheme be sanctioned, great scope for such work will be found among the poor fishermen living in the neighbourhood of the acquired waters.

The co-operative society formed for the benefit of the fishing community at the Lower Anicut is appreciated and the night school at the same place is valued and well attended, not only by boys, but even by a number of adult fishermen.

V.—SOCIO-ECONOMIC SECTION.

92. *Education.*—This work in common with the social activities of the department aiming at the betterment of the fishing community was under the efficient control of Rao Bahadur V. Govindan, Assistant Director of Fisheries (Coast). The Training Institute for pupil teachers opened in July 1919 progresses satisfactorily. Thirty-four students underwent training and out of six who completed the three-year course of instruction, five successfully passed the final examination. Besides the usual course of training for employment as teachers in elementary schools, the students were given frequent opportunities to learn the rudiments of the fish products industries as carried on at the Cannery and at Tanur Experimental Station. A fishing canoe with its gear was also at their disposal and they were sent to sea periodically in batches to learn at first hand the rudiments of fishing. The sale-proceeds of the fish caught on these fishing trips amounted to Rs. 296. They were also sent to sea in the Ratnagiri machuwa to learn something of deep sea drift-netting and trawling. The final year students were given a special course in the elements of marine zoology, and were familiarised with the methods of fishery research in use in the current sardine and mackerel investigation. To teach them how to manage a co-operative society, one was started among the students themselves, the senior outgoing students being the office-bearers. A scout corps was organized, in which the boys take a keen interest, and 17 of the students joined the Territorial force and underwent training at Cannanore. I am glad to say that the recruiting officer was specially pleased with these recruits; he told me he considered them exactly of the right stamp for the particular needs of this force.

93. *Village schools.*—Of these 27 are now directly under the management of this department, 18 being day schools and nine night. The number of pupils rose to 1,533 from 1,385 in the previous year. The school at Puthankadapuram was burnt down during the Mappilla rebellion; it has since been rebuilt. The number of teachers employed is 59. Several applications for help in opening schools for the fisher community have been received, but the present financial stringency precludes help being given.

94. *Temperance and other socio-economic work.*—In last year's report I commented on the danger of reaction when temperance is forced prematurely upon a community and is not the growth of

education and reasoned belief. My fears were realized earlier even than I expected; it is now reported that the ardent fishermen teetotalers of a year ago, who in the Mangalore and Udipi taluks decided that as they had given up drink, so should all their neighbours, are backsliders and again patronize the toddy shops; the original movement, artificial and altogether too sudden and drastic, is reported to have been largely the work of non-co-operators and Khilafat agitators. Owing to the disturbing influence of these men it was not possible to carry on any substantial constructive work among the fisherfolk. Government have been pleased to sanction a grant-in-aid of Rs. 3,693 towards the building of a Temperance Hall and school in Malpé for the local fisher people; the work is now in progress.

95. *Co-operation*.—At the beginning of the year there were 57 Fishermen's co-operative societies on the west coast including three productive societies (two in South Kanara and one in Malabar) with a total membership of 3,279 of whom 427 were females. During the year one new society was started at Elathur and the existing societies at Tellicherry and Quilandy were bifurcated owing to factious feeling among the members at the former place and on account of the wide area over which operations were carried on by the latter. Hence the number of societies at the end of the year was 60, with a membership of 3,581 and their paid-up share capital rose from Rs. 66,585 to Rs. 81,702 and the amount of loans disbursed from Rs. 1,69,103 to Rs. 2,53,303. The following table contains the important figures relating to the working of these societies and shows the rapid progress they are making:—

	West and East Coast.			West Coast alone 1921-22.
	1918-19.	1919-20.	1920-21.	
Number of members—Males	1,644	2,446	3,099	3,128
Do. do. Females	256	381	445	453
Number of shares	1,900	2,827	3,544	3,581
	Rs. 2,438	Rs. 3,852	Rs. 4,875	Rs. 4,978
Paid-up share capital	25,388	49,232	66,585	81,702
Loans disbursed	40,511	1,17,520	1,69,103	2,53,303
Loans for payment of prior debts ..	8,736	17,866	26,318	44,615
Loans for industrial use	8,736	26,410	61,788	99,634
Loans due to Central Banks and other depositors.	4,714	27,994	18,253	21,606

Notes.—The figures for 1921-22 relate only to societies on the west coast as the 13 societies on the east coast were transferred to the control of the Labour Commissioner last year.

Members of some societies have withdrawn their fully paid-up capital and have taken up new shares, and had it not been for this,

the total of the amount of the paid-up share capital would have been much larger. The loans disbursed for industrial use have increased from Rs. 61,788 to Rs. 99,634 and the major part of the loans taken from the Central Bank was for the two fish-oil and guano factory owners' societies.

Only five new societies were organized during the year of which one has been registered and started; application for the registration of the others are pending with the Assistant Registrar. The need for societies in the remaining fishing hamlets on the coast is keenly felt but for want of literate people in these localities it was not possible to organize more societies. It is hoped that all the localities will be provided with societies as soon as Elementary schools are opened there, so that the school teachers may be entrusted with their management.

The productive societies in South Kanara were not able to carry on any business during the year on account of the failure of the sardine fishery and those in Malabar for want of experienced men to manage the joint sale business of their cured fish.

JAMES HORNELL,
Director of Fisheries.

21st August 1922.

Statement I.—Staff of the Fisheries Department, 1921-22.

Post.	Incumbent.	Period.
Director	James Hornell, Esq. ..	1st July 1921 to 30th June 1922.
Marine Biologist	R. H. Whitehouse, Esq. ..	Do. to 31st August 1921.
Assistant Director (Marine).	Lieut. J. H. Allan ..	Do. to 30th June 1922.
Assistant Director (Coast).	M.R.Ry. Rao Bahadur V. Govindan Avargal.	Do. to 30th June 1922.
Assistant Director (Inland).	M.R.Ry. B. Sundara Raj Garu.	Do. to 12th September 1921.
....	M.R.Ry. C. G. Chakrapani Ayyangar Avargal.	13th September 1921 to 30th June 1922.
Cannery Manager ..	H. L. Prager, Esq. ..	1st July 1921 to 30th April 1922.

Statement II.—Summary of expenditure and receipts of the Fisheries Department, 1921-22.

Particulars.	Expenditure.	Receipts.	Difference.
	RS. A. P.	RS. A. P.	RS. A. P.
I. Supervision and Research ..	1,34,705 0 0	3,385 8 6	— 1,31,319 7 6
II. Marine Fisheries	74,382 6 6	66,093 6 3	— 8,289 0 3
III. Inland Fisheries	74,694 7 0	88,235 1 11	+ 13,640 10 11
IV. Factories	31,126 7 5	41,134 4 9	+ 10,007 13 4
V. Capital expenditure	2,488 7 2	..	— 2,488 7 2
Total ..	3,17,296 12 1	1,98,848 5 5	— 1,18,448 6 8

Statement III.—Details of expenditure.

Particulars.	Capital expenditure.		Running expenditure.					Total.	
	RS.	A. P.	Salaries.	Establishment.	Allowances.	Supplies and services.	Contingencies.	RS.	A. P.
I. Supervision and Research ..	4,808	5 1	30,184 12 8	48,702 11 10	20,094 10 0	13,818 14 2	21,903 15 4	1,34,705	0 0
II. Marine Fisheries ..	11,207	5 6	9,228 1 0	16,513 7 6	4,066 11 6	42,916 9 9	1,657 8 9	74,382	6 6
III. Inland Fisheries ..	4,669	1 10	564 6 0	2,292 11 3	..	71,738 5 9	..	74,594	7 0
IV. Factories—									
(a) Cannery ..	3,770	11 2	3,085 0 0	2,548 5 0	..	16,089 1 1	670 0 0	22,392	6 1
(b) Tannery ..	428	15 11	..	1,974 1 0	..	6,610 0 4	150 0 0	8,734	1 4
Total Capital expenditure ..	24,884	7 6	..	..	..	..	..	2,488	7 2
Depreciation and interest on above at 10 per cent.	2,488	7 2	..	..	..	..	..	2,488	7 2
	2,488	7 2	43,062 3 8	72,030 4	72,161 5 6	1,51,172 15 1	24,381 8 1	3,17,366	12 1

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Statement IV.—Details of supplies and services.

Particulars.	Capital expenditure.		Running expenditure.					Total.	
	RS.	A. P.	Salaries.	Establishment.	Allowances.	Supplies and services.	Contingencies.	RS.	A. P.
I. Supervision and Research—									
(1) Maintenance charges of "Lady Nicholson," 25 per cent ..	3,341	9 5	..	..	..	..	..	3,341	9 5
(2) Fisheries Training Institute ..	6,477	0 2	..	..	..	..	..	6,477	0 2
(3) Day and Night schools ..	4,000	4 7	..	..	..	..	..	4,000	4 7
II. Marine Fisheries—									
(A) Chank Fisheries—									
(1) Ramnad Fisheries ..	10,635	3 9	..	..	..	..	..	10,635	3 9
(2) Other Fisheries ..	4,996	4 9	..	..	..	..	..	4,996	4 9
(B) Pearl Fisheries—									
Pamban Pearl Farm ..	249	7 3	..	..	..	..	..	249	7 3
(C) Vessels—									
(1) "Lady Nicholson" ..	8,364	11 5	..	..	..	..	..	8,364	11 5
(2) "Leverett" ..	3,651	15 3	..	..	..	..	..	3,651	15 3
(3) "Sutherland" ..	1,693	5 10	..	..	..	..	..	1,693	5 10
(4) "Pearl" ..	1,048	6 11	..	..	..	..	..	1,048	6 11
(5) Inshore fishing experiment ..	5,704	12 1	..	..	..	..	..	5,704	12 1
(6) Machwa ..	512	7 1	..	..	..	..	..	512	7 1
(D) Other works—									
(1) Pulicat Oyster Farm ..	1,235	7 0	..	..	..	..	..	1,235	7 0
(2) Marine Fish Farm ..	408	11 8	..	..	..	..	..	408	11 8
(3) Marine Aquarium ..	4,617	12 7	..	..	..	..	..	4,617	12 7
(4) Beach-de-mer Fishery ..	398	0 2	..	..	..	..	..	398	0 2
III. Inland Fisheries—									
(A) Tank-stocking—									
(1) Compensation to District Boards ..	56,134	14 0	..	..	..	..	..	56,134	14 0
(2) Stocking of tanks ..	1,005	12 7	..	..	..	..	..	1,005	12 7
(3) Chingleput and Nellore tank-stocking scheme ..	1,895	2 10	..	..	..	..	..	1,895	2 10
(B) Other works—									
(1) Sunkesala Fish Farm ..	5,051	1 3	..	..	..	..	..	5,051	1 3
(2) Ippur Fish Farm ..	2,327	9 10	..	..	..	..	..	2,327	9 10
(3) Powder Factory Farm ..	957	2 9	..	..	..	..	..	957	2 9
(4) Hilsa Hatchery ..	297	6 3	..	..	..	..	..	297	6 3
(5) Investigation of new schemes ..	30	0 0	..	..	..	..	..	30	0 0
(6) House boat maintenance ..	219	0 0	..	..	..	..	..	219	0 0
(7) Nallamalai scheme ..	345	5 9	..	..	..	..	..	345	5 9
(8) Kanigiri scheme ..	433	9 2	..	..	..	..	..	433	9 2
(9) Chingleput Fort Moat scheme ..	428	10 0	..	..	..	..	..	428	10 0
(10) Mopad scheme ..	2,612	13 4	..	..	..	..	..	2,612	13 4
	42,916	9 9	..	..	..	..	..	42,916	9 9

Statement V.—Details of Receipts.

I. Supervision and Research.	II. Marine Fisheries.	III. Inland Fisheries.	IV. Factories.
Rs. A. P. 34 0 0	Rs. A. P. 51,195 7 7	Rs. A. P. 87,353 1 8	Rs. A. P. 16,835 9 1
(a) Receipts being rent realized from Ennur Bungalow.	(a) Receipts from all chank fisheries including Bechê-de-mer Fishery.	(a) Rentals from tanks and rivers, etc., the fisheries of which were taken over by this department.	A. Cannery— (1) Actual receipts (amount remitted into treasury) from sale of canned fish.
2,331 5 7	(b) Receipts from Pamban Pearl Farm.	(b) Receipts from Sunkesula Farm.	(2) Amount outstanding— On 1st July 1922. 16,009 11 2 Do. 1921. 2,024 15 1
520 2 11	(c) Receipts from Marine Fish Farm.	(c) Receipts from sale of larvicidal fish.	13,984 12 1 Deduct collected in 1922. 29 12 0 advance.
	(d) Receipts from Pulicat Oyster Farm.	(d) Receipts from Powder Factory Fish Farm.	(3) Value of goods on hand— On 1st July 1922. 27,120 10 9 Do. 1921. 26,160 1 8
	(e) Miscellaneous receipts— (1) Aquarium guides and other pamphlets.	(e) Miscellaneous receipts.	Difference .. 960 9 1
	(2) Aquarium shop rental.		31,751 14 3
	(3) Miscellaneous Pearl Fishery receipts.		8,440 5 5
3,355 8 6	66,093 6 8	88,235 1 11	B. Tanur— (1) Actual receipts .. (2) Amount outstanding— On 1st July 1922. 2,053 14 6 Do. 1921. 912 4 3
			Difference .. 1,140 10 3
			On 1st July 1922. 1,288 10 10 Do. 1921. 1,487 4 0
			Difference .. - 198 9 2
			9,382 6 6

Statement VI.—Profit and Loss account of the Chank and Bechê-de-mer Fisheries for the season 1921-22.

Expenditure.	Amount.	Receipts.	Amount.
Chank Fisheries—	Rs. A. P.	Value of chanks fished—	Rs. A. P.
Tinnevelly	11,411 12 8	Tinnevelly	14,895 15 7
Ramnad	20,591 0 5	Ramnad	27,204 7 1
Sivaganga	287 5 0	Sivaganga	806 8 7
Bechê-de-mer Fishery ..	398 0 2	Bechê-de-mer receipts ..	439 3 0
Ninth year's proportion of the total consideration paid in 1913-14 for a 15 years' lease of the Ramnad Fishery.	4,000 0 0	Chank rentals realized—	
Law suit expenses—Messrs. J. B. Dutt & Sons.	150 0 0	Tanjore district	4,466 10 4
Supervision charges, viz.:—	6,091 2 6	South Arcot district ..	1,932 11 0
50 per cent of pay and travelling allowance of Assistant Director (Marine).		Chingleput and Nellore districts.	1,250 0 0
The balance of profit ..	8,266 2 10	Godown rent and interest received from Messrs. J. B. Dutt & Sons.	661 15 1
Total ..	51,195 7 7	Miscellaneous receipts ..	38 0 11
		Total ..	51,195 7 7

Statement VIII.—Trading account of the Government Fisheries Cannery, Chaliyam, Malabar, for the year 1921-22.

	RS.	A. P.	RS. A. P.
To stock of canned fish on 1st July 1920 ..	23,778	14 10	..
To stock of guano, oil and empty tins, etc. ..	137	8 10	..
To stock of empty tins manufactured at the cannery.	2,244	3 0	..
To cost of solder, tin-plate, empty cans (imported), tin and manufacturing sundries used.	7,929	4 2	..
To cost of fuel ..	1,042	14 3	..
To cost of fish used for canning and curing ..	1,995	8 6	..
To cost of condiments and packing oil ..	2,124	8 6	..
To cost of sundry miscellaneous stores ..	797	13 1	..
To cost of salt and preservatives ..	78	2 9	..
To cost of packing materials ..	746	0 9	..
To rent of packing stall ..	30	0 0	..
To rent of Bangalore staff and extra labour ; 50 per cent only debited.	1,583	1 11	..
Wages of temporary staff ..	1,191	8 9	..
Railway freight on parcels of canned fish and other goods and petty coolie and carriage.	..	..	..
Gross profit (transferred to Profit and Loss account).	17,534	14 8	..
	14,325	10 7	..
By sale of canned fish remitted to Treasury from 1st July 1921 to 30th June 1922.	16,263	6 10	..
By sale of cured fish ..	..	..	..
By sale of fish guano ..	259	10 9	..
By sale of tin scrap, empty tins, etc. ..	38	10 9	..
By sale of fish oil ..	33	0 0	..
By sale of miscellaneous articles ..	208	3 6	..
Deduct amount collected and remitted into Treasury against the previous year's sales.	2,024	15 1	..
To amount collected in advance and remitted into Treasury against future orders.	29	12 0	..
By value of canned fish, etc., sold but proceeds not remitted to Treasury on 30th June 1922.	2,054	11 1	..
By value of manufactured goods on hand on 1st July 1922—	14,780	14 0	..
Canned fish ..	..	..	..
Guano ..	..	..	..
Fish oil ..	..	..	..
Prawn shells ..	..	..	..
Pit manure ..	..	..	..
By value of empty cans manufactured at the Cannery on hand on 1st July 1922.	1,577	12 5	..
	27,120	10 9	..
	57,911	3 11	..

Statement IX.—Profit and Loss account of the Government Fisheries Cannery, Chaliyam, Malabar, for the year 1921-22.

	RS.	A.	P.	RS.	A.	P.
To pay of permanent staff, 50 per cent only debited.	3,979	4	10	By gross profit transferred from trading account.	14,225	10 7
To service stamps	725	0	0			
To advertisement charges	471	9	9			
To depreciation and interest at 10 per cent Rs. (14,312 — 1,396 + Rs. 3,770 at 10 per cent)—Rs. 350 = Rs. 16,336.	1,633	9	7			
Net profit	7,081	2	5			
Total ...	14,225	10	7	Total ...	14,225	10 7

The honorarium of Rs. 1,500 to Sir F. A. Nicholson for writing the bulletin "Remarks on canning" has been excluded in working out the Profit and Loss account.

Statement X.—Trading account of the Tanur Experimental Station for the year ending 30th June 1922.

Particulars.	Amount. RS. A. P.	Total. RS. A. P.
To stock of cured fish on hand on 1st July 1921.	160 15 0	6,072 12 9
To stock of fish guano on hand on 1st July 1921.	198 15 0	1,065 8 7
To stock of fish oil and foots on hand on 1st July 1921.	177 0 0	688 12 9
To stock of prawn shells and pit manure on hand on 1st July 1921.	9 9 0	103 1 6
To stock of expendible stores on hand on 1st July 1921.	940 13 0	109 11 4
To charges (1st July 1921 to 30th June 1922)—	1,487 4 0	400 6 6
Establishment (temporary) wages (only 50 per cent debited) Rs. 727-6-10.	1,712 1 11	8,410 5 5
Wages for coolies on muster-rolls and overtime bills Rs. 984-11-1.	3,018 1 4	913 4 3
To cost of fish for curing	315 13 2	
To cost of fish for oil and guano	115 10 9	
Fuel	6 0 0	
Saw dust	419 13 10	
Packing materials	675 5 3	
Railway freight on cured fish	199 7 3	
Railway freight on other goods, petty coolie and carriage.	288 4 0	
Sundry stores	267 10 0	
Salt and preservatives	127 11 10	
Miscellaneous		
Total ..	7,095 15 4	
To gross profit ..	8,583 3 4	
Total ..	2,286 7 2	
Total ..	10,869 10 6	
		1,288 10 10
		2,053 14 6
		..
		7,527 1 2
By sale of cured fish remitted into Treasury from 1st July 1921 to 30th June 1922.		
By sale of fish oil and foots		4 2 0
Do. fish guano		312 14 0
Do. prawn shells and pit manure		40 10 0
Do. fish meal		93 0 11
Total book adjustments of sale-proceeds ..		837 15 11
Deduct outstandings shown in 1920-21 accounts.		..
By value of stock on hand on 1st July 1922—		
Cured fish		
Fish oil and foots		
Prawn shells and pit manure		
Fish guano		
Expendible stores		
By value of goods sold but not realized on 1st July 1922.		

deserved commendation. Valuable experiments appear to have been conducted in respect of the methods of drying guano and with production of fish meal. The Pulicat Oyster Farm paid its expenses and would probably have shown better results had the season been more favourable. The Madras Marine Aquarium continues to be popular and earned a profit, although the figures of attendance have shown a decline. Under the head of Inland Pisciculture the revenues are principally derived from the sales of fishing rights in the tanks and other waters taken under the control of the department. The revenues suffered considerably from the non-co-operation agitation and would probably have shown a surplus not less than that of 1920-21 but for this cause. On the whole, however, the efforts of the staff were fairly successful in counteracting these adverse influences and this branch of the department's work has shown a profit of Rs. 13,641. Valuable work was done in the matter of stocking inland waters with Mullet and with the quick-growing carp, known as *Catla catla*, and pearl-spot (*Etroplus*).

4. The results of the chank fishery have been disappointing during the year under review although the revenue exceeded the expenditure by over Rs. 8,000. In the case of the chank fishery there seems to be no doubt that the prices obtained for shells during the past few years have been abnormally high and that the contractors who purchased them suffered considerable loss; and in the revenues of the year under report these losses are reflected. In addition to these causes, however, the results have been rendered poorer by the difficulties in securing labour for fishing shells. The management of this part of the department's activities requires the careful supervision of the Director in the current and ensuing years with a view to securing economy in management and more satisfactory results. If the two sections of the Pearl and Chank Fisheries are taken together, the results of the working shows a considerable loss, over Rs. 18,771. But a considerable portion of this represents the heavy cost of installing new engines in the "Lady Nicholson" and of maintaining and running that vessel; and the Government have decided, since the close of the year, to dispose of her in the interests of economy. For similar reasons, they have also decided to abandon the inshore fishing experiments at Madras and Negapatam.

5. Under the head of research, the post of Marine Biologist was abolished during the year under review for the reasons stated in paragraph 8 of the review of last year's working (G.O. No. 2142, dated 17th November 1921). Research work was concentrated, under the direct control of the Director and his Sub-Assistants, on investigating the life histories of the sardine and the mackerel on the West Coast. The economic importance of these fish to the

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