

**NOTE ON
FISHERIES
IN
JAPAN.**

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NOTE ON
FISHERIES
IN JAPAN.

AMERICAN ACADEMY
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OF ARTS AND SCIENCES

BY

SIR F. A. NICHOLSON, K.C.I.E., I.C.S. (RETIRED)

On Deputation, Madras Fisheries Investigation.



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PREFACE.

THE following note is the result of a ten weeks' tour in Japan in 1906, during which I paid various visits of inspection to experimental stations, schools, fishing villages, etc., consulted various local authorities, and obtained a variety of information, largely through special translations, which has been partly embodied in the Note. Now that the Note has been written, many lacunæ and imperfections are obvious to myself, imperfections which I hope to correct in a later visit, but which at present must remain. The difficulties of the language, the scarcity of interpreters, the paucity of reports in European languages, the difficulty of ascertaining the existence or nature of laws, reports, and so forth, the impossibility of reading a single word for myself in Japanese, the strangeness of the country, and the shortness of my visit, must be my apologies for many of the imperfections and for, possibly, erroneous statements or inferences. But certain unavoidable errors apart—and I trust they are of a minor character—the broad facts are undoubted, and it is to these that I would direct attention; errors in detail matter little, since it is not a history or technical description of Japanese fisheries at which I have aimed, but a presentation of the broad outlines of fishery work and modern methods of development especially by Government institutions.

The difficulties adverted to were greatly smoothed by the invariable courtesy extended to me from the highest official to the simplest fisherman; Japanese courtesy is proverbial, but it must be sorely tried by the now frequent foreigner whose business is the asking of questions, the demanding of information, the pursuit of the Japanese "how" and "why"; to those whose patience may have been tried by cross-questioning or whose time was occupied by interviews I tender

not my apologies, but my sincere thanks for their invariable kindness through which alone my visit could be made profitable. I would especially tender my thanks to His Excellency the Marquis Saionji, Prime Minister, His Excellency Mr. Makino, Minister for Education, Professor Mano, Director of Public Instruction, Dr. Mitsukuri, Ph.D., Professor of Zoology in the University of Tokyo, Professor S. Matsubara, Principal of the Imperial Fisheries Institute, Dr. T. Fujita, Professor of Zoology in the same, Mr. Maki, Head of the Fisheries Bureau, for kind introductions, Dr. Kishinouye of the Fisheries Department who devoted much time and thought to helping me, to the officials of the several Fishery Schools and Experimental Stations who made my visits profitable, to Mr. Kondo, Mr. Maruoka and other merchants who gave me interviews and practical suggestions, and to Mr. S. Fujita of the Zoological Department in the College of Science, Tokyo University, who gave many days of his spare time to act as my assistant in tours, and as translator of numerous laws, regulations, and reports.

I desire also to express my obligations to His Excellency Sir Claude Macdonald, K.C.B., British Ambassador, to other members of the Embassy, to Mr. T. Harrington, Vice-Consul in Yokohama, and to the Consul-General of the United States, for kind introductions and other assistance.

In the way of books and papers I am indebted for assistance to various publications mostly official or the work of officials or experts; such as "Japan in the 20th Century" prepared for the St. Louis Exposition of 1904, various catalogues and brochures prepared for other exhibitions, two pamphlets by Dr. Hugh M. Smith of the Fisheries Department, U.S.A., a learned lecture delivered in America by Dr. Mitsukuri on the culture of aquatic fauna, a note by Dr. Kishinouye on Fisheries in Japan, a report by Mr. T. Kitahara on the coral fisheries, three official reports descriptive of some of the fishes, and several minor brochures and articles in various languages; annuals issued by the Japanese Government have provided

the most recent statistics. But the bulk of the Note where not original and based on personal observation and enquiry, is derived from special translations of the laws and regulations affecting fisheries and fisher folk, of reports of various societies, and of other papers; most, if not all, of these have never before been translated, and some relate not merely to fisheries but to industries in general and to their development, as also to education; this will be seen in my forthcoming Note on Japanese agriculture.

A list of the translations made for this Note will be found in Appendix III: a copy of any such translations will be sent to any one who may require it for business purposes.

MADRAS,
28th February 1907.

F. A. NICHOLSON.

NOTE
ON
FISHERIES IN JAPAN.

INTRODUCTORY.

A consideration of the Japanese Fisheries as studied on the spot and in reports, regulations, etc., induces me to attribute their present condition and their growing success to the following reasons, and it is believed that after a perusal of this note they will be accepted by its readers, although the necessarily imperfect presentation of the facts seen, heard, and read, may render them less immediately apparent to those who have had no opportunity of personal observation. The relation of population to subsistence and to the cultivable area, and the absence of other animal food, are of course the *basic* reasons for the existence of this industry in its already large proportions, and the rapidly increasing pressure of population on the food supply (see note on Agriculture) is a main cause of the necessity for immediate development; this note merely attempts to bring out the methods by which the Japanese Government and nation are meeting this necessity and the reasons which appear to be leading to pronounced success. They may be summarized as follows:—

(1) The co-operation of Government and people; the Government statesmanlike, resolute in progress on lines systematically thought out and determined, imbued with the scientific spirit, liberal in necessary expenditure; the people responsive, enterprising, alert to utilize opportunity and to follow example, and willing to accept taxation needful to meet special expenditure.

(2) The perception of the necessity (*a*) for a general and simultaneous enquiry into local conditions and facts and into the facts, methods, and implements, etc., of foreign countries both as to the capture, preservation, and culture of aquatic products, and as to the methods of business and trade; (*b*) for detailed enquiry by means of wide and continuous experiment.

(3) The acceptance of the necessity, in the condition of the fisher folk generally, for the initiative being taken by Government in matters needing experimental enquiry, in radically new departures, and generally in measures involving continuous enquiry and effort, certain expense, and profit probable but not immediately demonstrable.

(4) The consequent establishment of a directive department which combines science with practice, a full knowledge of local conditions and facts with a large knowledge of the fishery industry, trade, and needs of the world, and is therefore, able to direct enquiries and experiments in proper directions, to co-ordinate work and collate information, to utilize the results by demonstration and publication, and to push successful products by means of exhibitions and other advertisement.

(5) The consequent adoption, by necessity, of numerous (29) experimental stations, and the success of such stations in ascertaining and introducing new or improved implements (boats, etc.), methods, and processes.

(6) The recognition of the importance of education (*a*) *general*, by which the children of fishermen compulsorily receive in common with all other children, a sound primary education, (*b*) *special or industrial*, as in supplementary (continuation) schools, fishery schools proper including the great Imperial Fisheries Institute at Tokyo, sessional schools or classes such as those worked from Experimental Stations, and displays of implements, processes, products, etc., whether temporary as exhibitions, or permanent as museums, at various centres or experimental stations.

(7) The readiness of cultivated intelligence in various ranks and social classes to take up the industry practically, and for that purpose, whether as Government delegates, students or merchants, to explore the world for knowledge and for trade openings and to invest capital individually or associated in various fishery enterprises. The application of scientific knowledge to practical developments is well exemplified in the culture-pearl industry.

(8) The ready and general formation of associations; (*a*) associations of fishermen for the carrying out of combined work through the union of joint funds and labour, and for the prevention of disputes; (*b*) trade associations or Fishery Chambers for the general development of the industry and trade by the improvement and standardizing of products, by the pushing of business, and by the provision of trade information; (*c*) fishery societies for the general furtherance of public interest, knowledge, and progress in fishery matters.

(9) The utilization of opportunities such as those for pushing the industry into other waters, and their products into other countries.

(10) The utilization of every aquatic product that may be turned to account industrially or dietetically.

(11) The habit of not merely accepting marine produce which may come to hand, but of going out and searching for it and of following it up even at great risk and with frail boats in seas notoriously stormy, and on foreign and inclement shores; of expressly

cultivating various aquatic products in novel and highly successful ways, and of scientifically using such products in manufactures.

The conclusions are necessarily of the highest importance in India. For, in Japan—and it was for this reason that it has been studied—we see a very ancient and general industry of paramount importance to the life of the people, but pursued till the Restoration of 1867 only in primitive and customary methods; subsequent to that date we can watch the application to that industry of scientific foresight, the deliberate grafting thereon by far-sighted authority and by keen-minded business men, of all that western knowledge and experience could teach, together with large additions suited to or needed by the conditions of the people and of the industry, such as experimental stations, fishery schools, associations, etc., which are not required or are not general in Europe or the United States of America, where private enterprise and capital, the advanced condition of the correlated fishing industries, the habit of forming private syndicates or companies, render Government initiative useless, and intervention unwelcome, save in exceptional cases. In India we have an industry equally primitive with that of the Japanese before 1867, a fishing population less numerous, less hardy, less adventurous, less adaptive, and more readily content with that which is; infinitely suspicious of Government interference yet almost incapable of initiative or of serious new departures without such intervention. Hitherto little has been done save in the grant of cheap salt in the fish-curing yards and in a general improvement of communications; Can Japan give us hints as to the wisest methods of further progress? The present note is a first attempt to answer this question.

The note is in no way intended as a history or as a description; it discusses solely such points as seem of importance in dealing with the final object of enquiry, viz., the development of Madras fisheries; only so much of a general nature is entered as is necessary for a proper understanding of the subject.

GENERAL.

2. *Statistics.*—The nutriment of the Japanese is practically confined to vegetable food and fish, since meat and dairy products are in general unknown; hence the necessary complement of agriculture is the fish supply, and the fishing industry has been universally practised from time immemorial on the 13,000 or 14,000 miles which, including estuaries and other indentations, but excluding Formosa and many minor islands, form the coast line of 116 main and connected islands. The fisher folk in 1904 numbered 997,132 households with a population of about 5 million, of whom 939,893 were fishermen—including boys actually at work—whose sole business is fishing, while about 1·4 million combine fishing with some other business such as

farming; in other words slightly over 10 per cent. of the population are directly connected with the fisheries, mostly marine. These men owned 426,287 boats and about 1,200,000 nets; the average value of the former is not clear, but the 36,642 boats built in 1904 were valued at nearly Rs. 72 each on the average; nets average Rs. 18 apiece. Boats are very cheaply built, chiefly of pine wood, and last only 10 or 12 years; hence the low average value; most of them moreover are very small and frail with an average cost of only Rs. 51. The weight of the annual catch is doubtful; in 1905 Dr. Hugh M. Smith, U.S.A. Fisheries Commissioner, stated it at 3,000,000 tons or about three times the total catch of Great Britain and Ireland or of the United States, but this seems doubtful since the official statistics for the main islands for 1904 give just 97·5 million *kwam* or 360,000 tons as the weight recorded for all fish of importance including shell fish, *plus* about one-third more—judging by values—for unclassified fish, making a total of 480,000 tons; other years are not very dissimilar. To this must be added the catch for Hokkaido, the weight of which is unknown, but judging by the value which is about one-third of the recorded value for the main islands, another third should be added on this account making a grand total of 640,000 tons; in 1900 the weight actually given (“Japan in the 20th Century”) was about 610,000 tons. The value of the *catches* of 480,000 tons in 1904 exclusive of Hokkaido, was about Rs. 630 lakhs (42 million yen or £4,280,000) or about Rs. 130 per ton or 11 pies per pound, which seems high for Japan; the total value in 1900 for 610,000 tons was Rs. 850 lakhs (£5,700,000) or nearly Rs. 140 per ton or exactly one anna per pound. This estimate nearly agrees with Dr. Smith’s valuation of 30 million dollars or £6,000,000.

3. To this value must be added the increment obtained by manufacture; the value of “marine products” which in the statistical returns represents such portion of the total “catches” as has been dried and salted or turned into manure, etc., is about Rs. 450 lakhs (30 million yen). Hence the gross value of the fisheries, including the whole of Japan except Formosa, the whole of the products (fish, shell fish, seaweed, manure, etc.) and the whole plus-value obtained by manufacture, averages annually above Rs. 1,300 lakhs (850 + 450) or £8,750,000. The above figures should be understood to be approximations from official statistics and nothing more.

4. Dividing the weight and value of the catches by the number of fishing households the average catch per house is 0·68 ton and the value about Rs. 90, but it will be remembered that more than half the fishermen have other small occupations including farming. It must also be remembered that though fish abound, it is considered that the nearer or inshore waters except in Hokkaido and the north, are largely depleted, as shown by the distances to which boats must go

for their larger catches ; hence the moderate catch per house and per boat. It is certain on the other hand that the statistics are only minima ; *e.g.*, considering that the fishermen are taxed it is possible that they understate their catches ; it seems impossible that statistics can already be correctly gathered from so vast a length of coast and so many individuals—notwithstanding the statistical value of associations—and it is certain that there are lacunæ in the tables which, moreover, give very different and much lower figures than the statements of persons who enquire into particular yields, as for instance Dr. Smith's and Prof. Mitsukuri's figures for carp and horiculture round Tokyo.

5. Statistics apart it is clear that the industry is of vast importance ; even 640,000 tons means about 30 lb. per head of a population of 48,000,000 ; in Madras the catch probably does not exceed one-fifth of this yield for a population just one-fifth less, or say $7\frac{1}{2}$ lb. per head. Moreover an immense subsidiary business is carried on in the subsequent manufacturing processes applied to vast quantities of produce and to its packing and transport.

6. The case for the Japanese fisheries is put by Dr. Smith in a too brief paper of 1905 ; he says, "The fisheries of Japan are less valuable than those of several other countries, but they take first rank over those of all other nations (1) in the actual number of people making a livelihood ; (2) in the relative number of persons engaged in and dependent on the industry ; (3) in the quantity of products taken annually from the water ; (4) in the relative importance of fishery products in the domestic economy ; (5) in the ingenuity and skill shown by the people in devising and using fishing appliances and preparing the catch for use ; (6) in the extent to which all kinds of water products are utilized ; (7) in the extent to which the fisheries of foreign countries have been studied and the best methods adapted to home conditions ; (8) in the extent to which aquiculture has been carried ; (9) in the zeal and intelligence displayed by the government in promoting the development of the fisheries and the welfare of the fishing population."

Items (1) to (4) have been sufficiently dealt with above though, as will be seen, statistics do not seem to bear out item (3), since the fishery outturns of Great Britain and of America are considerably larger than that of Japan as recorded ; item (8) may also be open to doubt. With the others I fully concur, and propositions (5) to (9) will be demonstrated in the following notes.

7. *The conditions and characteristics of fishing and fishermen.*—Perhaps the qualities most patently noticeable in Japanese fishermen are their skill, hardihood, and self-reliance, these characteristics being obviously the product of their climate and seas. For Japanese seas

do not present the regular, unbroken seasons with the steady winds and rare storms almost confined to well-known seasons and to well-defined zones of the Madras waters; the winds shift indeed to certain quarters at certain seasons but they are liable at any moment to grave disturbances and tempests, due possibly in part to the mountainous character of the country from which storms seem to swoop down on the home waters, while the typhoons of summer and the storms of winter are notorious. Consequently the seas are not only rough for a considerable part of the year but dangerous, and boats are too often blown out to sea and swamped; the average annual number recorded is about 1,300, and in a storm a few weeks ago 132 boats and 800 men were destroyed in a single locality. The climate, too, for a large part of the year, especially in the north where the herring, cod, etc., fisheries are so prolific, is severe, the bitterest cold weather with abundance of ice and snow prevailing for many months in the great fishing centre of Hokkaido and the northern districts. Consequently the Japanese fishermen have become a hardy, venturesome race who habitually go many miles out to sea in frail pinewood boats mostly of no structural strength, small, wholly undecked, and without shelter, save that of mats, for the crew, and of very defective sailing powers. The work of the Japanese navy in the late war, largely manned as it was by men drawn from this class, is intelligible enough, especially when hardihood is coupled with that facility for grasping new methods which the fishermen are already showing in their ordinary industry.

8. As will be shown later on, the fisher folk are very poor and usually indebted for working funds to capitalists, but their groups of neat wooden cottages are a contrast to the fishing hamlets (kuppams) of the Madras Coasts, while the neighbouring foreshores, which in this Presidency are often filthy with nuisances, may be walked on with perfect safety. Under the law which makes education universal, they are educated like the rest of the community and are thus able to understand and to accept intelligently the new teachings prescribed to them in the Fishery schools, in the universal associations (see *infra*), and by the Experimental Stations.

9. *History*.—Up to the time of the Restoration (1867) the fisheries remained in their primitive condition; population was moderate and increased but slowly; Japan was isolated from the outer world, and beyond a small trade, chiefly with China and Korea in foreign ships, there was little external movement in marine products; by a strange law of the 17th century direct foreign trade and emigration were wholly prevented by a stringent limitation of the size and rig of all Japanese vessels (only one mast was allowed) and by a death penalty for the crime of going abroad. Hence Japanese fisheries could not profit by foreign experience and the stimulus both of foreign trade and of a rapidly increasing home population was also wanting. Up

to the date in question, moreover, the country was split up into about 270 fental estates largely independent of central authority and governed by local chieftains (Daimios); intercommunication was difficult and fisheries were regulated by local usages and taxed according to local necessities or fancies. The resources of the sea were little attended to by the local authorities and though there were rules for the protection of fish, these were, at least partly, dictated by religious ideas regarding the sanctity of animal life. Merchants and capitalists, however, appear to have put capital into the business, owning large nets and financing the fishing population, usually on the sharing principle, and assisting them in bad times; hence on the one hand a certain amount of control of the fishermen by capital, and on the other the advantage that capital was accustomed to the business and ready to undertake developments when the Restoration provided the opportunity. Moreover, owing to disputes between the farmers who owned or claimed rights over the foreshore, and the inshore fishermen, rules and customs had sprung up by which the rights and limitations of local fisheries were defined and certain close times and other protective usages had sprung up, while these very disputes and the necessity for working large fisheries in common, had accustomed the fishermen to associate in groups, a matter of importance in considering the success of the fishery associations established by recent law. Everything however was primitive and confined within moderate sea limits and hereditary methods; Professor Matsubára, present Head of the Imperial Fisheries Training Institute, describes it as the period of chaos, but this can only be taken in the sense that the methods in use and the business in general were unorganized, without central direction, protection, or stimulus.

10. But with the Restoration (1867) came an immediate change; the régime had hardly begun when the proper control and development of the fisheries were seen both by the authorities and by the more intelligent of the people, to be an absolute necessity. The first overt steps were taken by Government who, on behalf of the Sovereign, resumed by edict the control of the whole foreshore and of the inshore waters, but declared that the rights of the fishermen and others should continue to be governed by local usage. This contained the germ of that deliberate, far-sighted, organized promotion of fisheries, by Government and people alike, which seem to me the central lesson of my Japanese fishery studies. For when Government assumed administrative rights over fisheries it equally accepted, as in agriculture and other industries, correlative duties such as the protection and development of the State's public assets in its fisheries, the increase of the food and manure supply for the general population, the promotion of the arts of obtaining, preserving and cultivating its aquatic products, the development of a foreign trade in improved marine products, the welfare of the fisher population economically,

educationally and industrially, the proper ascertainment and delimitation of local rights and privileges, and so forth. In dealing with these duties the State was assisted by the public to no small degree. Indeed, it is difficult to say how the first impulse of improvement was given; whether the people in the persons of its leading men, fishery merchants, and others, first initiated new methods and enterprises, or whether Government gave the primary impulse. It will be seen presently that, as in agriculture and industries, honours are divided; Government and the people have gone hand in hand in progress, each acting and reacting on the other.

11. The points to be considered are as follows:—(1) the gathering of information and suggestions from other countries; (2) the creation by Government of a department to deal with the industry, and by private persons of fisheries societies; (3) the examination and registration of local conditions and facts; (4) the carrying out of research and the formation of practical experimental stations; (5) the establishment of educational institutions; (6) encouragement and protection; (7) the organisation of the fisher folk and of those concerned with the industry into associations of various nature; (8) the utilisation of exhibitions; (9) taxation and expenditure; (10) the position of the fisher classes.

After discussing these points, a brief description of Japanese methods and implements useful to Madras will be given under the heads of boats, nets and gear, the preparation of certain products, the use and preparation of various marine products other than fish such as sea weed, shells, etc., and finally certain methods of aquiculture. Suggestions for Madras will conclude the Note.

THE GATHERING OF INFORMATION.

12. One of the canons of action laid down by Government at the Restoration, 1867, was as follows:—"Knowledge and learning shall be sought after throughout the whole world in order that the status of the Empire may be raised higher and higher." Perhaps this is one of the most noteworthy of visible advances. Prior to 1868, visits to foreign countries were punishable with death in Japan; from 1868 the emissaries of progress went or were sent from Japan throughout the world; before the Restoration foreigners were practically excluded from Japan; after that event experts of all nations were brought in, in order that they might teach the Japanese all that they knew of western knowledge, science, arts, and industries. So far as fisheries were concerned one of the first Japanese efforts was the despatch of delegates with exhibits to various exhibitions such as those of Vienna in 1871 and Philadelphia in 1876, and these shows taught the Japanese something of the advance made by western

nations in fishery matters; it was however the special fisheries exhibitions of Berlin, 1880, and London, 1883, that fully enlightened the nation. In 1880 one of the delegates to Berlin was Professor Matsubára, the present learned and experienced Principal of the Imperial Fisheries Training Institution, and the knowledge he gained was instrumental to progress in a high degree, as will presently be seen. It was at these exhibitions and through the studies which accompanied them, that Japanese delegates became acquainted with modern processes in preserving and canning fish, in artificial fertilisation and hatching, and with classes of boats and gear to which they had hitherto been strangers; this knowledge they brought to Japan and, sometimes with and sometimes without the aid of Government, they put this knowledge into practice. Since that time Japan has regularly taken part both as exhibitor and student in the various exhibitions, ending with the present international Exposition at Milan. The emissaries and students however are always everywhere; students and others were sent to America, and of course elsewhere, for practical training in the various branches of the industry and brought back either complete plans of all necessary buildings and plant or the plant itself; *e.g.*, about 20 years ago the salmon rivers of Hokkaido were being depleted by over-fishing, whereupon a Government official was sent to the United States to learn their methods of salmon hatching with the result that on his report a hatchery was established in 1888 which is now only one of 18 salmon hatcheries in the empire, most of them being private property but receiving grants in-aid; the first canning plant was bought by Government delegates at the exhibition of 1880 and was utilised and copied at home. In the register of graduates from the Imperial Fisheries Institution it is recorded that many of the graduates since 1893 are studying abroad either as private students, or as the agents of associations, or with Government scholarships. In a single number of the Journal of the Japan Fisheries Society, I note that Professor Matsubára, a councillor of the society and Mr. K. Ito, a fishery expert, had just returned from the International Fisheries exhibitions in St. Petersburg, 1902, whither they had been sent by Government, that Mr. O. Kajikawa was just starting on a Government mission to inspect the fisheries in French India (Cochin-China?) and China, and that the Honorary Secretary of the Society had just returned from a visit in a warship to an island 1,000 miles from Tokyo Bay, which it was considered might be a convenient basis for Japanese fisheries on the high seas. At this moment a Government fisheries officer is engaged in a complete investigation of European fisheries, having spent 1906 in the British Isles while 1907 is to be spent in Europe; at Yarmouth I found a Japanese expert who had been working for two years at every branch of the fisheries there, and these are but individual instances that happen to be known to myself,

of the thorough and assiduous interpretation of the canon above mentioned ; the Japanese students, private, despatched by the associations or industrial companies, or by Government, are everywhere seeking knowledge in the most practical ways and reporting to their principals for necessary action at home. Not only so but foreign experts have been brought in to teach trade methods ; in Hokkaido Americans were imported to teach the best method of preserving the fish for which that island is so famous ; at Nagasaki a French expert was employed by a private person to teach him the art of canning sardines in oil, with the result that the local factory is a success at this day. This is one of the ways in which Japan works ; the search after foreign knowledge has been and is being most thoroughly carried out not by Government representatives merely but largely by students and by agents of private associations and capitalists, while Japanese fishermen and capitalists are ready at once to take advantage of the knowledge brought to them either by adopting the methods at home or by going out to places where such knowledge can be utilised. The action of Government, of the University, of the College of Agriculture, and of private persons in the matter of the study of foreign agriculture, may be compared ; see my note on Japanese Agriculture.

CREATION OF A DEPARTMENT AND OF A NATIONAL FISHERIES SOCIETY.

13. One immediate result of these enquiries abroad was the establishment by Government in 1885 of a bureau within the Department of Agriculture and Commerce, to deal with marine products. This bureau underwent several changes of form and scope but in 1897 its duties had so developed that it was separated from Agriculture and erected into a distinct department under the Minister for Agriculture and Commerce. Considering Japanese methods and thoroughness it need hardly be said that the department is thoroughly equipped for all purposes with the best experts and specialists in biology, economic and industrial fisheries, fish culture, and fishery law ; its best description will be found in the narrative of the work done as will be seen *passim* below.

14. But this development was simultaneously attended and even preceded, by private effort as a matter both of public interest and of industrial profit ; the " Fisheries Society of Japan ", a private association of wide and practical scope, was founded in 1881 and has now attained a large membership and great usefulness. In 1880 Professor Matsubára and Mr. Murata attended the Berlin International Fisheries Exhibition as Government delegates and the lessons they

learned regarding Western methods compelled them to recognise the necessity for public co-operative work by all persons interested in the fishing industry, if progress was to be made. The Fisheries Society of Japan was accordingly started by their efforts in 1882 under the presidency of a Prince of the Imperial family, since which time it has done splendid work which will now be detailed; figures, etc., are mostly up to 1900 only. In the first place it is a society which combines science with practice; it is a working and not a talking society; there are lectures, discussions, and conferences but they are by practical men for definite practical objects, and the outcome is practical work by its members and staff; its lectures are on practical subjects intended for public industrial enlightenment. The members are mainly men connected with or interested in the industry such as fishery proprietors, fishermen, manufacturers of marine products, students, scientists and experts, with only a sprinkling of officials. The membership (subscription Rs. 3) in the first year was 471 but steadily rose to 2,144 in 1893, to 4,826 in 1900, and it has now well over 5,000 members. It has the usual officials (honorary), besides experts and specialists who are presumably paid; in 18 years up to 1900 there had been 18 general meetings, 124 regular meetings when lectures were given by experts and discussions held on fishing subjects, the audiences numbering from 140 to 2,500; other lectures were also occasionally given. In 1886 the society began a series of public exhibitions of which there were 10 in various places up to 1900; these were extremely useful in conveying a knowledge of new methods and implements and in the interchange of knowledge between various fishing districts; especially was this the case in the matter of better boats and nets. The Society also opened a museum and library which was destroyed by fire and has not been replaced, an omission much to be regretted. In 1888 the Society started one of its most useful works, viz., a Fishery school for the education of selected young men in modern fishery methods both catching, preserving and culturing, and in the correlated sciences; this was immediately successful; from 1893 it was developed by grants from the Minister of Agriculture, and in 1897 it was finally transformed into the Government Training Institution described in detail later on. During the nine years of its existence as an institution of the Society it turned out 395 graduates nearly all of whom are now directly connected with the industry and are leading spirits in its development.

15. The Society issues a regular monthly journal in Japanese, now close on its 300th number. The character and objects of the Society may be gauged from the title page of an issue taken at random; there are four leading articles (1) on certain islands and stations for high sea fisheries, (2) on the encouragement of sardine canning, (3) on the fishery law, (4) on the utilisation of the sea; there are

“technical jottings” on foreign fisheries, historical notes on the industry, miscellaneous notes as to oyster fisheries, etc., current fishery news, very useful articles on foreign methods such as the manufacture of boneless cod, Experimental Stations in America, etc., commercial notes containing current price lists, supplements containing local fishing regulations, and so forth. Besides this periodical, many occasional publications on fishing matters have been issued.

16. Then the Society sends commissioners to examine the condition of fisheries at various places both within and without the Empire, and during such tours improvements and new methods are explained to local fishermen; the chief Director, Mr. Murata, alone made 18 such tours in five years; while its members and experts are continually being sent on special tours, either by Government or by the Society, such as those mentioned above in paragraph 12. The direct instruction of fishermen by ambulant instructors is also a special feature of the Society's work; the present Principal of the Imperial Fisheries Training Institution, Professor Matsubara, was one of such instructors. Then the Society undertakes investigations confided to it by the Fisheries Department; for instance in 1893 it sent commissioners on a steamer along the Pacific Coast to observe the depth, etc., of the sea, the character, seasons, and condition of migratory fishes, the abundance or otherwise of seaweed, the best method of using new nets, etc. Another set of experiments was in the matter of improving the fishing boats intended for deep sea work, especially in connection with safety and convenience in use in rough seas. Experiments were also made in the preservation of fish by refrigeration and desiccation; these were conducted at the Fisheries school. During the Japan-China war, the Society suggested to Government the use of canned fish as army rations; at the request of the department, the Society established canneries and supplied above 20,000 tins of fish to the commissariat.

17. A most useful conference was summoned by the Society at the instance of Government in 1897; members of the conference—apparently not necessarily members of the Society—were taken from those actually engaged in the various branches of the industry, as well as general experts; they reported upon certain questions submitted to the conference by Government, such as the establishment of salmon hatcheries, the institution of local experimental fishing stations at various centres, the exploration of fishing grounds, statistical enquiries, a law regarding fishing associations, the establishment of harbours erected at State expense or by grants-in-aid, the amendment of the law for the encouragement of high sea fisheries, the creation of a special bank to supply capital to the fishing industries or the widening *ad hoc* of the scope of existing local mortgage banks, the

improvement and cheapening of fish transport by rail, the provision of storm warnings along the coast at State expense, etc.

Besides the above duties, the Society assisted distressed fishermen and widows and orphans of those overtaken by calamity, and in 1898 it was solely entrusted by the Government with the duty not only of preparing the exhibits for the International Fisheries Exhibition in Norway in that year but of sending its officers to that country for the management of the exhibits.

The Society has also done a great deal in the matter of culture, but it is believed that this has been abandoned except in one locality which I inspected (see "pisciculture" below); pisciculture has so developed as an industry that the Society no longer needs to work at it. There are, it is said, six branch societies of which I was not able to gather particulars.

Several other societies interested in the fishing industry and in studying matters of importance in connection therewith are also said to exist, but the one described is the oldest and most important.

18. It will be seen that this Society has done and is doing splendid work both scientific, practical, and educational (in a wide sense), but while it arose out of the delegation by Government of its founders to a foreign exhibition, it is itself purely the outcome of private initiative and public spirit, and though it works hand in glove with the Government in does so as an independent body. The readiness with which the suggestions of its founders were accepted and the rapid and practical development of the society have lessons peculiarly for Madras; it is for this reason that the work of the society has been detailed with some fulness.*

* It is indeed but a platitude—yet one that is often lost sight of by those who think imitation of Japan easy—that the progress of the nation is due to its spirit and genius; a far-sighted and statesmanlike Government have done much, but in many items and methods of progress they were anticipated by the people themselves and have shown their statesmanship by developing and assisting the nascent ideas or methods. For instance, though Government sent delegates to an exhibition it was not only the action of the delegates thereafter as private persons that led to the formation of the Fisheries Society, but the ready response of the public to the call of those delegates; Government, again, noting this and similar instances (see Agricultural note) and observing the power and possibilities of co-operative association in western countries, further developed the idea of association and made the practice universal by law; the people, again, responsive to wise suggestion, and prepared to some extent by long-standing custom, accepted the Government regulations, and, both in agriculture, industry, trade, and fisheries, have formed innumerable and practical associations throughout the country. It is this responsiveness to suggestion, this popular search for new knowledge and new openings, this national eagerness to seize opportunities, this readiness to wander over the world and endure all manner of toil and hardship in the pursuit of practical knowledge and industrial development, this absorption of the spirit and meaning of Western methods, this readiness not merely to adopt but to adapt, assimilate, and even improve them to Japanese needs, that are among the characteristics which, almost in a generation, have taken Japan to her present position and which so strongly differentiate her from the people of the middle and tropical East. History, climate, temperament will not be denied.

THE EXAMINATION AND REGISTRATION OF LOCAL CONDITIONS AND FACTS.

19. This duty was carried out by Government in various ways, *e.g.*, by exhibitions, by commissions formed for the purpose, by conferences, and by ambulant instructors, who not only taught but observed and reported. The first National Fisheries Exhibition was held in 1885 and served to show the primitive and unorganised character of the industry rather than its advance; for instance, owing to poor inter-communication whether materially (as in the matter of roads), educationally, or commercially, practices in one part of a district were quite unknown in another part of the same district, and excellent nets, long lines, etc., used in one area were unknown close by; this has similarly been found on Madras coasts. This exhibition was followed by others both by the Government and the Fisheries Society, and served largely to increase the knowledge of the authorities, and to distribute information; the prizes offered also stimulated the invention and exhibition of improvements especially in boats.

20. The second method was by direct commissions of enquiry; the first, created by Government in 1888 or earlier, travelled over the country and reported in detail in 1891; this enquiry was again followed up, and in 1893 a commission for a more extensive and scientific enquiry into marine products was formed, the special objects of which were (1) to extend the fishing industry, (2) the fabrication of marine products, *e.g.*, dried, salted, and canned fish, pearls, seaweed products, salt, etc., (3) pisciculture. In 1898 this particular committee was abolished but its duties were entrusted to the department which continued the enquiries more completely and systematically including researches in hydrography, plankton, and other matters of general importance. For many years there has been a Marine Biological school solely devoted to the study of marine life, but this belongs to the University and is largely attended.

21. A third method was by means of conferences; this subject is not quite clear; that of 1897 has been mentioned, *s.v.*, "Fisheries Society," but in 1890 a standing committee seems to have been formed, consisting of men of competence and experience in the several fishing industries, and this committee was consulted by Government in matters of importance; this appears to resemble the standing committees of experts so much in evidence in Italy in agricultural, industrial, and trade matters.

22. A fourth and the most important method of enquiry is by experimental stations; these, however, will be treated by themselves being of supreme importance and large scope.

THE CARRYING OUT OF RESEARCH AND THE FORMATION OF EXPERIMENTAL STATIONS.

23. A chief instrument of research and of progress is experiment; the Japanese authorities did not long delay its use, and numerous experimental stations have been started. But enquiry by experiment is only preliminary to instruction, and these stations fulfil this double duty. In fact, instruction seems to have preceded systematized experiment, for a large number of itinerating teachers were employed by the prefects, under the orders of the Minister, to give instruction by lecture and example to the public; in several places there were also established schools intended to be of a practical character.

24. But—probably for the reason that practical knowledge was insufficient for sound and acceptable teaching—it was rightly decided to start experimental stations, and as these increased, the itinerating teachers were reduced and the practical schools mostly became stations, so that there are now 29 stations, 4 schools, and only (1902) twenty-four itinerant teachers. The reason given in a report on the progress of the stations for the substitution of stations for schools, is that in the latter instruction tended to become theoretical only, which seems to be due to the fact that instruction had not been sufficiently preceded by experiment. The experimental stations are extremely practical and are places not so much of scientific as of practical enquiry and experiment as in the use of new nets, the building and trial of new boats and the training of fishermen in their use, the art of preserving fish by canning or otherwise, and so forth. At present in one place a school coexists with the station; in some stations instruction is not given directly; in others short practical courses only are given. But instruction in the wider sense, viz., in training fishermen in new methods, seems to be the work of all.

25. As usual in Japan these experimental stations, schools, etc., are initiated, maintained, and paid for from prefectural (local) funds* receiving only a moderate grant-in-aid from the Imperial Treasury (*cf.* "Agriculture"). The suggestion, possibly amounting to order, apparently emanated from the Minister in charge, and the prefects with their expert advisers and thoroughly aware of the importance of the industry and of its development, have vied with one another in establishing and supporting the stations and in supplying them with the best men and the necessary means. The first experimental station was founded in 1894 at Shinojima in the Aichi District (see below for

* See note on Japanese Agriculture for explanation as to Prefectural (District) administration and funds.

description); this was apparently selected because sardines are abundant there, and the canning of sardines was a primary object of experiment. The second station was in Hiroshima, a district famous for its oysters and oyster culture was therefore a principal object of station experiment. Similarly each station is devoted to experiment in the particular industries or methods of the locality, which is selected on a consideration of its importance, and experiment is directed to the discovery and counteraction of defects and to the instruction by practical teaching of new methods or implements; in other words, the objects were: (1) the conduct of experiments in improvements, (2) the dissemination of such improvements.

26. The following branches of the industry are especially dealt with: (1) *Capture of fish, etc.*; e.g., the use of new or the improving of old nets of various kinds and for various classes of fish, especially the purse-seine for sardines, of the long line, of hand lines for sharks, of trawl nets, of implements for securing algæ, etc.; improvements of boats and gear especially in the matter of safety for deep-sea boats; the preservation and transport of fish in a fresh condition; the preservation and use of bait; the examination of fishing grounds and oceanography in general including plankton (fish food) researches; observation as to breeding and shoaling seasons; meteorology; investigation of the Korean waters, etc.

(2) *Preservation of fish, e.g.*, the pickling (wet salting processes) and smoking various classes of fish (these processes were not much in use originally except the smoking of bonito, fish being chiefly light salted and dried), canning, refrigeration and desiccation, new modes of drying fish of various classes, including shell fish; the manufacture of fish oils, vegetable isinglass, iodine, salt, and fertiliser; the investigation of the trade in these articles, and so forth.

(3) *Culture, e.g.*, salmon hatching and the bionomics of salmon; the hatching of various fish; the culture to maturity of carp, mullet, eel, snapping turtle, pearl oyster, oyster, bêche-de-mer, clams, and other molluscs and seaweed; the culture of carp for distribution to paddy fields (see below): enquiring into the breeding seasons of marine animals; the distribution to fishermen of fry and spat especially of new and approved species and so forth.

(4) *General*, such as the encouragement of fishery associations, education especially practical, the encouragement of thrift and the status of the fisher folk, etc.

It will be seen that the subjects enquired into at these stations are in the highest degree practical, and it will presently be shown that the methods of experiment and instruction are equally practical.

27. Statistics for 1902 show the classes of experiments carried out in that year, as follows;—

Head.	Nature of experiment.	Number of stations engaged.	Fully successful.	Promising.	Remarks.
Capture of fish.	Improved boats ..	6	4	..	(a) Several kinds of nets were tried at various stations; hence the number is larger than the number of stations.
	Improved nets ..	38 (a)	20	..	
	Improved lines ..	21	7	..	
	Preservation and transport of fresh fish.	1	1	..	
Preservation.	Pickling and smoking.	5	..	5	(b) The small number successful is probably due to the totally novel nature of many experiments, as in canning crustaceans and molluscs, for ordinary fish canning has long passed the experimental stage in Japan.
	Canning and bottling.	19	2 (b)	9	
	Drying fish ..	23	1	3	
	Various methods of preparing algae, isinglass, etc.	16	3	2	
	Do.				
Culture ..	Salmon	6	6	..	....
	Carp	10	10	..	....
	Oyster	13	4	..	....
	Pearl oyster ..	4	3	..	....
	Clam	3	2	..	....
	Bêche-de-mer ..	2	2	..	....
	Eel	5	4	..	....
	Mullet	6	1	..	....
	Other shell fish ..	5	4	..	....
Algae	7	3	..	....

28. By "successful" is meant experiments which yielded the results hoped for and which have, in most instances, been promptly followed in the industry; at this day many profitable changes in method or new operations are in full practice such as the adoption of the purse seine, the various canning and preserving processes, the hatching and culture of various fish, etc. For instance, the purse seine is a successful American variant of the ordinary seine, used especially for the catching of menhaden and sardine; for full description see *infra*, s.v., "Fishery plant". This new net was introduced into two districts and was at once copied by other stations who

employed instructors from those districts to teach the use of the new net; the experiments were successful and many fishermen are now using them, *e.g.*, in Hyogo there were only 2 in 1898 and 43 in 1903; in Aichi the net, borrowed from the Fishery department, was introduced in 1896, and being successful, Rs. 600 were advanced next year to five fishermen for making similar nets; by 1903 there were 87 such nets, and now they are almost exclusively used for catching sardine. The net was not however always accepted by the fishermen.

29. Similarly the boat and long line used for catching shark and tunny in some prefectures was successfully introduced by the stations of other districts; many advances were given to the fishermen as soon as the new venture was shown to be locally successful, and good business has actually resulted. In two districts an expert in shark catching was introduced by the station from other districts and under his instruction, improved shark boats are being built by the aid of advances to the fishermen who now successfully use them for shark and tunny fishing even in distant waters.

30. The introduction and wide dissemination of the method of canning fish are largely due to the experimental stations, and for this the note on Aichi station (Shinonjima) may be read; other preservative methods, such as the smoking of salmon, the pickling of herring, are also matters of experiment. At the various exhibitions of modern times, especially that of St. Louis in 1904, these stations have shown a large variety of excellent and low priced exhibits including not only all sorts of canned goods prepared at the stations, such as sardines in oil, bottled anchovies, pickled sardines and mackerel in barrels, eels pickled in jelly, fish in vinegar, and so forth, but models of improved boats and other fishing implements and products.

31. So also the artificial hatching of salmon in the northern districts has been successfully introduced and the cultivation of oysters, carp, etc., has been also developed.

32. The instruction of the fishermen by these stations is variously carried out: it is a general rule that (except at regular schools under the Educational department) only the adult sons of persons actually engaged in the industry shall be taught, and by means of practical work; the course is given at various places in the district; *e.g.*, in Chiba district courses on canning and bonito curing were given in 5 places during fifteen months and 59 students successfully went through the examination: in another, 95 pupils were taught, in 7 localities, various methods of pickling and preserving; in another 117 completed in two places courses lasting 304 days, and so forth; altogether 902 went through these highly practical courses of from a few days to several months in 1902. It is hardly necessary to add that whatever the subject of instruction—catching, the use of new boats or nets, preservation, culture, etc.—the students or apprentices learn *by*

doing; they are taken out in the boats and made to handle and sail them, they make the cans in every detail from the flat tin sheets, handle and treat the fish in every stage, close and process the cans, and so forth; at Shinojima the newest deep-sea boat had gone to Korea with a selected crew of local fishermen under instruction in its handling.

33. The following matters have been laid down by the department for the guidance of experimental work at these stations. First as to *catching*; the inshore waters are becoming exhausted, while the demands for home consumption and for export are daily growing; moreover, it is found that the fish of the autumn and winter catches are more suitable for export than those caught at other times (probably because they are brought to shore in better condition in the winter); hence encouragement is necessary for the fisheries of these seasons, for which purpose special attention must be paid to the invention and provision of good safe boats able to face the stormy seas of those periods, and to the instruction of the fishermen in the use of the nets, and to other (financial?) assistance to them. So also the use of improved nets as found in Europe, etc., is to be encouraged and attention should specially be given to several points; viz. better material for nets and the use of machinery (capstans, windlasses, etc., either manual or power) instead of mere manual handling, the manipulation of nets, the selection of boats suitable to each locality and class of fishing, the employment of trained fishermen (as instructors apparently), a close investigation of the fishing grounds and seasons, and the introduction of long lines where not now in use, or for different classes of fishes. Finally, the proper treatment and transportation of fish from catch to sale; this is considered of great importance, and the use of carriers for the conveyance of fish from the fishing smack to shore and of bait from shore to smack, is suggested (*cf.* my West Coast report).

34. *Secondly, as regards preserving.* Special attention is to be given to the preservation of certain classes of fish, *e.g.*, sardine, mackerel, cod, etc., for export to Europe and America, and of salt herring, shark fins, *bêche-de-mer*, dried cuttle-fish, ear-shell, prawns, etc., for China, and of various classes for home consumption. It will be noticed not only that the Japanese strongly desire to foster the export trade, but that they are fully aware of the classes of fish required in each country. The methods of packing are also to be improved, and the use of ice inculcated for keeping the fish fresh.

35. *Thirdly, as regards culture.* Experiments in certain classes such as salmon hatching, transplantation of shell-fish, algæ, etc., may well be undertaken by public bodies (experimental stations, etc.), while the minor and easier branches, such as the growth of carp, eel, mullet, snapping turtle, nori (an alga) may be left to private persons,

Oyster and nori culture form most important branches of experiment as there are immense areas along the coast suitable for their growth but at present unutilized. It is usual for Government to assign special experiments to certain stations; such as the improvement of boats, the development of the preserving industry as regards particular fish or methods, and so forth, while certain classes of experiment, chiefly culture, are carried out by all stations.

36. The stations are also reminded that there are three aspects of their work; (1) industrial experiment which must be shown to be profitable, (2) the instruction of the public in industrial methods found beneficial, (3) scientific investigation, *e.g.*, into the fauna and flora of the waters and into bionomics in general. Another duty is the distribution of ova, spat, fry, etc., to the public.

37. At a recent council of the Directors of the several stations, Fishery School officers, and other Fishery officials—in all seventy-nine persons—the following matters were discussed and suggestions made to Government:—

(1) Since very little advantage has been taken of the law for encouraging (by bounties) distant deep-sea fishing (36 boats in 1905), it was suggested (*a*) to send round officers of the department to explain in the various fishing centres the advantages of the law; (*b*) to educate leading fishermen (in navigation?) and to enlist young men for special training at the stations in the handling of large boats and deep-sea methods (the law provides for this); (*c*) that new boats should only be built by experts who have built similar boats; (*d*) that the duty of experimenting in deep-sea fishing and the treatment of fishes caught far out at sea should be specially entrusted to particular stations; (*e*) that the training of students should be undertaken after consulting the Department; and (*f*) that when deep-sea fishing has been found successful, prefects should specially investigate the conditions of such fisheries (presumably to ascertain the causes of success).

(2) In investigating with a view to pisciculture, the most careful preliminary enquiries as to methods, locality, suitable products, cost, markets, etc., are to be ascertained.

(3) The encouragement of thrift among the fishermen was set forth as a matter of the first importance; by such means as the promotion of credit associations (interest charged by capitalists is very high in Japan) and indigenous societies (“Tanomoshiko”) for furnishing capital for members for boats, nets, gear, harbours and wharfs, etc., instruction in a proper account system, the introduction of regulations favouring savings deposits, co-operative savings banks, etc.

(4) Improvements in transportation, namely by cheapening ice for fish refrigeration, spreading information as to the proper use of ice

and the profits gained by the better price obtainable for fish thus preserved, the use and price of the best preservative substances (presumably boric acid) with comparative statistics of price for fish so preserved, the best method of packing fresh fish for transportation, the structure of railway fish cars, etc.

(5) Promotion of co-operative factories for curing fish, *e.g.*, by encouraging associations, establishing experimental factories, and utilising them for common service, by procuring and publishing plans and estimates for such factories, by collecting and exhibiting articles properly prepared and packed for export, by ascertaining and making known the kind of product for which such factories will be adapted.

(6) The establishment of a standard for each class of product, *e.g.*, in the case of ear-shell, *bêche-de-mer*, etc., the amount of shrinkage or loss in drying, percentage of water allowable in the dried article; for dried cuttle-fish, a minimum size and degree of dryage, and so forth. In the description, *infra*, of the Chambers of Fishery, it will be seen that one important duty with them is the standardising of products prepared by their members for export beyond the limits of the associations, *e.g.*, dried squid, smoked bonito, etc., and that this standardising is maintained by the employment of inspectors, and by insisting, under penalty, that the products shall be inspected and marked before being exported. So it is elsewhere reported that the important product called "Kanten", (agar-agar or vegetable isinglass prepared from a seaweed, *Laminaria*) showed signs of becoming inferior, so that Government has intervened and requires all Kanten to be inspected and the quality branded before export. The council evidently desires that this practice shall be made exact and stringent. As may be seen, the export trade and its demands are always kept well in view.

(7) The simultaneous conduct of enquiries into particular subjects in several localities at once.

(8) The proper enforcement of the regulation for the due protection of animals and plants, as by close times where necessary, the prohibition of certain modes, instruments of capture, etc.

(9) The better organisation of Fishery Associations and Chambers of Fishery.

38. *Inspections.*—Visits of inspection were paid to several of the experimental stations and the following notes may be of interest. The first was at Shinojima, in Aichi district, situated on an island a few miles from the mainland, in a good locality for fishing especially sardines. It is, of course, a prefectural institution paid for from district funds which merely receive a small Imperial grant-in-aid; it was started in 1894 as the first of all stations, and, by the advice of Professor Mitsukuri, of the University College of Science, while

attending to various items in the several branches of the industry, viz., catching, preserving and cultivating, it was specially charged with improving deep-sea fishing, canning sardines, and, at a branch station, in growing carp both for the market and for distribution to the paddy fields.

39. As regards *deep-sea fishing*; the locality, while abounding in sardines at the proper season, is said to have been largely depleted of other fish, so that it is necessary to go far out to sea for profitable catches, and though the boats even now go many miles, it is at great risk and with many losses of the frail open boats. Hence the building of good boats was a primary object; one of the staff is an expert in boat building having taken a special course beyond the usual ship building course at the Tokyo Fishery Institute, where, like the others of the staff, he was trained. For some years the station has built a new boat each year, and on the experience of the year at sea, has improved that of the next year; the latest is called a 10-tonner, 45 feet long by 10 feet wide and 5 feet deep, fully decked, with cabin aft for the men and net hold; forehold for gear, provisions, etc.; live chests amidships for bait; low bulwarks, wing boards or sponson decks on both sides to assist stability; keel and centre board (Japanese boats are all keelless and flat bottomed), lugger rigged: cost with masts and sails about Rs. 1,200, and with all nets and gear about Rs. 3,300. The station originally brought trained fishermen from other localities to teach the use of the new boats and nets at sea.

This boat of which only a model was on view, had gone to Korea to fish with a selected crew of fishermen under training by the expert who is not only skilled in building but in handling fishing boats; two or three other boats had been hired out to fishermen who had also gone to Korea. The best local boats could not venture on such distant voyages over waters often stormy, as they are at best only partly decked and much smaller, costing about Rs. 400, without nets and gear. The station is now contemplating a motor boat with kerosine engine, which would, it is considered, be invaluable in following up fish, in bringing them rapidly to the shore, and in enabling men to make for refuge in case of storms.

40. As regards fish *preserving*: the station is in the midst of one of the best sardine grounds, where the annual catch is counted by tens of millions of pounds and is capable of unknown extension; owing to want of facilities for sale they are largely turned into manure, and the object was not only to catch more but to render them more available as food; hence a very complete canning plant was established and other new methods, e.g., salting in barrels, have also been successfully tried and the products put on the market. The plant comprises all machines necessary for can making and closing, baths for the preliminary boiling, and cookers for "processing" under pressure at about

240° F. The chief products are sardines in oil, boiled sardines, and sardines salted in barrels; the station was the first to can the fish in oil. The methods will be fully described hereafter; briefly, for sardines in oil the fish are beheaded with scissors, partly split and gutted, washed and placed in strong brine for twenty minutes; placed in wire baskets to drain and then dried in the open air for an hour or two; then suspended for a few minutes in boiling oil contained in pans over furnaces or in steam heated troughs; next they are packed in boxes with a given measure of oil and left to soak all night; in the morning they are examined soldered up and "processed" in the cookers at about 6 lbs. pressure, slightly below 240° F. The tins are put into a hot closet kept at about blood heat and left for several days to test the soundness of the process, since unsound cans will by then be bulged with gas. Boiled sardines are large fat fish; these, treated at first like the others, are not dipped in boiling oil after the brine bath nor are the tins filled with oil, but are closed, boiled, pin-holed and reclosed, and then processed; the fat suffices for them and is found as a cake on the surface when opened. For drying the fish in wet weather, there is a good drier or warm closet kept at about 75° F. through which air, warmed by passing around steam pipes, is driven by a fan; the object is not to desiccate but to dry, though, as will be hereafter shown, similar but more powerful driers are used elsewhere for actual desiccation and may be useful in Madras, since plenty of warm dry air is far better for drying fish for preserving purposes than a torrid roasting sun which toasts the outside to a hard crust and leaves the inside a moist and incubative nidus for prolific bacteria. For other matters of interest seen at this station see "fixed trap nets," "live chests," "boats," etc.

41. The practical benefits arising from this station have been partly shown above in the matter of boat building and the training of fishermen, but a main benefit is from the canning experiments. Canning in oil first shown here, is now common in Japan, and considerable local manufacture is the *direct* result of the example and teaching of the station. On the mainland at the port opposite the station is an excellent private canning factory started on the model of the station factory; this and others are run by a company in Nagoya, the district capital, and can turn out 2,000,000 tins per annum; the business manager of the company is the late principal of the Experimental Station who was originally trained at the Imperial Fisheries Institute, became the canning expert at the station and has now transferred his services to the company. Hence, the building of sea-going boats, the training of fishermen in the handling of them and of the nets which have become available by their use, the consequent ability to go many hundreds of miles (to Korea, etc.) and fish in heavily stocked unexhausted waters for valuable animals such as

whales, fur seals, sharks, etc., as well as for the more ordinary fish, the ability to catch more fish locally and to utilise them as wholesome preserved food for a vast number of people, the development of an industry which gives good employment to many and profits to the nation, are directly traceable to the foundation of this station only a dozen years ago. But the station was founded with knowledge and foresight; the exact objects to be sought were defined, the experimenters were and are enthusiastic and not only enthusiastic but experts, and the men of the locality were, like other Japanese, ready to be taught and ready or, rather, anxious to take advantage of opportunity.

42. The station, moreover, has a branch at Atsuta near Nagoya where pisciculture is carried on; it has a good staff, the Principal being, of course, a graduate from the Imperial Fisheries Institute; it consists of the usual office and other buildings and about 9 acres of land, nearly the whole of which is occupied by 5 large and 17 smaller ponds of somewhat brackish water; the small ponds are for breeding and the large ones for growing for market carp, mullet, eel, and snapping turtle. The methods will be detailed *s.v.* "pisciculture" but the objects and results are as follows: the objects are to popularise by experiment, example, and advice the best methods of breeding, to experiment on and introduce new and more profitable classes or species such as the Chinese eel, foreign varieties of carp, etc.; and to supply young carp for growth in the paddy fields, a peculiar Japanese method of fish culture. The large ponds contain the fish grown for market; these are fed on all sorts of cheap nutriment, and as this is a silk growing locality, the dead pupae from the cocoons are largely used either whole or crushed with other food stuff such as meal.

43. Last year the station sold 100,000 * carp, 25,000 mullet, and thousands of pounds, weight of eels, and distributed, gratis, an immense number of carp fry; these last are spawned in spring in the small ponds, as will be described *s.v.* "pisciculture", and early in June, when about 1" or 2" long, are sent out in pails slung on kavadis and containing several thousand each; if the water be changed they will travel up to 40 miles, sufficient aeration being given by the motion of the carrier. At their destination they are turned into the paddy fields where there is abundant animal and vegetable nutriment in the shape of copepods, larvae, small crustacea, etc.; by harvest time in October, they will be 8" or 9" in length and fit for market; should the field irrigation fail during that period, a pit is dug in the field and the fish collected there. Considerable profit is obtained in this way by the farmer.

* These were the figures given to me in conversation but there seems to be some error, the quantity being hardly credible, or reconcilable with the published official statistics of carp production in Aichi and other districts. See "pisciculture" *infra*.

44. It was stated that several private culture farms have resulted from the example of this branch station so that it has been useful in the way of advice, experiment, example and supply. There is very much of interest for Madras in these piscicultural stations, and one lesson is the way in which small culture farms may be profitably worked in Madras districts by small ponds for which water may as in Bengal, be bought, if necessary from irrigation sources; abundance of cheap fish food may be collected by children from the fields, and if silk culture can be combined, as in Mysore and in British territory above ghauts (Kollegal, etc.), the pupae will form a large fish food addition.

The total cost of this experimental station and branch in the year ending March 1905, was Rs. 27,385.

45. Another station, Isohama, in the Ibaraki district on the Pacific coast, was inspected. This was started only in 1900; special attention is here paid to improving the capture and preservation of fish, and to the culture of carp at a separate branch station. As regards capture: the staff has newly introduced from another district (Chiba) the method of catching bonito in a drift net instead of by line: the net is a thin cotton net of about 2 inch mesh against which the bonito, a swift large fish, strikes and entangles itself (as I have seen porpoises caught by accident in mackerel nets on the Madras West Coast); this method has now been taught to local fishermen by the station staff all of whom are graduates from the Imperial Fishery Institute. A motor-boat is now being built for the station; size, 50' × 13' × 8' with a "Dan" kerosine motor; sloop rigged, fully decked, live wells for bait, ice and fish hold, etc.; capstan and windlass but manual only; motor can be disconnected when sailing; cost Rs. 11,700 complete with 2,000 fathoms of drift net; intended primarily as a drifter, she will also be fitted for and with an otter trawl, as the bottom between 20 and 70 fathoms, but not elsewhere, is suitable for trawling; she will do deep sea work and stay out ten days or more. An ordinary local bonito boat of from 30 to 50 feet in length costs Rs. 1,500 complete, is lightly built and quite open, and takes a crew of 12 to 30 men; these are usually built by small capitalists who hire a crew with whom they work; borrowed money costs 10 or 12 per cent. and is usually worked off by a share of the catches.

46. The station has good buildings including a useful museum, with models of apparatus, such as driers, new forms of nets, etc. The cannery is complete as usual and manufactures, *inter alia*, special products for export, such as white fish in tomato, sardines in oil, fish pudding in tins, that is, boiled white fish mixed with boiled potato, pounded together, placed in cylindrical tins, soldered up, and boiled for an hour in ordinary boilers; then pinholed, reclosed, and processed

at 6 lbs. There are other canned products which do not commend themselves to European tastes ; smoking is also under trial.

47. This station has had a small fishing school attached to it for three years, not under the Educational but under the Fisheries Department ; it is for sons of fishermen and others, with a two years' course. Students must have passed the Upper Primary, be above sixteen years of age and residents of the district ; they are admitted on nomination by a village head to the head of the county (taluk) who makes his recommendations ; all must be boarders and they are maintained at the cost of the school if the pupil needs such assistance, but at a cost not exceeding Rs. 6 each per mensem ; tuition is free. So far (three years) 4 have passed out, who have all gone for fishery work in one form or other ; 10 will pass out this year ; they are taught new methods and ideas in the several branches of the industry. The station has also a special itinerating instructor who gives twenty-day courses, at various localities, to sons of actual fishermen only and in special subjects, such as the manufacture of iodine from seaweed (a profitable Japanese industry), the proper preparation of dried bonito (a universal Japanese food stuff), the preserving of fish in soy, etc. ; apparatus is taken from the station and practical teaching given therewith.

The cost of the station in the year ending March 1905 was Rs. 14,122.

48. *Marine Biological Laboratory*.—There is a Marine Biological Laboratory a few miles from Tokyo, but this is attached to the University and is intended for scientific research of which Professor Mitsukuri is the head. This laboratory is largely attended, and while devoted to pure science the results have, as elsewhere, led to important economic suggestions ; it was on Professor Mitsukuri's advice that the first Experimental Station was founded ; it is he who suggested the method of growing artificial pearls (*q.v.*) and it is believed that his suggestions in the culture of turtle, etc., have been of much value.

ESTABLISHMENT OF FISHERIES SCHOOLS.

49. These are of various grades and classes from the Imperial Fishery Institute frequently mentioned above to the Sessional courses given by itinerant instructors. As already stated, there seem to have been travelling instructors for some time before 1894 and the Fisheries Society also employed instructors, but organised technical education was soon found to be necessary to supply in the first place the necessary fishing experts and instructors, and secondly, to train and teach the fishing classes. The institutions may be divided into the Imperial Fishery Institute at Tokyo, the Fishery schools under the Educational

Department, the Fishery schools attached to the Experimental Stations, and the Sessional schools.*

50. *Imperial Fishery Institute*.—In the remarks on the Japanese Fisheries Society, it is stated that in 1888, that society saw the need for providing a body of well-trained experts and accordingly established a school near Tokyo at the expense of the society; this was immediately successful so that the Museum building had to be given up to the school until a proper building was erected in 1893; from that year the Minister for Agriculture and Fisheries gave a subsidy of Rs. 9,750 per annum towards the improvement of the school which then largely developed; in 1897, Government decided to take over the whole school and reopen it on a very complete basis. Dr. Hugh M. Smith (U.S.A. Fisheries Commissioner) who recently visited Japan writes as follows of this Institution:—

“The Imperial Fisheries school, located in the outskirts of Tokyo, is an institution which the Japanese may be pardoned for regarding with great pride, for in no other country does there exist a similar establishment which can compare with this in comprehensiveness of curriculum, completeness of equipment, and thoroughness of instruction. The last week of my sojourn in Japan, I was invited to speak before the faculty and students of this school on the fishery work of the United States Government. After I had been shown about the place and seen something of the methods and equipment I felt exceedingly doubtful of my ability to impart any information. The institution aims to equip young men for careers of usefulness in connection with the fisheries. The graduates obtain good position in the Government service and in the fishing, fishcuring, and fish-cultural establishments. There are three departments of study, each with a three-years’ course, with provision for post-graduate work. There is a full corps of able professors, instructors, and assistants, some of whom have taken degrees abroad.”

* At the moment (December 1906) of correcting this note, I find in an American trade journal that next year (1907) a Fishery branch will be attached to the Agricultural College in the Imperial University of Tokyo, and that Rs. 1,50,000 have already been appropriated to meet its expenses. This was not so much as mentioned last spring and I conclude that it has been found necessary to give a thorough scientific knowledge of aquatic fauna and flora and of the sciences connected with the fishing industry in all its branches, and to train men, probably those who have passed out from the Imperial Fisheries Institute, for the highest posts as advisers of Government and heads of the various fishery institutions. It may be mentioned, that in Japan the University connects itself *directly* with the main practical industries of the country, that while “*literae humaniores*” are prominent as a subject, yet science, both pure and applied, is given equal rank, while students of Agriculture as the greatest industry in the country (or rather, to quote a Japanese phrase, its root or source of life) are counted as worthy of the hall-mark of the university as those who have studied language and literature. It now appears that Fisheries, as the second industry of the country are to be accorded equal rank; *si sic in India!*

51. A somewhat full description of the Institution and work will now be given, based partly upon two visits of inspection, partly on official papers, chiefly a descriptive pamphlet. By an Imperial Edict of 1897 "the school course was extended to three years, and in the third year each student was to specialize in one of three courses, viz., fishing, fisheries technology, and pisciculture. A post-graduate course was also founded for those who, having graduated in the regular course wished to select and study one or more subjects in their special lines. At the beginning, students of this course were permitted to stay only one year at the longest in the institute for further study; but this term was afterwards extended to three years. In June of the same year the department of Agriculture and Commerce issued the Regulations relating to the course of Pelagic fishing, and the institute began the training of the students who had taken up that course of study. In June 1900, an Experimental Station for the course of Fisheries Technology was founded at Odawara in Kanagawa Prefecture.

In September 1899, a fishing schooner of about 140 tons was built for the purpose of training the students and was named the *Kaiyo Maru*. Since that time the students in the department of fishing have been sent on board this vessel for practice.

In the matter of the training of the teachers for the fisheries schools or technical schools, the institute has been doing a good deal of work. In 1896, fifteen graduates of various normal schools were sent by the department of Education to this institute to be specially trained as teachers.

The institute has also been busy with the training of men who desire to go through a shorter course of study relating to such industries as canning and curing fish, the manufacture of fish oil and iodine, net making, etc.

Besides, in compliance with the request of the department of Agriculture and Commerce, the institute is engaged in giving a short course of lectures to the members of the Local fisheries experimental stations and fisheries schools on special subjects in all branches of fisheries."

The President is Professor S. Matsubara, a well-known expert mentioned *supra, passim*, who has been delegated by Government on various important occasions and who, with Mr. Murata, was instrumental after the Berlin Fisheries exhibition of 1880, in founding the Japanese fisheries society; he is assisted by 5 professors and 4 lecturers, besides a subordinate staff in the several departments.

52. The regular work is divided into three courses, fishing, fisheries technology, and pisciculture; each course lasts three years and no student can take up more than one at a time, or change from course to course; each course is again sub-divided into lecturing and

experimental or practical. Besides the regular courses, there are special ones, viz., a post-graduate course which may be taken by a graduate of a regular course on a subject studied in that course; a pelagic or deep-sea course; and a special industrial course. Extra laboratory work and practical training outside the regular lessons are given when necessary or possible, and the summer vacation of two months is, in the third year, wholly devoted to such work. The academic year is of 290 days. Candidates for the regular courses must be graduates from a middle school or of equal educational attainments, must be above 17, and must pass an entrance examination held in January every year in Tokyo and the districts simultaneously.

53. The three regular courses have the following objects: "fishing" is to teach all the best methods of capturing fish and other marine products, and of managing boats, nets, lines, and gear necessary; the technological or "preservation" course is to teach the art of preserving fish as food, and of manufacturing or treating marine products of various kinds such as oils, manures, salt, icdine, vegetable isinglass, fish skins, etc.; the "culture" course is to teach the art of the artificial hatching and rearing of various aquatic products.

54. The subjects taught in the department of *fishing* are, methods of fishing, navigation, seamanship, shipbuilding, meteorology, oceanography, applied mechanics, applied zoology, applied botany, mathematics, law, economics and book-keeping, English, elementary fisheries technology with laboratory work and practice; 27 hours a week are given to lectures, and the rest to practice. In the course of *fisheries technology*, the subjects are foods (marine products), industrial materials (marine products), bacteriology, applied mechanics, industrial chemistry, chemistry, chemical analysis, applied zoology, applied botany, law, economics and book-keeping, English; in the first year 25 hours and in the second 18 hours per week are given to lectures, and the remainder to laboratory and workshop work and practice. In the course of *pisciculture* the subjects are fresh water culture, salt water culture, protection of fish, etc., embryology, bacteriology, oceanography, chemistry, applied zoology, applied botany, law, economics and book-keeping, drawing, English; 24 and 22 hours a week are given to lectures and the remainder to practical work.

55. The investigation or post-graduate course is provided for those who have graduated from the regular course in any of the three departments and who wish to devote another three years at the most to some subjects in their special lines. Those who are admitted to the course are placed under a professor specially appointed by the Institute, and when they have completed their study they have to produce an essay pertaining to the particular subject they have been studying. On passing this test they receive diplomas.

A scholarship may be granted to any one who shows superior capacity or attainments, and it is probably from such men that are chosen the students who are sent abroad for further studies in foreign countries.

56. The pelagic or deep-sea course is intended to train men for managing fishing smacks in distant waters, but no one can take up this course unless he is a graduate from the regular "fishing" course; these students may receive monthly stipends of Rs. 22-8-0. The training is for three years and is wholly practical, being given on board the Institute's training ship or in other fishing boats in distant waters such as the China and Korean seas; by the law for the encouragement of deep-sea fisheries boats which receive bounties are bound to receive students on board when so required by Government; students may also be sent abroad for further training or sent on board foreign fishing vessels.

57. The special industrial course is for men who or whose families are engaged in one other branch of fishery work and who have, therefore, practical knowledge of the same; these may undergo a 3 or 4 months' course in the winter in their special subjects; such courses hitherto have been in net fishing, preparation of dried bonito, iodine, oils and wax, and canning; other courses will be gradually available.

58. There is an Experimental Department where special experiments are made in the various branches, and the results, if conclusive, are made known to the public in bulletins and used in the school teaching.

59. The premises cover 8.6 acres, of which the actual buildings occupy 2 acres and the dock 1.6 acres. The buildings consist of 91 rooms, workshops, etc., many of large size and full of machinery; there are 7 General Office rooms, 25 living and miscellaneous rooms, the official residence, and 59 lecture rooms, laboratories, workshops, etc., as per following list:—

- Standard Instrument room.
- Lecture room (Physics).
- Library.
- English, Law, Economics.
- Mathematics and Book-keeping.
- Lecture room (Chemistry).
- Dark room.
- Specimen room.
- Drawing.
- Pisciculture.
- Fisheries Technology.
- Hall.
- Fishing.

Meteorology and Oceanography
 Ship-building and Mechanics.
 Navigation.
 Nautical Instrument room.
 Zoology and Botany.
 Pisciculture.
 Laboratory (Zoology).
 " (Zoology and Botany).
 " (Botany).
 " (Bacteriology).
 " I (Chemical Analysis).
 " II (" ").
 " III (" ").
 Standard solution.
 Balance room.
 Laboratory I (Technological Chemistry).
 " II (" ").
 Nitrogen distillation.
 Laboratory III (Technological Chemistry).
 Laboratory (Applied Chemistry).
 Designing room.
 Rigging.
 Hook-making room.
 Net-making room.
 Testing room.
 Curing " } nets.
 Tanning " }
 Can-making machines (I).
 " " (II).
 Can-soldering room.
 Canning room.
 Engine " ,
 Boiler " ,
 Fish-oil refinery.
 Salt and Iodine manufactory.
 Secondary batteries.
 Workshop.
 Drying room.
 Place for dressing fish.
 Cold storage.
 Boat-yard.
 Dock.
 Library.
 Gymnasium.
 Play ground.

Special arrangements are made for practical training which cannot be given within the Institute.

“ For the use of the students belonging to the Fishing Department, the sailing vessel, the Kaiyo Maru, was built; the students are practically trained on board the vessel in the various works of their department. This schooner is of 140 tons gross tonnage, and 132 tons net tonnage. She measures 93 feet 6 inches in length, 25 feet 6 inches in breadth, 9 feet 5 inches in depth, and her speed is about $12\frac{1}{2}$ knots; she is so built as to afford facilities for various kinds of fishing, and also to be sea-worthy for an ocean voyage.”

60. To the Experimental Station in the town of Odawara, Kanagawa Prefecture (see inspection note below), students in the Department of Fisheries Technology are sent to get practice in their special subjects of study.

61. Several hatching and experimental stations in and out of the city are connected with the Department of Pisciculture. A station at Fukagawa, Tokyo is devoted to the culture of carp, eel, etc.; while that of Chuzenji near Nikko is for the hatching and breeding of trout. The students are sometimes sent to these places where they can get practical knowledge of pisciculture. For Marine Pisciculture there is a station in Yawata, Chiba Prefecture, where experiments are made on oysters and other shell-fish. Investigation is made in the neighbouring seas with regard to flat-fish, spiny lobsters and algæ. Three other stations are also mentioned as available for practice, and students are also sent to any place where special knowledge and practice are to be gained.

62. The students in the regular courses are about 150 in number, 50 being admitted, if suitable, each year; those in the other courses are obviously not a fixed number. Last year there were no less than 385 applicants for 50 vacancies but only 45 were selected as suitable. From 1897 to the date of the most recent report available, 210 men had graduated, and it is noteworthy that nearly all, if not all, had gone to fishery work in one form or other; 72 had passed in the fishing course, 104 in that of technology, and 34 in pisciculture; or again, 19 had gone to private fishing industry, 24 to fishery companies principally canning, 18 to Government appointments (probably to the Department), 41 to Fishery Experimental stations, 10 as experts to districts, 11 to Fishery schools, and so on; 4 had taken a post-graduate course, while not less than 16 had gone abroad for study or on foreign boats, 6 of whom had obtained Government scholarships for the purpose; a considerable number, of course, had gone as soldiers. Of the 438 graduates prior to 1897, 94 went into private industry, 27 into companies, 14 into Fishermen's associations, 85 to Government, 22 to Fishery schools, 49 to Fishery Experimental stations, 20 went abroad, and so on. It is clear that there is a

great demand both for education in fishery matters and for educated men for the various fishery services both public and private. One ex-student and capitalist, whom I met, had put his training to great advantage for, already a dealer and broker in fishery products, etc., he, with others, has just established a canning company with a capital of about 50 lakhs of rupees, intending to absorb a number of the small companies that have lost their business at the cessation of the war and are too small and poor to develop and export trade by themselves, and to open an export trade with first-class goods only, since it was found that American and other orders had followed the Japanese exhibits at the St. Louis Exposition of 1904. The instance is a good one not only of the practical usefulness of the training but of the promptitude with which the Japanese seize a likely opening.

63. The following details from my notes of inspection may be useful and interesting.

64. The Museum is contained in two rooms and has many useful exhibits, such as nets of new or old pattern, models of fish traps, purse nets, live chests of wood or bamboo, boats, etc. The library is not extensive but is up to date as regards reports especially those of the United States. The laboratories (see list of rooms *supra*) are completely equipped for all necessary purposes. The technological workshops attracted my special attention as the first seen in Japan and as singularly complete for a teaching Institute; the shops form a complete factory fitted with all plant necessary for a considerable business both in canning, net and rigging making, oil expressing, etc. In the canning shops young men were working with machines (generally German, or copies from the German) for every process in can-making; in a second shop the students were at work soldering the variously-shaped tins under the teaching of expert mechanics; there was a large (Vancouver) automatic soldering machine but it was not in use. By one process cans were hermetically sealed with rubber instead of solder, the flanged edges being turned over so as to form a completely air-tight joint; this is said to stand processing perfectly well. All machines not for manual or foot-power, were driven by electricity generated on the establishment. Another room contains the steam baths, etc., viz., steam jacketed kettles, wooden baths heated by free steam or coils at pleasure, and processing chests or cookers used at from 225° to 240°F.; also a vacuum pan for substances requiring evaporation at low temperature.

65. There is a complete set of chambers for drying fish, fish-glue, etc.; air is driven by a fan at 750 revolutions, absorbing 1½ H.P., amongst steam pipes and then to a series of 10 wooden hot closets about 6 feet high, 3 or 4 feet wide, and 4 or 5 feet deep which can be used in series or cut out by a simple series of dampers; the trays of material are arranged one above the other on trolleys or cages running

on light rails so that they can be loaded outside and drawn quickly in or out of the closets.

66. The refrigerating plant is very complete ; a 20-H.P. engine drives a Linde ammonia machine in which brine, cooled in the usual way, passes through pipes first through a room kept merely cool, and thence into the cold storage rooms the walls of which are covered by a ramification of pipes holding hundreds of gallons of brine ; there are 4 cold rooms each of several thousand cubic feet. This brine system has the great advantage that in case of a breakdown the great volume of cold brine in the pipes will keep the rooms cold for some hours.

67. The large dock opens on to the river estuary by a lock gate : the schooner was away on a fishing cruise but there were several other boats in which the students are instructed. Practical rigging, sail and net making are taught, and the students were at work on all these branches ; barrel-making seems to be omitted, possibly because it has attained such perfection in Japan or because barrelled fish are not yet much in vogue ; in India it would be a necessary addition.

68. There are two Chinese students at work and it was said in reply to questions, that there would be no difficulty about admitting Indian students if of proper educational attainments ; nationality is not regarded ; possibly this is partly due to the fact noted above, that enough Japanese of proper acquirements are not always available. If students of the proper stuff were selected in Madras and sent to Japan they would be ready for employment three or four years hence, provided that the Japanese authorities would be willing to receive them.*

69. The heavy annual cost of the Institute is defrayed entirely from Imperial funds.

70. The Odawara practical cannery is many miles distant at an excellent fishing locality, but is only opened on the 10th July which is the beginning of the summer vacation so that no students were at work when I visited it. The factory deals with bonito, tunny, shark, mackerel, and sardine ; bonito in its dried form is an absolutely universal food ; pounded shark served in broth, etc., is consumed in vast

* Whether it is advisable to send the students is a different matter ; obviously in a school of this sort and with students of very moderate educational acquirements, the whole tuition will be in Japanese, and, in fact, very little English is known there, Professor Matsubara's European language being German. On the other hand book tuition has a subordinate place, and a student after at least six months' steady work in Japan at nothing but Japanese, might take a place in the school and would soon follow the work especially as so much of it is practical. But before men are sent, the Japanese authorities should be communicated with in view to know whether they will be received ; the young men appropriate to such a training and such a business would also have to be selected with much care.

quantities, and sardines are now canned both for home use and export. The factory—nearly all workshop—is close to the beach and contains 15 rooms and sheds, all of wood as usual in Japan; the first shed, open-sided, with a stream of running water, is for cutting up and dressing the fish; the next has 6 steam jacketed kettles, ordinary open boilers with free steam or steam coil, an oven for baking certain classes of fish at certain stages, cooker, etc. There is a small steam engine with boiler which supplies the steam for the various apparatus, a mill for preparing shark pulp, hand presses for baling dried fish for export to Manchuria during the war, screw press, etc.; also a good desiccator which will be described with others in my final report, and which will in four or five hours dry fresh fish sufficiently for trade purposes; a smoking arrangement only used for the dried bonito wedges, consisting of trays with open-work bottoms of wire netting or bamboo, piled vertically over a furnace, a simple but not a good arrangement, as the trays nearest to the fire are smoked before the top ones, and the whole have to be moved when the lower ones are ready. These same fish trays are used for carrying and supporting the fish on the ‘ flakes ’ (drying tables or low scaffolds like parallel bars) during dryage in the open air, so that the currents of air play freely on both sides of the fish and dry it regularly and equally: this or a similar method is that always used in America, Great Britain, etc., for drying fish and is that suggested in my West Coast Report as a substitute for the unscientific and harmful method of drying fish on the surface of the ground; the process is described below as also that of preparing shark flesh paste and other fish edibles.

71. The canning rooms contain the usual plant, mostly American, for making and closing tins from 2 lbs. downwards; inspection in other countries and exhibits at Milan, etc., show that larger tins are greatly in demand. Gas fitted soldering irons of the most modern type such as I have seen in use at Yarmouth, were being introduced.

Fruit desiccation and canning are taught as a subsidiary business in this factory.

72. The school seems remarkably complete, and young men, already part trained at the Central Institute eventually become thoroughly practical and skilled men after a full course in this factory where everything is done by the students only. The practical and successful nature of the school factory is shown by the fact that a similar one, copied from this but with larger plant, was opened next door and supplied fish for the troops during the war; probably it is one of those which will be taken over by the Tokyo Company mentioned above.

73. *New Fishery Institute.*—At Sapporo in Hokkaido which is a fishing locality of vast potentialities, a new and very large and complete Fishery Institute is now being opened by Government; the

current allotment for buildings, plant, etc., is Rs. 2 lakhs ; men will be thoroughly trained here theoretically as well as practically, and some will then be regularly sent to Europe for further study of practice and institutions. Such men will form the experts of the future.

FISHERY SCHOOLS UNDER THE EDUCATIONAL DEPARTMENT.

74. Of these there are eight or nine regular schools all taught by men trained at the Fishery Institute ; three (or four) were established by the Prefecture (district), three by counties (taluks), one by a town, and one by a village ; there are no schools directly established or paid for by Government from Imperial Establishment funds, but grants-in-aid are given to the above schools. The fishery instructors in these schools have all been trained at the Imperial Institute.

75. The schools are regulated by an edict of August 1899 which provides that they shall be paid for from district funds allotted to the improvement of industries ; that there shall only be one in each district but with any number of branch schools ; that the three branches of fishing, preserving, and culture shall be taught, with accessory subjects such as zoology, botany, chemistry, physics, mathematics, meteorology, drawing, physical geography, etc. ; that the Prefect may order the school experts to itinerate in order to give lectures or courses or to make enquiries ; that the course shall be at least two years ; that the permission of the Minister (Agriculture and Commerce) shall be obtained before opening or closing the school, and that annual reports shall be sent in.

This brief edict was supplemented by orders of procedure issued by the Minister, according to which the ordinary course must be of three years but may be shortened to two or extended to five when conditions require it. Lecture hours shall be 27 per week, with practical work at the discretion of the principal ; subjects shall be those mentioned above with the addition of morals (universal in Japanese schools), Japanese, law and economics, and gymnastics ; some of these may be omitted except morals and the subjects relating direct to the industry. History, foreign languages, book-keeping, singing, etc., may be added.

76. In the regular fishing course the curriculum for *fishing* embraces the outlines of fishing, catching, marine zoology and botany, navigation, boat building, meteorology, oceanography, ship hygiene, emergency methods, etc., for *preserving*, the outlines of fishing, preserving, marine zoology and botany, bacteriology (outlines), chemical analysis, outlines of mechanics, etc., for *culture*, outlines of fishing, cultivation, marine zoology and botany, outlines of embryology, etc. Apparently a school does not necessarily or ordinarily teach all

branches, but only one or two. Entrants must be above 14 years of age and have finished the upper primary or an equal course: a preparatory general course for boys of 12 and upwards may be attached to a fishing school but shall not exceed two years, with a maximum of 30 hours per week in morals, Japanese, arithmetic, geography, history, science, drawing and gymnastics, with foreign languages and singing optionally.

A special course for single important subjects may be opened, and students may also be admitted to study one or more subjects only; an advanced course not exceeding two years may also be started for students who have passed the regular course.

77. A deep sea course not exceeding three years may also be opened; in this, navigation, ship handling, catching, the outlines of ship building, meteorology, oceanography, etc., or some of these subjects, may be taught: for this course only students who have passed the three years' fishing course may enter. Other articles deal with the internal rules of the school, the number of teachers, the provision of proper accommodation, and special stress is laid on the necessity for all proper apparatus and the machines for practical work.

78. Inspection notes of one school may be useful. The Otsu school on the Pacific Coast is a primary institution maintained by the 'town' which is a large fishing village, where, in addition to fish catching, fish is dried in the usual Japanese fashion (the odours resemble those of the Madras West Coast) and iodine is made; salt is largely manufactured in villages near by; hence there will be scope for the school graduates who are already in demand. It was established four years ago, has a five years' course of which the first two are preparatory as the boys enter at 12 years' old from the primary school; 24 graduates have passed, of whom 10 went through the regular course and 14 the special course only, and 130 boys are now studying. There is also a special course for girls, of whom there are 14 (it will be remembered that Japanese girls attend the primary schools compulsorily like the boys), who, besides a general teaching in fishing matters, are specially trained in canning which in Japan is largely carried out by females. Of the 24 graduates 7 have gone straight into a cannery in a distant (Kyoto) district. Of the present students 15 are sons of actual fishermen, some are sons of fish traders, some of agriculturists; all hope to get into the fishery business in one branch or the other. There are eight teachers, of whom three are graduates of the Imperial Fishery Institute; the principal, an enthusiastic scientist, is not so trained, but is a normal school man with special training.

79. All three courses are taught. For *catching*, the school has a boat of ordinary type, and skilled fishermen are engaged to teach the boys at sea; an improved boat has been sanctioned but the late 'affair' (war) has prevented the allotment of funds which is

regrettable as the local open boats, though taken as far out as 30 miles and more, are easily upset and dangerous, and an improved sailing boat would be a most useful object lesson; the principal even ventures to hope for an auxiliary motor-boat in the near future. New classes of nets are not taught as the locality is advanced in that respect and the bottom is not suitable for trawling.

80. As regards *preservation*, there is a canning factory attached to the school where all are trained; the pickling of fish in salt or brine, a process not at all usual in Japan where fish are dried rather than pickled, is also taught, as well as the manufacture of iodine. Being of a small type there is no steam engine or steam boiler and consequently no steam cooker; all canning is done by ordinary boiling at 212° F. All apparatus, on a small scale, is provided for making and closing cans.

81. The local fishermen only go far out to sea to catch bonito which they boil—the first process in bonito preservation—on board. Salt is not used to keep fish on board from tainting, but natural ice is sometimes availed of. The chief local trade is in fresh fish sent on by train to Tokyo (some hours distant) and in bonito.

82. *Pisciculture* is at present only taught from books as there are no ponds; next year this defect will be remedied. There is a very good little museum which the principal is eager in improving.

83. The cost of the school is paid partly by the town and partly from Prefectural funds.

84. *Supplementary Fishing Schools under the Educational Department.*—To a large number of primary and some other schools have, of late years, been attached continuation or supplementary schools of an industrial character, as described in the Report on Agriculture. About 36 of these are fishery schools, and up to 1903, 161 youths graduated from them. The Regulation of 1902 applicable to supplementary schools in general lays down that the duration of the course, subjects, hours of teaching, shall be settled according to need, but shall be suited to the class of students and the nature of the industry; morals, Japanese, arithmetic, and subjects pertaining to the industry shall be taught; the second and third subjects may be omitted for others. Students should be above ten years of age and have passed at least four years at a primary school. The precise subjects for a supplementary fishing school are not laid down in the Regulation, but that they are full and suitable may be judged by the curriculum in the agricultural schools of this class (see report).

85. *Fishing Schools attached to Experimental Stations or independent.*—These are under 'Agriculture' and not under 'Education.' One of these schools and its work are described above, paragraph 47, *s.v.*, Isohama Experimental Station. The following details are for a school independent of a station, which was established in 1898 to teach *elementary* science relating to fisheries with practical work; the regular

course is of two years with a special practical course of from one to three months: no fees are charged nor are students aided; all students must be boarders except for good reason. The subjects of the regular course are, in the first year, general fishing, marine zoology, botany, chemistry and physics, and in the second term of the same year catching, preserving, culture, applied zoology and botany, physical geography and meteorology, applied physics and chemistry, and practical work; the second year is devoted solely to practical work in catching, preserving and culture. No more than 30 students are taken and must be over 16 years of age and have passed six years at a primary school and be healthy. The special practical course is only for those actually engaged in fishery work or their sons; the subjects in the 'catching' course are (1) the preparation of hooks and lines and methods of fishing and the mode of preserving bait, (2) the preparation (making, barking, etc.), and handling of nets, and (3) the making and use of other fishing implements; in the 'preservation' course, the methods, recipes for seasoning, manufacture of oil and wax, and the making of vegetable isinglass (from seaweed): in the 'manure' course the constituents and preparation of the several classes of fish fertiliser; in the 'culture' course fresh water culture including salmon hatching, the hatching and growth of carp, gold-fish, eel, mullet, and snapping turtle; and in marine culture the growing of shells and algæ. No fees are paid and the students must be over 18 years of age; the places of instruction are settled from time to time.

86. The staff consists in all of fourteen persons, including a principal, an expert, and two assistant experts, etc. Three-fourths of the 23 graduates are now actually engaged in fisheries or as experts under Government or Companies, and all, but two of the 11 graduates of the special course, are actual fishermen: out of 18 graduates in the practical course, 13 are engaged in actual fishing work. The information given me was only up to 1901.

87. In a similar school the practical course embraces long line fishing for sharks, yellow-tail (*Seriola quinqueradiata*), hand line fishing for squid, yellow-tail, etc., and the culture of carp. Students must be primary school graduates, above 18 years of age and engaged in actual fishery; they pay no fee and get Rs. 3 per month from the school in aid of their expenses.

88. *Sessional Schools*.—These are the courses held by itinerant teachers usually attached to experimental stations or to schools, chiefly the former. They have been mentioned above, *s.v.*, "Experimental Stations," paragraph 32. The following note relates to one of these sets of courses in the Chiba district where they were opened in five places to teach methods which had been proved useful by actual experiment; one was at the experimental station and four others at selected

fishing localities each for 90 days ; at the station the methods of canning were taught, and the best method of preparing dried bonito (Katsubushi) in the other places, from 10 to 20 young men being taught at each place. At the station course lectures were given for two or three hours a day when actual canning was not going on ; during practical work the students were formed into small groups of two or three and their work regularly reported on ; subjects were, the proper selection of all materials, the preparation of the product, the making of tins and handling of machines, etc. The students were between 18 and 36 years of age, nine of whom were engaged in fishery work ; all proved eager at study hoping to improve their prospects and successfully completed the course ; five of them at once started business on the new methods.

89. At only one of the other four localities where the preparation of bonito flesh by improved methods was taught, were regular pupils (18) received ; at the others the preparation was simply carried on by the experts and the public were invited to inspect the processes which those engaged in the business readily did and asked innumerable questions ; at first, it is said, they objected to and ridiculed the new processes considering the old fashioned ones good enough, but speedily recognised the economy in labour and material of the new methods and are now adopting them, the most convincing argument being that 114 barrels of bonito prepared by the experts fetched from Rs. $4\frac{1}{2}$ to Rs. 12 more per barrel than the ordinary stuff.

ENCOURAGEMENT AND PROTECTION.

90. From the time of the restoration, 1867, the fisheries have been the care of Government, the improvement and extension of the catches, the development of preservation and consequent trade both home and foreign, and the welfare of the fishermen being the object of constant action both legislative and executive. The greatest stimuli have been described above, viz., those of investigation, experiment and education, but various additional methods have been adopted such as bounties to improve ship-building and deep-sea work, grants-in-aid to Prefectural funds, encouragement and subsidies to fishery and the fishery trade associations, rebates of the salt excise duty, rebate of the import duty on oil on exports of canned goods, the establishment of close times and prohibition of injurious methods and implements, protective measures for the safety of fishermen including warnings against the frequent storms, the encouragement of provident and thrift institutions.

91. *Bounties for sea-going fishing vessels.*—As already mentioned there was up to the restoration an edict prohibiting the building of vessels above a certain size, or with more than one mast, or of any rig but Japanese, and foreign travel was also prohibited. After the restoration the necessity for developing the fishing industry became

apparent, and as the nearer waters seemed to be less prolific than formerly and as valuable sea-animals were to be obtained in distant waters, the Government decided to encourage the building of sea-going boats for fishing in the further waters of China, Korea, Siberia, Russia, and even America. The law of 1st April 1905 repealing a law of 1897 provides as follows for the encouragement of Pelagic fishing :—

(1) A sum not exceeding Rs. 2,25,000 annually may be spent from Imperial funds for this purpose: this shall include bounties, costs of supervision, stipends of students of such fisheries, etc. ;

(2) only Japanese subjects, whether individuals or corporations, are entitled to benefit by the law ;

(3) the conditions of assistance are that the persons shall be actually engaged in fishery or in the transport of marine products ; bounties shall vary according to place, season, class of fishing, character and age of the boat, and shall not exceed per annum Rs. 33 per ton for existing steamers or Rs. 27 per ton for sailers not older than five years ; four-fifths of the crew must be Japanese ;

(4) the crew of a subsidised boat may also receive bounties not exceeding Rs. 108 per annum for a head fisherman, Rs. 54 for an ordinary fisherman, and Rs. 18 for an apprentice ;

(5) steamers or motor-boats specially built or fitted with engines according to Government plans, may receive up to Rs. 60 per ton if of iron or steel or composite, and Rs. 45 if of wood only ; *plus* Rs. 15 per I.H.P. of a steam engine and Rs. 30 of a petroleum (kerosine)* motor ;

(6) rules shall be framed for carrying out the above provisions ;

(7) no bounty shall be given if the boat is not actually worked for three-fourths of a fishing season save in the case of *force majeure* : the same in the case of the crew ;

(8) no subsidised boat may sell, lend, or pledge any such boat to a foreigner within five years from date of its being first entitled to the bounty, unless he either returns the bounty to Government or unless the boat has become unseaworthy (!) or unless he has received express permission from the Minister ;

(9) a subsidised boat must fish for three-fourths of every fishing season for five years from first becoming entitled to the bounty ;

* Japanese opinion of the future of the kerosine motor in the fishing industry, is indicated by this double bounty for such motors as compared with steam. On the U.S.A. eastern coast, both at Boston, Gloucester and elsewhere the petroleum motor is greatly in evidence in fishing boats, launches, and yachts, from the little 1½ H.P. motor in a dory with a one man crew, to the sea-going yacht or to fishing boats with 125 I.H.P. auxiliary gasoline motors which I find mentioned in Trade Journals ; so also, and perhaps to a still more marked extent, in Scandinavian waters where an auxiliary kerosine motor is fitted to many hundreds of boats. The subject will be more fully examined this summer at the Bergen exhibition, etc.

(10) the Minister may demand that the owner of a subsidised boat shall carry out any investigation in deep-sea (pelagic) fishing and shall admit students of such fisheries on board for voyages;

(11) boats below 20 tons gross may, under special circumstances, obtain the benefit of this law.

92. By rules under the law the fishing industries subsidised are confined to whale, sea otter, fur-seal and bonito fishing, and to fishing with trawls, drift nets, long lines, and hand lines; the size of the boats is also limited to certain minima and maxima, *e.g.*, to 50 to 200 tons for steam trawlers and 20 to 100 for sailers; steam carriers must be within 80 to 250 tons and within 15 to 150 if sailers: the minimum limitation is probably for the purpose of safety. Certificates of various grades are issued to subsidised fishermen, and only head fishermen holding first-class certificates are entitled to go anywhere and in any class of boats as masters; head fishermen of the second and third grades are restricted to the nearer pelagic waters or to boats of small size.

93. As regards students, they must be graduates in the fishing course of the Imperial Institute or persons of admittedly equal attainments; they must then study in the pelagic department of that Institute, but may also be ordered to embark on foreign fishing boats or to go to foreign countries for special subjects of study and work.

The course shall ordinarily be one of three years, and students will receive either a monthly stipend or a lump sum: when sent abroad travelling expenses will also be granted. (Unfortunately I have been unable hitherto to ascertain the stipends given to students sent abroad.)

94. The results of the bounty system, which began in 1897, do not seem remarkable, as will be seen by the following statistics. Yet pelagic and foreign fishing has immensely increased, and Japanese fishermen are numerous and energetic on the coasts of Siberia, Canada, America, Korea, China and the islands of the Pacific, showing that the enterprise of capitalists and fishermen is, in the circumstances of Japan, more efficacious in promoting fisheries in distant foreign waters than mere bounties, especially when the latter are coupled with various restrictive rules or conditions. In 1905 only 36 vessels aggregating 2,389 tons and with 793 hands were entitled to bounties; 20 of these were engaged in fur-sealing and 10 in shark catching, and only one was a steamer, *viz.*, a swift carrier of 143 tons, a crew of 13, and I.H.P. of 135; one boat for catching bonito, of 25 tons, had a 20 H.P. petroleum engine; the rest were sailers. The total catches of these subsidised boats in 1905 were valued at Rs. 7,99,000, of which Rs. 6,20,000 were due to fur-sealing. The number of head fishermen qualified and certified under the Act was 79, of whom 70 were in the second grade; 228 fishermen were also certified. The

amount of subsidy is not stated, but in 1902, for only 23 boats, the subsidies paid amounted to Rs. 42,000. But besides the Imperial grants there are also grants-in-aid from prefectural funds, the total amount of which is unknown; the matter is further mentioned below *s.v.*, "pecuniary encouragement."

95. *Rebates of excise and customs duties.*—Since 1905 the salt industry has, for revenue purposes, been burdened with an excise duty: the manufacture is in private hands, but all salt must be delivered to Government at a price varying according to quality; Government resell this salt in wholesale quantities *plus* an excise duty of Rs. 2-4-3 (1.48 yen at Rs. 1-8-6 per yen) for 133 lb.; this closely resembles the present Indian duty which is Rs. 2-4-0 per 123 lb. (1½ I.M.). But in order to assist the fishery trade it is provided either that salt may be sold at a special fixed price if intended for certain industrial and especially chemical purposes, including "(6) the preservation of salmon, trout, cod, whale, and fur-seal," or, if salt at ordinary prices has been used, that a rebate varying from about As. 12 to Rs. 1-8-0 per 133 lb. of any salted salmon, trout, cod, whale, or fur-seal shall be granted, and a similar rebate on salted herring and mackerel *when exported*.

96. When salt at a special price is demanded, the applicant must give security in cash or negotiable paper at the rate of Rs. 2 per 133 lb., and when such salt has been used for the above purpose (6), he must present an application to the Salt office having jurisdiction stating the catch, locality, salting place, and destination of the goods and obtain a certificate, after examination of the goods, that the salt has been rightly used. The weight of salt so used as compared with that of the goods, shall be calculated by the Salt office at the following percentages, viz., salmon 65 per cent., trout 75, cod 40, whale 40, fur-seal 50; that is, 100 lb. of salt cod shall, for the purpose of estimating the salt used, be calculated as consisting of 60 lb. fish and 40 lb. salt, and 100 lb. of salmon as 35 lb. of fish and 65 of salt.* These weights are here mentioned to show (as will elsewhere be shown) the large quantities of salt which, in countries other than India,† are

* "The quantity of salt used which is to be certified by the Salt office shall be calculated at the following percentages of the quantity of the articles salted: salmon 65 per cent.," etc., etc.

† Of course the amount of salt which it is necessary to use in other countries in the proper salting or preserving of fish, *e.g.*, either in the fish holds of sea-going smacks, or in herring tanks or barrels, is far in excess of the salt actually contained in the article when in use as an edible. But in this country where only a minimum of salt is issued and used, it would seem from experiments by the Chemical Examiner to the Madras Government that, in the case of large fish, almost the whole of the salt issued is found in the fish, even though much of it is antiseptically useless; the percentage of salt is specimens taken at random being as much as 14 per cent. on an average. This is an unexpected result. The antiseptic effect of the rough salt used in Madras curing will be discussed in a future report.

considered necessary for fish properly salted ; the rate for salmon and trout seems in this case excessive.

97. When duty-paid salt has been used drawbacks may be granted at the following rates :—

Herring or mackerel salted and *exported* Rs. 1-2-0 per 133 lb. of herring and mackerel in brine (pickled), As. 12 of salted herring (probably dried and salted) ; salted salmon obtains a drawback of Rs. 1-4-0, trout Rs. 1-8-0, cod and whale As. 12, fur-seal Re. 1, whether exported or not. These drawbacks may be obtained in the case of exported goods by presenting an application to the Custom house with the necessary papers proving export ; in cases where the fishing takes place without the empire, proof of the use of the salt must be given by presenting papers (article XXIV) to the Salt office having jurisdiction over the place of salting, stating the quantity of the catch, the fishing ground, salting place, and destination of the goods, and the goods must be submitted for examination. As regards the use of such salt in places out of the empire, *e.g.*, when duty-paid salt is taken on fishing boats to China or Korea, Siberia, etc., the following provision is in force ; (article XXV). “ If a person engaged in fishing in deep-sea in a foreign country or on the coast thereof, desires to claim any of the drawbacks he shall, before he sets out to fish, present to the Salt office having jurisdiction over the port of departure, a declaration stating the name of the vessel, the ports of call, the fishing ground, and the quantity of salt on board, and submit to the examination of the said salt. The person who has made the declaration shall upon return to port proceed to the locality where the Salt office to which the declaration was made is situated or to a place named by the Salt office, present an application corresponding to that prescribed in the preceding (article XXIV) and submit to the examination of the catch and the salt remaining.”

The above provisions are quoted as confirming the suggestions made in my West Coast report for permitting boats to take duty-free salt to sea.*

It will be seen that the Japanese rules are in one great respect not so liberal as the Madras Fishery yard rules which issue cheap salt for all fish salted in the yards whether for domestic consumption or for export, this being equivalent to permitting, *pro tanto*, the consumption of cheap salt in food.†

* Since the above was written the Government of Madras has granted the concession suggested in that Report, viz., that boats proceeding to sea may, under certain conditions, take salt practically at duty-free rates, for the preservation of the catches at sea. This should in itself give a strong impetus to the trade and industry, viz., by promoting the building of good sea-boats capable of keeping the sea comfortably for many days together, with a possibility therefore of real deep-sea fishing and of bringing in the catches whether of one or more days old, in a perfectly sound, untainted condition.

† See footnote above relative to the amount of salt actually contained in salt fish as placed on the market.

98. Another instance of the fostering of the industry is in the grant of a rebate of the import duty of all olive oil re-exported in the shape of canned fish; the import duty before the new tariff of May 1906 was Rs. 6 for 133 lb. But there is no serious duty on oil imported into India. Tin-plate was by that tariff imported duty free, obviously with the intention of supporting the export industry in various canned goods.

Establishment of close times and places, and prohibition of injurious practices.—As will be seen by perusal of the Fisheries Law of 1901 power is taken to suspend, abrogate, or otherwise limit fishing rights and privileges whenever it is found necessary for the protection or improvement of fisheries; for instance, by section 13, Prefects, with the sanction of the Minister, can issue orders to limit or prohibit the catching or selling of marine products, to limit or prohibit particular methods or the use of particular implements to limit the number of licensed fishermen, to prohibit or regulate the fishing of the waters; the Minister himself can prohibit or regulate the placing of any construction (*e.g.*, weir, or anicut) which may interfere with the passing of fish up a stream, and so forth. The use of explosives is entirely forbidden by one of the rules issued for the execution of the law.

99. By way of illustration the following rules are taken from the regulations of the Aichi Prefecture, which, of course, has rules suited to its own conditions and quite different from those of other districts. Rule 9 provides for the suspension, restriction, or cancelment of licenses to fish when a fishery is recognised as harmful to the protection and increase of marine animals and plants or to public interest. Rule 11 prohibits the catching of certain fish and of all fish during certain seasons, *e.g.*, sea-cucumber (Holothurian, *hêche-de-mer*) between 1st May and November 30, young mullet between May 1 and July 31, young eels between March 1 and May 31: it is obvious that these close times can only be laid down upon a complete knowledge of the bionomics of the various fish, and it is the object of the several fish Commissions and of the Department and Experimental Stations, to ascertain the life history of all marine products with a view both to their protection and cultivation as well as to their capture. So also by rule 13 the fishing of sea-cucumber and of sardines is prohibited in certain areas which are defined by reference to certain marks and bearings. Rule 14 prohibits all fishing from 1st September to 31st December of every year along certain parts of various rivers or even the taking of sand and pebbles, presumably in view to avoid disturbing the spawning fish though the season seems strange; and another rule prohibits the obstruction of a certain river to the passage of anadromous fish. Rule 16 excludes the use of the gill-net for sardines from certain inshore areas: apparently this is to avoid

disputes with the inshore fishermen within two miles from shore. As will be shown elsewhere (*s.v.* "Associations"), strict rules are laid down to prevent interference of one fishery with another, and most elaborate and careful surveys have been made and maps drawn out to secure observance of the rules and prevent disputes.

100. *Encouragement of Relief and Thrift.*—Under the head of "Associations" will be found rules and remarks relating to the relief of distressed fishermen and for the promotion of thrift to which is attached much importance, as also to the promotion of Mutual Credit Associations.

101. *Pecuniary Encouragement.*—As stated above, the law for promoting pelagic fisheries by bounties provides a sum not exceeding Rs. 2,25,000 annually for such purposes; at present not much above half a lakh is actually granted. Other pecuniary encouragement is given as noted under education, especially in the large provision for the Imperial Fishery Institute which is solely paid for from Imperial funds. But, as is usual in Japan (*cf.* Agricultural note), the chief expenditure in promoting fisheries is from Prefectural funds, with moderate grants-in-aid from the Imperial treasury. In 1887 the total expenditure from Prefectural treasuries for the promotion of various industries (Agriculture, Sericulture, Fisheries, etc.) was Rs. 2,04,870, of which only Rs. 2,296 were spent on fisheries; in 1896 the amounts had risen steadily to Rs. 12,39,300 and Rs. 73,632, and in 1902 to Rs. 49,15,629 and Rs. 5,40,064, respectively, so that the proportion allotted to fisheries rose from one-ninetieth to one-seventeenth and then to one-ninth. By far the largest part of the fishery expenditure was devoted to the Fishing Experimental Stations (including schools attached to them), *viz.*, in 1902 Rs. 4,20,265 or seven-ninths, of the total; of this amount Rs. 64,900 or slightly over one-seventh, were contributed from Imperial funds; in 1905–1906 the prefectural expenditure on fishery matters was Rs. 7,79,776, out of which Rs. 5,85,420 were spent on 29 Experimental Stations; the budget for the current year has risen to Rs. 8,27,371. The above expenditure includes not only that on experiment, investigation, and teaching, but also grants-in-aid to fishermen and fishery associations to assist in carrying out improvements, *e.g.*, grants-in-aid to Fishery societies or associations, to pelagic fishermen, to the purchase or making of better nets, boats, implements and gear, to students, etc.

102. The aid given to fishing associations engaged in useful new work is sometimes considerable and by the rules of one district may amount to one-third of the cost; the matters chiefly aided are pelagic fishery and the searching out of new fishing grounds; *e.g.*, Chiba gave Rs. 5,400 in a single year to 2 companies for deep-sea fishing; Miye gave Rs. 1,500 towards the expense of an improved fur-sealing boat;

Okayama passed a regulation granting an additional Rs. 7-8-0 per ton to steamers and to sailers of European pattern eligible for the Imperial subsidy, and Rs. 105 per boat for any Japanese-built fishing boat fully decked, above 6 feet beam, and proved to be safe in heavy seas, with the result that in 1901 the district had 84 boats in Korean waters and paid Rs. 5,400 as subsidy; Iwate gives Rs. 45 per ton for boats of from 30 to 50 tons.

Altogether it is stated that 16 prefectures granted during the seven years 1897-1903, the sum of Rs. 3,30,000 in aid of fishing in Korean waters, while from 1900 the Imperial Treasury has granted Rs. 30,000 per annum to the guild of Japanese fishermen fishing in Korea. To these subsidies is, at least partly, due the increase between 1897 and 1901 of boats from 950 to 2,532 and of catches from Rs. 4,06,000 to Rs. 15,75,000* : it will be noted that the value of the catches per boat increased from Rs. 427 to Rs. 622, doubtless owing to the improved character of the boats.

103. It is stated moreover that Government lends money to fishermen when they have a bad season and when they are unable to provide a proper outfit from their own means. Fishermen who open new fishing grounds or who start new fishing establishments are exempted for some years from any fishery tax whenever the outlay on such new ventures is considerable. It has been recently suggested either that there should be special district Fishery lending Banks similar to those provided for agriculture, or that these latter should be empowered to extend their operations to fishermen.

THE ORGANIZATION OF FISHERY ASSOCIATIONS.

104. Apparently there has always been a tendency in Japan for artisans or traders to unite in small guilds or associations, like the *artels* in Russia, and doubtless this was the case also with regard to fishermen especially as the fishing community were frequently at odds with the local farming community as to various foreshore and inshore rights of fishing and sea-weed collecting, and as some fishing operations require combined effort and expenditure. Be this as it may, a far-sighted Government, for reasons similar to those given, *s.v.* "Agricultural Associations" in my Agricultural note, determined on the creation by law of Fishery Associations, and in this they were, as in Agriculture, assisted by the fact that private Fishery Societies were already in operation. The first law on the subject was passed in 1886, but this was found insufficient and was repealed by

* This is the figure given in an official return but seems altogether too low, since the boats are of considerable size. The Journal of the Fisheries Society for October 1902 gives the value of the catches in Korean waters as 3 million yen or Rs. 45 lakhs.

the general Fishery law of 1902, an abstract of which will be found in Appendix II.

105. There are, then, in Japan three classes of Fishery Associations, the first two of which are the product of or are formed in consonance with the above law; the third is the "Fisheries Society of Japan" which is older than the law and is of purely private foundation and maintenance.

106. *Associations formed under the law of 1902—Class (1) Gyogyokumiai.*—Sections 18 to 21 of the law are as follows:—

"Fishermen residing within specified boundaries may, with the sanction of the authorities, establish a fishery association (Gyogyokumiai). The territorial limits of the association shall (with exceptions) be those of a village or hamlet, or fishing hamlet. The association shall possess rights and obligations in the matter of owning and exercising the business of fishing, but cannot itself, *i.e.*, *quâ* association, conduct fishing operations. When an association has obtained the license for the exclusive fishing rights in the sea over against the shore boundaries of the association, its members shall conduct the fishing in accordance with the rules of the association. The Minister of the Fisheries Department shall issue regulations for the establishment and guidance of these Associations."

107. The associations here mentioned are associations of working fishermen and deal only with the catching of fish: the object of the law is to avoid interference with the fishery usages which have developed in times past among the local community, to establish in each little area a self-governing body of fishermen who will settle among themselves the rights and duties of the individual members, and who will have, as a common object, the furtherance by combined action of the common interests of the members. When a number of fishermen are isolated and independent one of the other, each individual will be in opposition to every other individual so that disputes will be frequent, while there is no local authority except the courts to settle the disputes; when the men are associated they will not only settle among themselves their several rights and duties but can readily prevent or decide disputes; in other words, there will be a tendency to co-operation rather than to disunion. Moreover, the tendency everywhere in fisheries, as in other developing industries, is from the individual to joint systems; as operations become greater and more complex and therefore more costly, as boats and nets become of necessity larger, the scene of operations more distant, the expenses of keeping the fish fresh and despatching it to market more considerable, the individual fisherman with his little boat tends to disappear in favour of the capitalist with his fleet of big boats and his paid crews (*cf.* the Hokkaido, etc.). But the joint system is not *necessarily* that where

capital commands and labour obeys : in the simpler industries the co-operation of workers, individually weak and poor, may easily succeed by combining funds and forces in associations, and this is, doubtless, one of the main objects in making these associations practically compulsory and in providing that fishing licenses, at least of certain classes, shall only be granted to such associations and not to individuals. Hence, though these associations may not, *quâ* associations, themselves carry on a fishery, they tend to keep the fishermen together and to develop co-operative methods ; for these reasons the law fosters associations and grants to them exclusive rights of fishing in particular areas. For instance, there are certain kinds of fishing which can only be carried on by obtaining the exclusive use of a certain area of water as in the cultivation of nori (*Porphyra*), oysters, etc. ; section 4 of the Fishery law lays down that such license will only be issued to a Fishery Association existing on the shore bordering that area ; when the Association has obtained the license it settles among its members the rights grantable to each member. While the formation of such associations is not compulsory yet, where such associations are formed, it is expected, though apparently not obligatory, that all fishermen of the locality shall become members.

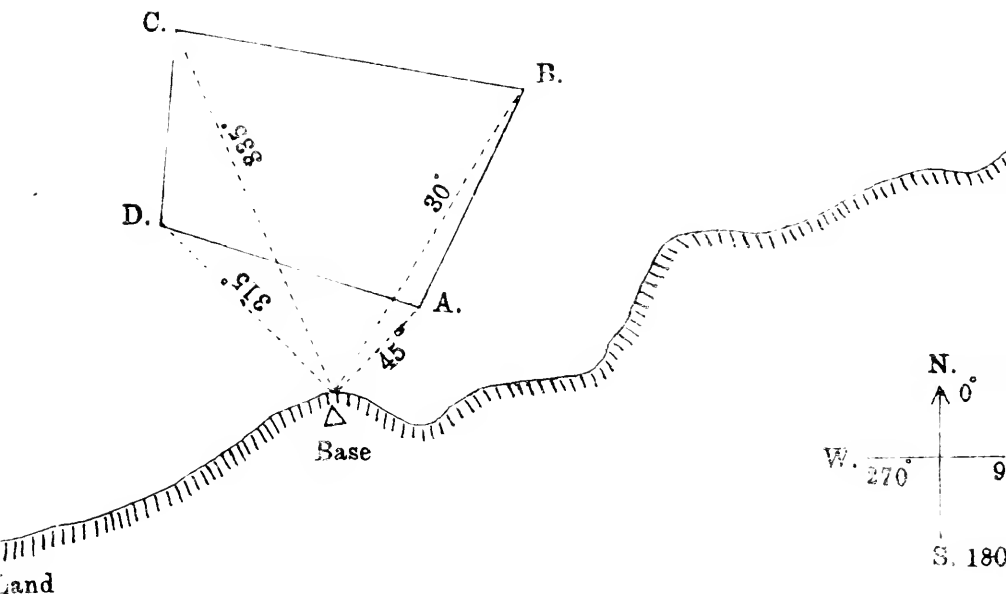
108. Again, it is obvious that the authorities can deal far more easily with a group than with a number of individuals ; Government can make suggestions or impart the results of Experimental Station work and so forth, with far greater ease and chance of a successful hearing than to a number of isolated units ; information, for instance, about a new sort of net (*e.g.*, the purse-seine), or about improved boats, can be readily given to an association which will discuss the matter and decide to try the experiment probably from the association's funds. *Per contra* such a group of men can far more readily report their grievances or make thoughtful suggestions to the authorities or can give well-considered replies to queries addressed to them. Finally, such a body can, by small individual contributions, create a fund not only for experiment in new methods or implements but for the relief of distressed members or their widows and orphans : the average number of boats destroyed annually by storm, etc., is above 1,100 with crews of probably five or six per boat (in a single storm a few weeks ago 132 boats with above 800 men perished in a single locality), so that relief is frequently needed on this score alone.

109. The above are amongst the reasons for establishing this class of association which in June 1906 numbered 3,242 ; the actual expenditure as associations of 1232 in 1905 was Rs. 2,15,347 or Rs. 174 apiece and the budget for 1906 of 2,607 was Rs. 5,24,325 or Rs. 201 apiece. The number of members is not given except in one out of 41 sea-coast districts, which had 13,201 members ; probably the greater part of the 900,000 odd fishermen are members of associations.

110. As usual in Japan, elaborate regulations were framed for the proper execution of the law: these provide that each association shall bear the name of the locality, that it shall be originated upon the consent of at least two-thirds of the resident fishermen at a general meeting and upon the sanction of the Prefect; that the preliminary general meeting shall settle the object, area, classes of fishing, the rules of the association, and so forth. The regulations further lay down rules for the appointment, powers, etc., of the administrative officers, and especially the proper auditing of the accounts; for the conduct of general meetings in which each member has one vote; for the appointment of a treasurer, when the income is considerable; for the collection of fees from the members and for the investment in Government or Municipal banks of any reserve, which can only be drawn upon in case of calamity or unavoidable necessity, or for some very noteworthy benefit common to the members. Every fisherman of the locality has a right to join unless there be some strong reason against him, and appeal lies to the Prefect against rejection or expulsion. The rules provide for dissolution, as by the reduction of members to below one-third of all resident fishermen, etc., and for liquidation when necessary, and any funds available after paying all debts shall be handed over to some public body or association. Associations are supervised by the Minister, by the Prefect, and by the Heads of counties (taluks); these can require reports, inspect the books, cash balances, etc., issue any necessary orders, and can cancel any resolution that may be considered harmful to public interest. Penalties are also provided for cases of false report, failure to keep or produce the proper books and accounts, or to submit the required reports and so forth. The source of these rules is obvious to those who have studied the laws and regulations applicable to and the internal rules passed by German Societies.

111. But legal aid does not stop here, for the Regulations lay down rules for delimiting, mapping, and registering the several positions or spheres of operation of the various associations or groups of fishermen or even of individual rights, a matter not only of vast importance for the prevention of disputes but of great difficulty when the immense number of fishermen, the vast length of coast and the conflict of interests are considered. A further reason for this delimitation and mapping is that it enables the fishery license fees to be readily assessed and collected. So far as ascertained, this work has been thoroughly carried out and though of no great immediate interest in Madras, it is mentioned as an example of thorough work and as a model for imitation should it become necessary, as for instance, should fixed nets be introduced. Owing to the immense number of fishermen and of various classes of fishing work, such as fishing by fixed nets or weirs, capture of bottom or surface fish, crustacea, molluscs,

DIAGRAM II.



Plan of "Enclosed" Fishery for the culture of Nori
(Porphyra, sea-weed).

Base. Cape—at—in village—.

△ Base.

The point *A* of the enclosure is *a* ken (fathoms) from the base (△) in the straight line drawn at an inclination of 45° E., of N.-S. line.

Point *B* is *b* ken from the base (△) in the straight line drawn at an inclination of 30° E. of N.-S. line.

Point *C* is *c* ken from the base (△) in the straight line drawn at an inclination of 25° W. of N.-S. line.

Point *D* is *d* ken from the base (△) in the straight line drawn at an inclination of 45° W. of N.-S. line.

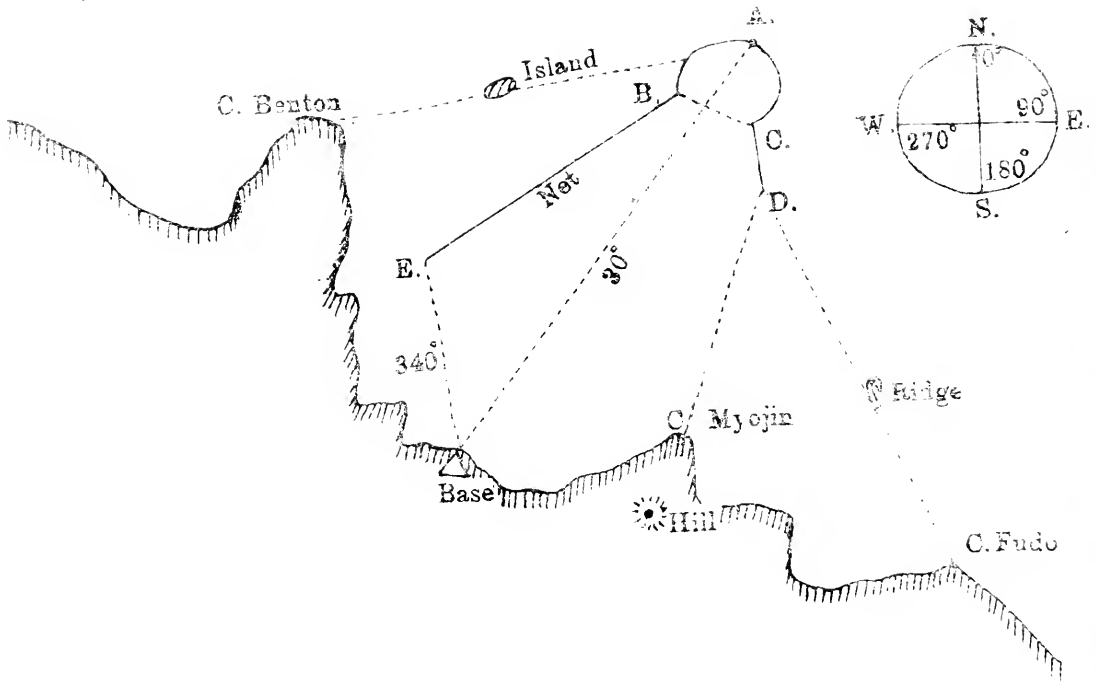
Dimensions of the Enclosure.

- From *A* to *B* *e* ken (fathoms).
- From *B* to *C* *f* ken.
- From *C* to *D* *g* ken.
- From *D* to *E* *h* ken.

Total perimeter —ken.

Area —tsubo. (1 tsubo = 4 square yards.)

DIAGRAM I.



Plan of Fixed Net Fishery.

Net used.—Oshikuami (a species of trap-net, of the Daiami class).

Base.—The rock called — at — in village —

The following positions are known:—

- | | |
|------------------------|--|
| (i) Cape Benton. | (v) Cape Fudo. |
| (ii) \triangle Base. | (vi) A small island over against Cape Benton |
| (iii) The Hill. | (vii) A ridge opposite Cape Fudo. |
| (iv) Cape Myojin. | |

The point *A* of the fishing ground is the intersection of two straight lines, one drawn from Cape Benton through the Island, and the other, drawn from \triangle at an \angle of 30° east of N.-S. line.

Point *E* is *a* ken from the Base (\triangle) in the straight line drawn at an inclination of 20° West of N.-S. line.

Point *D* is the intersection of two straight lines formed respectively by joining Cape Myojin with the Hill, and the Ridge with Cape Fudo.

Dimensions of the Fixed Net: "ken" = fathom.

- From A to B *m* ken } "Pound."
- From A to C *n* ken }
- From B to E *o* ken } "Wings."
- From C to D *p* ken }
- From B to C *a* ken.

and sea-weeds, rights and spheres of operation are greatly intermingled. There are, in fact, several classes of fishing laid down in the Regulations, viz., "Fixed", "Enclosed", "Special", and "Exclusive"; the first named is the fishery by means of fixed traps, pound nets, or weirs (American usage of the word, viz., a fixed trap formed of stakes and brushwood, etc.); "Enclosed" denotes an enclosed area in which marine products, such as oysters, algae, etc., are grown by cultching and other operations for the attachment of spat and spores; "Special" are such fisheries as whale or dolphin catching, etc., for which special licenses are issued on particular areas; "Exclusive" is the right of fishing within a given area to the exclusion of all others and by methods not included in the first three classes of fishery. All these rights, often contiguous or commingled and even conflicting, have had to be enquired into by the Prefectural (district) officials and the spheres of operation mapped out. According to a paper of 1894 by Mr. K. Ito "in every fishing locality the position of all traps and seines is located on a map, and this map is filed in the county (taluk) office for the reference of fishermen, so that when they have any quarrel in regard to the position of nets it can be settled very easily," and not only the position of nets but, as above explained, the areas of enclosed or exclusive, etc., fisheries. In the Regulations made for carrying out the fishery law of 1902 there are four appendices in the form of specimen sketches giving the precise position, dimension, distance from shore, and bearings of the several classes of fisheries; sketches of two are appended.

112. The following abstract of the rules, statistics, etc., of an association will give an idea of the work done by them. The Mukogasaki Fishery Association was established in May 1903 in a hamlet of the Miski town called Mukogasaki-kabujima: it has five directors including the chairman, three auditors, and one treasurer; there are 558 members employing 782 men with 250 boats of above 4 feet beam and 130 of less beam, out of a resident male fishing population above 15 years old of 1,658 with 500 boats; probably the youth of the association and the youth of many residents account for the fact that all residents have not yet joined; owners of 380 out of 500 boats, however, are members. The subscriptions were trifling, aggregating only Rs. 130 in 1905, but presumably a special levy could be made if necessary. It is interesting to note that the pay of the Secretary, the only salaried man, is Rs. 15 per annum, while Rs. 18 pays the rent of the office building and of the man in charge; the expenses of the council and of the general meeting amounted to Rs. 7-8-0. Honoraria were granted as follows: to each director Rs. 3, to each auditor Rs. 1-8-0, and to the treasurer—who has to furnish security—Rupees 7-8-0 per annum. There is a hint for Madras societies in these figures.

113. The value of the catches, on an average of three years, by the members of the association was Rs. 44,400, the great bulk being taken by hand lining; the catch *per* member is thus about Rs. 81 * *per* annum which is small; apparently the association is for the smaller class of fishing since only six drift-nets for shark, tunny, etc., were employed, and only 40 long line boats for tunny, bonito, tai, etc.

114. The rules of the association give as its object "the possession and the exercise of the right of fishery" within the recognised area and the development of the common benefit of the members; rules are laid down as to membership and administration; persons elected to office cannot refuse without good reason, though the posts of director and auditor are honorary. The usual rules are framed as to general meetings and as to the disposal of the funds, formation of a reserve, etc. The classes of fishing to be exercised by the members are 27 in number, nearly all being line fishing, and members may exercise their rights either singly or in partnership; when a particular fishing can only be exercised in one place by one person at a time members shall exercise it in turns, which shall be settled by lot. A relief fund shall be established up to a maximum of Rs. 750: from this fund grants may be made for building or repairing boats in case of loss or injury by shipwreck, etc.; for medical relief to a member injured by shipwreck or other accident, for the travelling expenses of men swept away to distant places by storm, for assisting the family of a shipwrecked member, for rewards to persons who have rescued shipwrecked members. All members are required to help one another at sea. Rates of subscription vary according to the need and according to the position of the members, *e.g.*, As. 2-6 (10 sen) to Rs. 1-8-0 and from Rs. 2 for a large boat to As. 4-0 for a small one; most members are in the lower classes.

115. Those who know the difficulty of dealing with isolated, ignorant, routine-led men and the frequency of disputes between units in disunion will recognise the advantages arising from a co-operative bond of the above nature.

116. *Class (2) Suisan-kumiai*.—These are of a totally different nature from class (1) (*Gyogyo-kumiai*); they are formed under section 22 of the Fishery Law of 1902 and may be called Fishery Chambers using the word "Fishery" in its largest sense of the fishing industry and trade, from the catching of the fish to the placing of the product, fresh or manufactured, on the retail shops. Section 22 lays down that "persons employed in fishing or in the manufacture or sale of marine (aquatic) products, may establish a Chamber of Fishery

* Compare the average value of Rs. 90 per household for all Japan mentioned in paragraph 4 *supra*. As a member of an association probably represents a household the similarity in catch, which was arrived at independently, is noteworthy. The cautions mentioned in paragraph are, however, to be remembered.

(Suisan-kumiai) for the improvement and development of the fisheries, for the protection and cultivation of aquatic products, and for the improvement of the industry and trade. These Chambers shall, except in matters provided for by the Fishery Law and Rules, be regulated by the Law of 1900 relating to Associations for Staple Products (Juyobussan Dogyo-kumiai)" for which see note on Agriculture. These chambers are not permitted to engage in actual fishery business but are trade associations intended to work for the general improvement of the industry in every branch as shown below *s.v.*, "Articles"; their sphere of operation is usually considerable and may cover a whole Prefecture. These Chambers, again, may unite to form federations (Suisan-kumiai Rengō-kwai), and some have already done so.

117. The Fishery Law relating to these Chambers has been interpreted by rules issued by the Minister; these provide, *inter alia*, that these Chambers shall not exercise the rights of actual fishery, that they shall be established on the sanction of the local prefect who shall approve of their Articles and any modification, and shall have power to cancel any resolution if illegal or injurious to the public interest: reports of work done and budgets and statements of account shall also be sent to the Prefect.

118. The Articles of such a Chamber specify, *inter alia*, (1) the work to be undertaken, *viz.*, enquiry into the methods of catching and preserving fish, and the provision of instruction in such methods; examination and standardising of manufactured sea-products; the means of protecting and increasing (*e.g.*, by cultivation) aquatic fauna and flora; the investigation of markets with a view to the development and extension of the trade; the settlement of trade disputes; the opening of shows or exhibitions and the preparation or procuring of exhibits for such shows; (2) the class of persons who may become members, *viz.*, fishermen and all persons connected with the fishery trade and industry who reside within the area of operation; (3) the usual rules for the admission, rights and duties, etc., of members; (4) rules regarding the several officials, it being a rule that no one may refuse office except for some strong reason, and that all offices are honorary except that the office manager may get pay; (5) the entertainment of experts and inspectors under the control of the President, the former of whom shall examine particular fishery subjects and the latter shall superintend the examination of articles manufactured by the members; (6) rules for general council and departmental meetings, departmental meetings being those of members of the same branch of trade, *e.g.*, curers, oyster-cultivators, etc.; (7) the usual rules as to finance; (8) rules under which members may apply, upon payment of a fee, for advice or for an investigation into methods relating to the industry or trade; (9) any trade matters to be specially dealt with by the Chamber; *e.g.*, one Chamber deals specially with dried squid

and dried bonito with the following provisions :—(a) a certain number of squid shall be called a “ soku ”, and a certain number of pounds shall be called a “ kori ”; (b) squid dried at different seasons shall not be mixed in the same kori; (c) kori shall be wrapped in well-dried mats of new rice-straw; (d) weights less than a kori are not subject to these rules; (e) squid shall be classified in three grades, the first grade being of good and uniform quality, dryness, color, and appearance, the second grade of good quality and dryness, but of inferior color and form, the third, inferior in all respects. First grade squid shall also be sub-divided into large and small according to a specified standard. As regards bonito (see *infra* regarding the universal use of dried and smoked bonito), it shall be packed in boxes of given volume and holding a given weight, of well seasoned wood of specified minimum thickness; bonito dried at different seasons shall not be packed in the same box, and each box shall be roped lengthwise and twice crosswise. There shall be two grades of bonito, viz., “ superior ” of good quality, thorough dryness, uniform shape and color, and “ ordinary ”. Members desirous of selling squid or bonito to persons outside of the Chamber’s sphere of operations shall, under penalty of fine, tender them for inspection at a small fee, if not less than a “ kori ” in weight; inspected boxes or kori shall be marked by the inspector with the ascertained grade of article; an appeal lies against any such mark to the President who may order a re-examination. These rules are of much importance: they compare with practices elsewhere found, such as the Scotch branding of pickled herring, and the minute rules laid down both as to the quality, methods of packing, and the material and hooping of the herring barrels; the object of this marking is, of course, to favour the development of trade, especially export, by providing a particular standard for every class of goods and by so marking the goods, after examination by responsible and expert inspectors, that buyers can depend upon always getting an article corresponding to their orders and to the price paid. Official or authoritative branding may not be necessary, indeed, when trade is carried on by great houses during a long series of years so that the goods are sufficiently warranted by the name of the firm or by its own special marks, but in the infancy of an industry and for small manufacturers such brands are of great importance. In any case, in the infancy of an industry the fixing of a particular standard for the several classes of goods is of the first importance, if only as a guide or standard for manufacturers; with such standards we should perhaps see better cured articles issuing from our curing yards.

119. Another special object of the same Chamber is the provision of shell-fish spat which is to be grown in a special nursery and supplied on payment to members; see below *s.v.*, “ oyster culture ” for a description of such nurseries. Further articles contain rules for

making suggestions on fishery matters to the Prefect, for the reporting by members to the Chamber of any facts injurious to fisheries, and for the investigation of the market for a particular article when a member presents a request to the Chamber stating the nature of the article, its price, probable quantity, and other details, and pays a fee ; rules for the opening of exhibitions or for preparing exhibits for public exhibitions ; rules for honouring persons who have improved the industry or increased the common benefit ; rules for settling trade disputes among members.

120. These Chambers seem already to be doing good work : they have formulated suggestions of many kinds ; a single Chamber has, *inter alia*, suggested to the Minister the project of a Fishery Bank to supply capital to fishermen who are now very hard pressed by scanty capital and high interest ; the necessity and position for a fishery harbour and improved boats and gear ; to the Prefect the necessity for a Fishery school in a particular locality : to the Governor of Korea the need for a fishing port with proper communications between it and the markets, the provision of education for the children of the Japanese fishermen working in Korea, and the necessity for sanitary measures on the shore. Another Chamber purchases salt wholesale and supplies it to members at rates cheaper than the retail market ; the sale per annum is 70,000 bags of $1\frac{1}{4}$ bushel (0.25 koku) each, and the saving effected to members was no less than Rs. 21,000. Another Chamber held an important conference, issued 500 charts of fishing grounds, opened a local competitive show, and passed resolutions which were sent to the Prefect in favour (*a*) of sending the committee to sea on board the improved fishing boat of the experimental station in order to acquire a knowledge of its working, (*b*) of adding fishery subjects to the curriculum of primary schools and industrial supplementary schools (see " Education ") in sea coast villages, (*c*) of starting a local branch of the proposed Fishery Bank as soon as it should be established, (*d*) of establishing at an early date Fishery harbours in two localities from which pelagic fishery is carried on ; and (*e*) of obtaining a subsidy from the Prefect for opening temporary (fishery) schools, for holding exhibitions by each Chamber in turn, for studying pelagic fishery, for the further employment of experts, and for the relief of shipwrecked fishermen.

121. Another Chamber devoted itself so thoroughly to the improvement of the members' products, to their proper packing and to a careful inspection of the same, that the outturn far exceeded that of non-members both in quantity and quality. This year the Chamber is proceeding to carry out trawling experiments.

122. It will be seen that these Fishery Chambers are extremely useful and practical Trade Associations. Presumably every person engaged in the fishing trade or industry ought to become a member

of a Chamber if established, since section 4 of the "Staple Products Trade Associations Act" states that "all persons who are engaged in the same trade as that for which the Association is established shall join the Association except when exemption has been expressly obtained from the Minister for Agriculture and Commerce." But this does not seem to be strictly observed.

123. Class (3) of the Associations is represented by the Fisheries Society of Japan which is outside of the Fishery Law, and by at least two similar societies. For a detailed account of this society see *supra* paragraphs 14-18.

THE UTILIZATION OF EXHIBITIONS.

124. Following out their determination to gather knowledge from all over the world, the Japanese have not only sent delegates to examine the world's fisheries but have diligently attended, through expert commissioners, every exhibition of importance—general or for fisheries only—throughout the world, beginning with Vienna in 1872; that at Philadelphia in 1876 seems to have first enlightened them as to the importance of the industry and development which it had taken in the west, but it was the special Fisheries Exhibitions of Berlin in 1880 and London in 1883 which not only marked the beginning of a vigorous development of fisheries among the Japanese but introduced Japanese products to western nations. As mentioned *s.v.* "Fisheries Society of Japan", it was the thoughtful observations of the delegates to the Berlin Exhibition which led to the starting of that great and useful society, a society which has not merely aroused and maintained a lively and practical interest in fishery matters throughout Japan but held some ten Fisheries exhibitions and established a school which developed into the Imperial Fisheries Institute (*q.v.*). It was the trained observation of Japanese delegates to the Paris Exhibition of 1878 which caused them to notice and to study the canning industries of the West and led to their taking home, under Government orders, a complete outfit of canning machinery and of practical knowledge by which the industry was fairly introduced and subsequently developed throughout the country till it has now attained considerable dimensions. Since 1883 Japan has sent fishery exhibits and expert commissioners to Chicago, Paris, Norway, St. Petersburg, St. Louis, and Milan (1903): and while its commissioners come back with abundance of information as to fishing methods, boats and gear, as to preserving processes, pisciculture, markets, etc., which would be utilised in developing the Japanese industry in all branches, its exhibits on each occasion have been attracting more and more attention from the developments shown and the excellence of the products; its canned goods at St. Louis have (so a leading merchant of Tokyo informed me) led to large orders for Japanese fishery products, and a

strong company was then (May 1906) in process of formation to supply the demand for them and for similar goods of the first class for American and European markets. In addition to the canned goods there were large displays of fish-oil of fine quality supplied by various Japanese companies, of cultivated pearls (see *infra*), of shells, shell buttons, and corals (much of the so-called Italian coral is really the Japanese coral imported to Italy), "agar-agar" (vegetable isinglass) and other products of marine flora including iodine, and so forth. At the Milan Exhibition in 1906, I saw a similar series of exhibits, the art products in tortoise-shell and mother-of-pearl and ornaments made with cultivated pearls being specially noteworthy. One result of exhibiting at the Bergen exhibition was an export to Norway of thread for nets valued at Rs. 1,05,000. It is clear then that the Japanese are utilising exhibitions to their full value both as sources of information and of trade.

125. Internally they also use exhibitions very freely: as stated above the Fisheries Society had held ten exhibitions up to 1900; Government also held a National Fisheries exhibition in 1883; in 1890, there was a large fishery branch in the third National Exhibition, and again in 1895: in 1897 there was a second Fisheries Exhibition, and there have been several other exhibitions since. At first these shows served only as a display of primitive methods and implements but later shows have steadily exhibited the increasing development of the fisheries; *e.g.*, in 1893 only 14,581 articles were exhibited of no particular value, an important lesson as displaying the simplicity and backwardness of methods, boats, gear, etc. In 1891, however, there were 46,906 articles, including 719 models of boats and implements, together with many manufactured products, etc., showing a considerable advance in a short period. Such shows drew the attention both of officials, of the trade, and of the public to the subject; they have proved of great educational value, while the competition at successive shows has led to considerable improvements in the goods.

FISHERY TAXATION.

26. The various departmental and Prefectural Fishery agencies, *e.g.*, the Fisheries Institute, the experimental stations, etc., cost a great deal of money; as mentioned above, the Prefectural Fisheries budget for the current year is 8.27 lakhs of which about three-fourths are for experimental stations. In Japan the Government does not hesitate to levy special taxes for special operations, the proceeds being probably ear-marked for the operation; it considers that a fisherman can and must spare four or eight annas, probably from his expenditure on saki (arrack), in consideration of the great improvements which a million such coins would work in the hands of enlightened and expert

hands. It has been impossible to ascertain the actual amount of taxation, since the taxes are prefectural and differ in every district; they are levied either as license fees for particular classes of fishery, or as rentals for particular areas, or as direct taxes on boats, nets or persons. The fees and rentals for the right to fish on the Saghalien coasts amount to a sum probably equal to the whole fishery expenditure of the empire; in the Hokkaido or Northern Island, where the herring fishery is pre-eminent, as also salmon and other valuable fisheries, the "taxes and public burdens" on the members of two-thirds of the associations are officially recorded as Rs. 5·88 lakhs, of which the actual fishery tax was Rs. 4·12 lakhs; as the total value of the catches by those associations aggregated to Rs. 108·24 lakhs, the actual tax was nearly 4 per cent. of the gross, and since there were 39,259 members in the associations, the taxes and public burdens were just Rs. 15 per head out of *per capita* proceeds of Rs. 275.

127. In a prefecture of the main island I found the statistics of a large fishing village to be as follows:—

Nature of net, etc.	Regular tax.		Additional tax.		Number of nets, etc.	Total tax.		Number of fishing houses.	Rate of tax per house.	Remarks.
	RS.	A.	RS.	A.		RS.	A.				RS.	A.
Yesake net ..	22	8	11	4	1	33	12	..	..	....
Seine ..	18	0	9	0	2	54	0	..	..	....
Drift ..	22	8	11	4	1	33	12	..	..	....
Bonito boats. {	22	8	11	4	} 44	1,305	0	.	..	According to number of oars; more than 11, 9, or 7.
	18	0	9	0						
	15	0	7	8						
Salmon (?) ..	45	0	22	8	26	230	0	..	..	"Salmon" is probably a clerical error in my notes or a mistranslation. The taxes are according to nature of net.
	to		to							
	6	0	3	0						
Miscellaneous.	6	0	3	0	187	1,449	0	..	..	Taxes on small boats, the lowest rate being for small boats with a single hand; average Rs. 7-12 per boat.
	to		t							
	1	8	0	12						
Total ..	..		..		261	3,105	8	890	3	8

Since the income per house probably does not much, if at all, exceed Rs. 100 per annum (paragraphs 4 and 113 *supra*), the tax amounts to about $3\frac{1}{2}$ per cent. of the gross earnings. The 50 per cent. "additional tax" is probably a war levy, but is not so stated.

As the usual number of working fisher folk per house including boys over 15, is about 2·4 per house, the rate per head will be nearly Rs. 1-8-0.

128. In another prefecture the Prefect kindly furnished the following rates:—

	RS.	A.	P.
Trap net (fixed or pound nets) each	67	8	0
Do. (small)	22	8	0
Various nets (seines, etc.)	3	0	0
		to	
		7	8
Poll-tax	0	5	0
Sea-weed collection by machine	15	0	0
Do. by hand, per person	0	2	6

No tax is levied for three years upon any net of an improved character introduced by fishermen for trial, or during enforced periods of suspension above six months, or upon women or boys under 13 years old when there is no adult male in the family. Nothing is stated as to any boat tax nor is the aggregate amount of taxation stated. This prefecture does little in the way of official fishery work, having expended only Rs. 2,952 in 1905 and having no fisheries experimental station, though it is an important district with a marine and river fishing population of 24,738 actual workers with 8,144 boats and 76 associations with 10,575 members; taxation at 4 annas per head and the above rates per net should yield a surplus above the expenditure.

THE ECONOMIC POSITION OF THE FISHER CLASSES.

129. In general the fisher folk are extremely poor, but there are many progressive capitalists and proprietors who are developing the industry in all its three branches; as in Europe these men are probably ousting the independent fishermen and bringing them under the control of intelligence and capital. For instance, Mr. K. Ito says that in the Hokkaido the fishermen are divided into three classes; the outfitter who supplies capital, nets and gear, and even food to the fishermen who are not able to supply themselves; proprietors who own the fishing vessels, fish houses, and the necessary gear; employes who are hired by the proprietors. Sometimes the work is done on shares, sometimes partly on shares, partly on wages. It is these proprietors who are intelligent, well educated and progressive; it is they who understand improved methods of catching, curing and cultivating; they form associations for the purpose of preventing the preparation of inferior articles and for the adjustment of disputes, as well as a Chamber for the improvement of fisheries and for the distribution of useful information. Probably much the same is found in the more progressive parts of the country in general, as evidenced by the numerous Chambers, by the various factories for the preparation of products, by the increasing number of large boats and new

gear for distant waters, etc. The tendency is, as elsewhere, to the disappearance of the small independent fishermen in favour of the capitalist system of modern times, although, as mentioned above, *s.v.*, "Associations," the legal obligation on the fishermen to form associations to whom alone, in many cases, fishery licenses will be granted, tends to counteract this tendency by the introduction of co-operation.

130. Data are largely wanting in regard to the financial position of the fishermen; in "Japan in the 20th Century" it is stated that the average capital is Rs. 40 per family, a sum which includes the value of boats, nets, lines, etc., and all other gear. Boats in Japan are very cheap and fragile and wear out in 10 or 12 years, so that the above capital though perhaps unduly small is not so absurd as it seems at first sight; anyhow the average individual capital is very small. Obviously, however, fishermen with such finances cannot of themselves build deep-sea boats and supply the costly gear and stores necessary for the deep sea and distant fishing which is now a necessity.

131. With such small capital, frequent losses, bad seasons, and periods of inactivity, the Japanese fisherman is largely in the hands of money-lenders who are spoken of in much the same terms as in India; the report above mentioned says (of Hokkaido fishermen) "they are obliged, in order to obtain their working funds, to have recourse to loans at exorbitant rates of interest, and often they have to pledge beforehand the anticipated catch of the season. Under the circumstances the lion's share of the profit coming from the fishery goes into the pocket of money-lenders, and it is hardly possible to expect the development of the industry while things continue in this condition." Out of about Rs. 145 lakhs required by the fishermen of 88 associations (out of 124) in Hokkaido as working funds, no less than 80 lakhs were borrowed money. Other accounts give similar statements regarding the want of own capital, the high rate of interest demanded, and the more or less dependent position of the isolated fishermen. It is for this reason that both the Fisheries Society and the Council of Directors of Experimental stations (and many others) lay stress upon the necessity for establishing (a) facilities for the promotion of saving, so that the fishermen may have a safe place in which to put by against bad seasons, etc., any surplus when, as happens, he gets unusually heavy catches; (b) credit associations among the fishermen where small loans may be obtained, *e.g.*, for repairs, replacing gear, working funds, etc.; (c) regular lending banks on the system of the Agricultural mortgage banks where men can get large loans for building boats, buying large nets, erecting pound nets and traps, etc., on mortgage of the goods obtained by the loan; (d) relief funds for assisting men who have lost boats, nets, gear, etc., by the storms so frequent in Japanese seas or have met with other misfortune. A few years ago in the Hokkaido,

Government granted loans at a low rate of interest with the hope of improving the industry, but on the abolition of the then system of administration, these takkávi loans were discontinued to the great embarrassment of the fisher folk. Apparently, however, even in this island the associations are greatly helping their members, for the above mentioned report states that out of Rs. 80.4 lakhs which are borrowed for working funds, no less than 38.8 lakhs are obtained from guilds (associations), 34.3 lakhs from local capitalists and 7.3 from other sources. This seems to be good work on the part of the guilds, but nothing is known as to the terms of the loans.

FISHERY PLANT, METHODS, ETC.

132. The original fishing apparatus of Japan and the using of it do not appear to have many lessons for Madras except, as has already been mentioned, the boldness and endurance displayed by the fishermen in putting far out to sea in small and fragile boats in the bitterest of weather and in seas liable to sudden and violent storms; it is their ready adaptation of western methods that provides lessons for India.

133. *Boats*.—Boats are invariably undecked, built of pine, with mat or cloth sails but generally of such a rig that they can only sail right before the wind, and are thus not only inefficient sailers but are very apt to be driven out to sea by adverse winds. One peculiarity is the very deep narrow rudder extending fully a boat's depth below the bottom of the boat; this is very efficient being immersed in comparatively still water even when the boat is pitching. In 1904 there were 426,287 boats of which only 22,399 were above 30 feet in length; 26,296 were below 18 feet. A boat above 30 feet is not necessarily or usually of any good size or strength, the average value of such boats being only Rs. 227 according to official statistics. Boats are built light since they are, to a great extent, driven by oars, they must be quick in manœuvring, and must be readily hauled up on the beach. Their life averages between 10 to 12 years as stated both by fishermen and fishery officials; this is confirmed by the statistics which show 36,642 newly built in 1904 and 35,098 worn out, or a 12-year life for the 4,26,287 boats; figures in other years are similar; the continual replacement of boats *plus* repairs must be a heavy tax upon the fisher folk. The point to be noticed is that the boats are improving in size and sea-worthiness; this is necessitated by the increasing distance and length of voyages; even with the present small undecked boats the men venture out, especially after bonito, up to 160 miles from shore, but voyages to Korea, etc., and the necessity for fishing in the stormy winter weather, are compelling the introduction of boats after Western models. This necessity is clear from the fact that in 10 years ending 1904 an average of 1,279 boats with crews of at least 5,000, were annually lost by

shipwreck, upsetting and drifting out to sea, etc : in one storm a few weeks ago 130 boats with crews of about 800 were lost. In 1900 there were only 17,682 boats above 30 feet in length : in 1904 there were 22,399 and some of these latter are real improvements. Such are the new liners of Oita district said to be the most sea-worthy in Japan ; broad, full-decked with water-tight hatches, accommodation below for crew, and so forth : the men have a special mode of preparing against storm and are said to be able to stand the heaviest gales. The bonito boats have to go out sometimes a hundred miles from shore and follow the shoals ; these are open boats with large crews of from 12 to 30 men and a live well for carrying live bait : they are being improved by half-decking, but as the wind in summer is light and the fish get tainted on the long row home, fishermen are now contemplating the addition of motors ; this was being tried in a boat which was building for one Experimental Station that I visited. So also the tunny boats, which have to fish in the stormy winter, are now being improved by decking, adding a centre-board, and strengthening with frames which are not ordinarily used in Japanese boats. In the improvement of boats the Experimental Stations are leading the way ; that at Shinojima which I visited, is building a new boat each year, each successive boat designed being an improvement ; Mr. S. Kato of the Fisheries Bureau has an excellent boat for the Oita District Experimental Station similar to a Thames trawling boat, ketch rigged, full decked, live well amidships, fish and net room forward of the well, and accommodation for the crew aft.

As in Malabar canoes, the crews of Japanese boats seem disproportionately large, eight men being common in quite a small boat and from 12 to 30 in larger ones.

134. *Nets*.—Here again, except in the matter of fixed nets and bamboo " weirs " there is not much to learn from original Japanese nets ; the lesson to be learned is the readiness with which the Japanese adopt or adapt nets new to them, whether it be districts adopting useful or improved nets from other districts, or the country in general adopting foreign nets. Formerly when communication was difficult and most localities were isolated from general intercourse, each fishing locality knew only of its only methods and implements ; as communications became easy, the knowledge and use of new nets spread from district to district, whether by the enquiries and intelligence of the people themselves or by the diligence of the Experimental Stations, which not only busied themselves with bringing nets and expert fishermen as teachers from one district to another, but introduced new nets from other countries, especially the purse seine from America which at once commended itself to the Japanese folk. In several districts I found that nets had been newly introduced from other localities, and one use of the schools is in showing that there are

new nets and methods in existence and in teaching their use. Not only so, but the fisher folk have been taught that fish which used to be caught only by customary methods and nets, may be also and more readily caught by other nets; *e.g.*, formerly sardines used to be caught only along shore (as in this Presidency) with the seine; the people have now learnt to use the purse seine and other nets out at sea for these fish (*cf.* the American catches of the menhaden, a relation of the herring and sardine), and the purse seine "has been so successful that it has become one of the important appliances for sardine fishery and is now used in many provinces." "Now-a-days with improved boats and gear there is a tendency to seek this fish further and further out at sea," a practice which is precisely that suggested for the Malabar Coast in my recent report; the Japanese found that instead of waiting for the fish to come and be caught it was better to go and search for the fish and follow them up and use new nets for their capture. Similarly, it appears that it is only of late years that the pound net has been used for catching herring in Hokkaido, yet these nets are now largely responsible for the enormous spring catches round that island.

135. The Japanese use many classes of net, some being identical with those found all over the world, such as the seine, the gill-net, etc.; some are common to Japan, the Mediterranean (Adriatic) and parts of this presidency, *e.g.*, a bag net with wings towed by boats against the tide like the Madras coast "thûri"; some are special to Japan, but not of sufficient importance for introduction.

136. Three nets or traps will now be described.

(1) The *to-ami* or simple cast net. This is used the world over and nowhere more extensively than in Japan and India, but the Japanese variety has an ingenious and deadly addition which I have only seen on occasions in Madras, *e.g.*, at Pulicat. The bottom is heavily leaded as usual, but thin cords are attached to the circumference, at every foot or two, which pass up the inside of the net and out at the centre. When the net is thrown these cords are pulled and draw the lower edge up into a bag in which the whole of the fish within the circumference of the net are enclosed and taken.

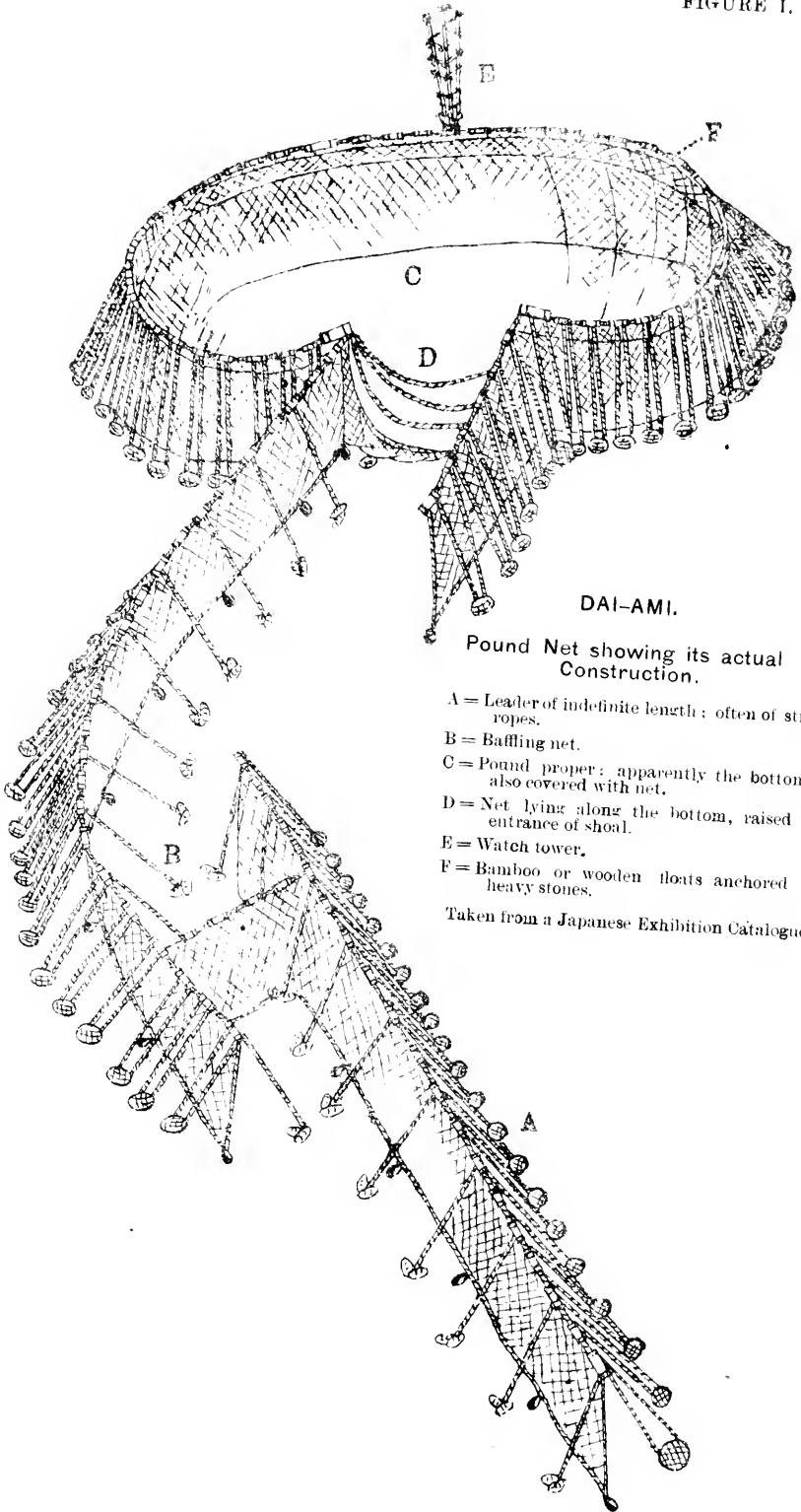
137. (2) *Purse-seine*—(*aguri-ami*).—This was introduced from America and enormously increases the catching capacity of the fishermen, since it can be used for all surface fish irrespective of the depth of the sea. The ordinary seine can only be used inshore where the depth is so moderate that the leaded foot of the net rests on the bottom; it is then either dragged ashore or, as used on the West Coast for sardines, it is gradually worked up to the six or eight boats which ring it round and the contents dipped or tipped out into the boats. But it is well known that sardine and mackerel shoals do not necessarily come close inshore but are met with well out at sea in depths

where an ordinary seine could not be used ; hence the invention of the purse-seine, used in America to capture the menhaden, an oil-bearing *Clupea*, which appears in vast shoals like its cousins the herring and sardine ; the fishermen search for shoals and when found follow them as long as possible using the purse-seine for their capture. The difference in this seine is that round the foot of the net are fastened a number of metal rings through which ropes are rove ; by hauling on these ropes the bottom of the net is closed up forming a vast basin, bag, or purse, so that when the net has been shot round a shoal and the bottom ropes hauled in, the fish are absolutely enclosed and the net may then be hauled to the side of the smack and emptied by boats and dip nets at leisure. Obviously the depth of the water is unimportant, so that the surface-swimming shoals of sardine and mackerel can be searched for and followed far out to sea. As stated in my West Coast Report, this is one great desideratum of our fisheries, viz., the ability to fish at any distance off shore and not merely inshore when the sardine and mackerel shoals choose to come and be caught ; the large boat is the first necessity, and the deep-sea purse net is the next. The Japanese net is often some 20 to 25 fathoms depth, and up to 150 fathoms in length, so that vast quantities can be taken at a shot.

138. (3) *The fixed or pound-net and its congeners (Oshiki-ami, etc.)*.—These are structures of some permanence, fixed in one position along the coast, into which the fish are guided by leader or scare nets or driven by boats and shouting ; the fish caught are mostly the migratory surface fish. They have many different names in Japanese according to their nature and perhaps the class of fish for which they are set ; in English or rather in American, for America possesses them in great numbers, they are called set nets, pound nets, trap nets, etc., if erected with nets, and traps, weirs, etc., when built of bamboo, reeds, and so forth ; the word "trap" will be used for brevity merely. There are apparently about 50,000 of these traps in Japan if we include pound nets and Shiki-ami, and I saw many in my tours. The accompanying drawings are taken chiefly from the catalogue of the Japanese Fisheries Exhibition of 1897 and another Japanese publication, but I have added a rough sketch of similar American constructions to show the similarity.

139. These traps are necessarily constructed along the coast especially between islands where there is a good current up which the fish stream ; at right angles or so to the coast is run a leader (guide or scare) net or bamboo wall, which may be hundreds of fathoms long ; on striking this obstruction, the fish turn out seawards along the guide net and find themselves again obstructed by the trap proper or pound ; if they try to avoid this there are "barrier" or "heart" nets which insensibly turn them back again towards the trap ; eventually they

FIGURE I.



DAI-AMI.

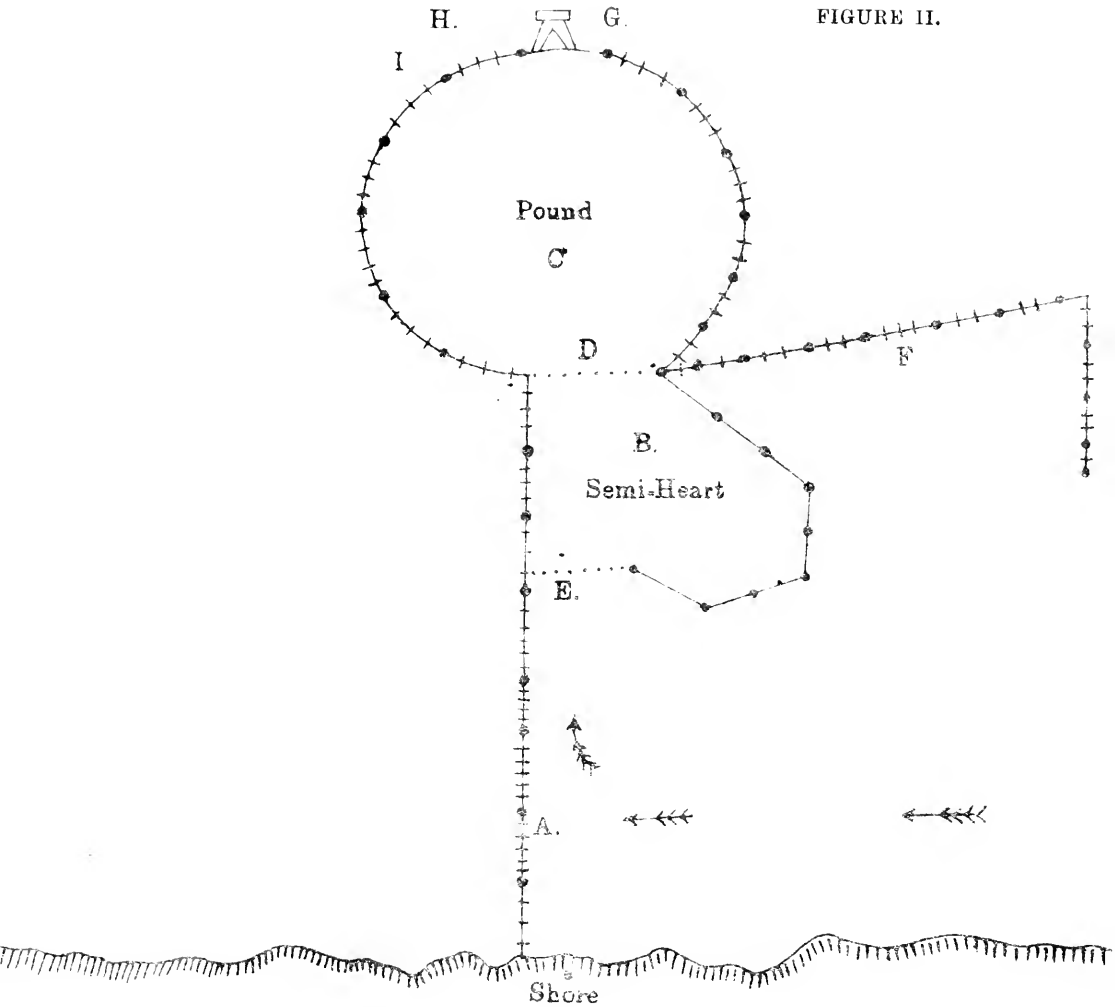
Pound Net showing its actual Construction.

- A = Leader of indefinite length: often of straw ropes.
- B = Baffling net.
- C = Pound proper: apparently the bottom is also covered with net.
- D = Net lying along the bottom, raised on entrance of shoal.
- E = Watch tower.
- F = Bamboo or wooden floats anchored by heavy stones.

Taken from a Japanese Exhibition Catalogue.

(See end of para. 138, page 64.)

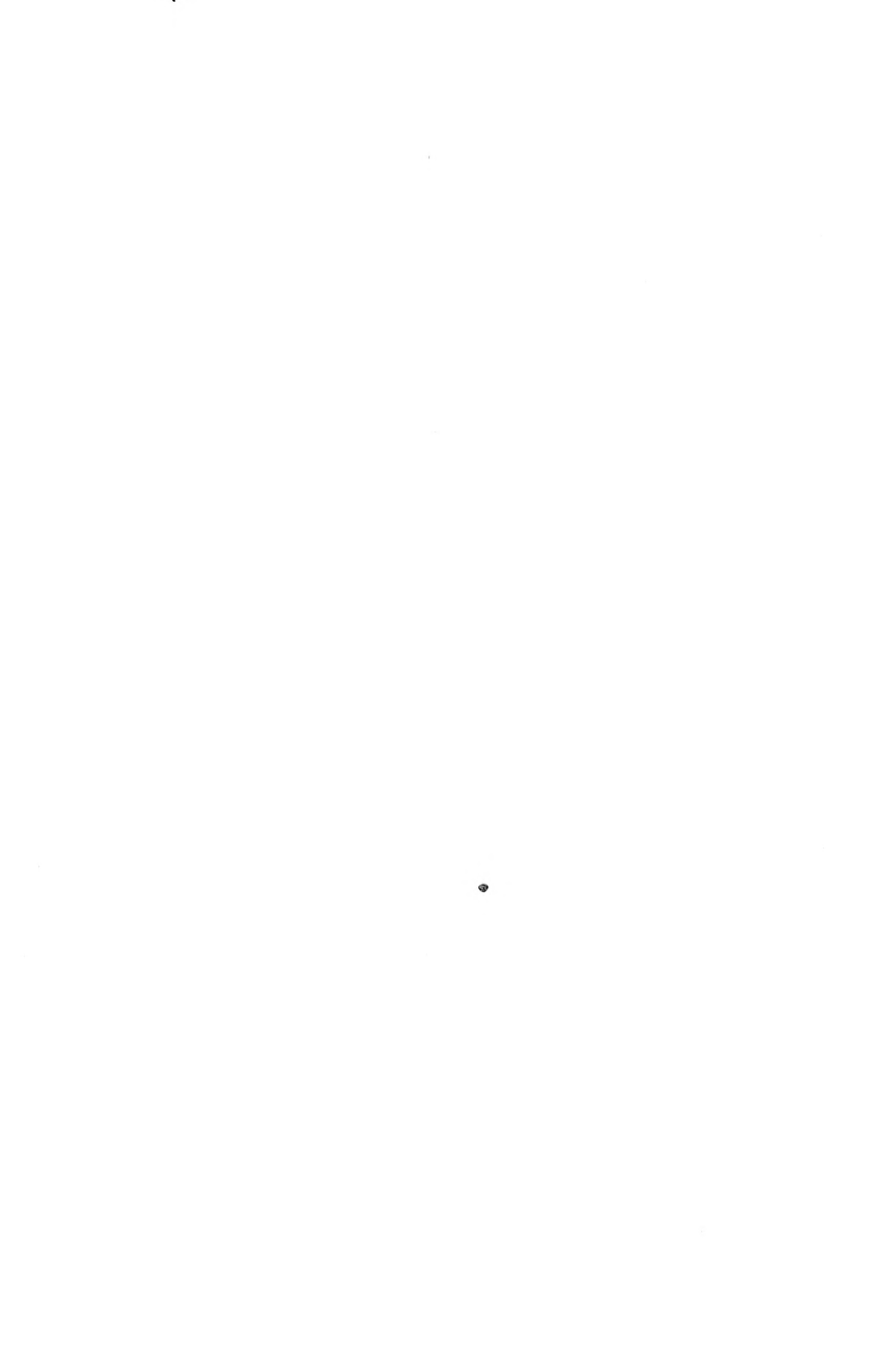
FIGURE II.



A Japanese Trap-net or Pound-net for tunny, yellow-tail, etc.: of great size: often, hundreds of fathoms long from shore to pound.

- A = Leader or guide net.
- B = Semi-heart to turn fish towards C.
- C = Pound proper.
- D = Net lying along the bottom which is raised when a shoal enters.
- E = Do. do. do.
- F = An outer barrier to baffle fish which at first escape the passage at E.
- G = Watch tower.
- H = Large floats anchored by heavy stones.
- I = Small floats.

N.B.—The net is not drawn to scale; the leader A is usually much longer in proportion to the pound C, etc. The sketch is taken from a Japanese Exhibition Catalogue, as a specimen of many similar ones seen in actual use. For a somewhat similar net, in elevation, see Figure I.



(See end of para. 138, page 64.)

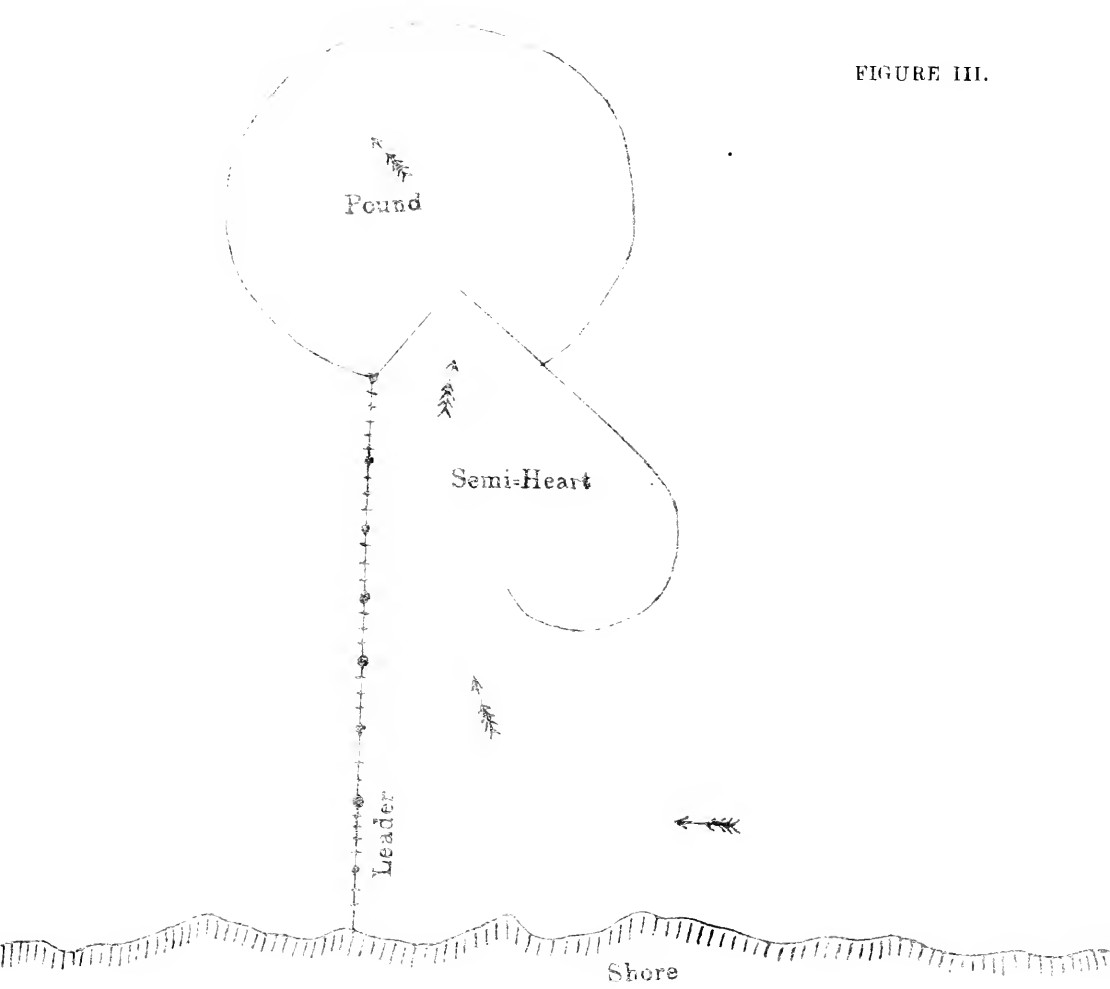


FIGURE III.

Sketched on the shore of Massachusetts, U.S.A., and introduced to show the similarity in design between traps indigenous to America and Japan. The sketch is not drawn to scale as the leader may be of any length.

The floats shown on the leader by dots and dashes are, of course, continuous, though not so shown, for the whole length of the net both pound and heart.

enter the pound by a narrow entrance usually formed by two converging walls of net or bamboo which project into the pound ; the tendency of fish being to swim along an obstruction and not to turn backwards at sharp angles, they simply swim round and round the pound which is often of labyrinthine construction so arranged that the fish get more and more deeply involved. In many traps of large size used for catching shoals there is a watch tower from which a signal is given when a shoal has entered, whereupon boats hurry up and close the pound by a net which was lying along the bottom of the entrance. In some traps the pound or part of it is netted along the bottom, the walls and bottom forming one continuous net ; when the fish are driven into this area and the entrance closed, the net is lifted beginning at the entrance so that the fish are brought gradually to the surface at the further or closed end of the net. It is extremely difficult to describe or to understand from description the building and working of these nets, but careful inspection of the plans with the lines and arrows marked thereon will help.

140. These constructions are common in parts of the East, in the Mediterranean, and in the United States of America ; but do not seem to be known in this Presidency : they have the advantage that, once erected, they catch fish automatically ; on the other hand, they are costly to build and repair. When made of nets they are necessarily secured by a number of powerful floats, *e.g.*, closed tubs, bundles of bamboo, etc., and keep at the level of the water, rising and falling with the tide ; at foot they are well weighted, usually with large stones. When made of bamboos, reeds, etc., they are so built as to project out of water at high tide ; strong posts or piles are driven deep into the ground at frequent intervals, and anchored by guy ropes attached to anchors or heavy stones ; between these piles is a closed lattice work of reed, bamboo, or straw. The guide or scare nets may be of wider mesh than the pound itself as they serve simply to scare the fish towards the pound.

Of the catches of herring in the Hokkaido to which herring shoals come in great abundance in spring, it is said that after the introduction, some 40 years ago, of the fixed trap net, the catches became so enormous that they could no longer be utilized merely as food, and so the fish guano and oil industries came into existence. One of the matters for Madras consideration will be the expedience of introducing or permitting these fixed nets in suitable localities.

As mentioned above, the positions of all such nets or weirs, as well as of other classes of fisheries are carefully mapped and registered in the county (taluk) offices for reference in case of disputes, etc.

141. Numerous small traps known in French as " nasse " for lobsters, prawns, etc., are also common ; they are usually coneshaped and funnel mouthed ; the elastic reeds forming the funnel converge

together within the trap so that though a fish can pass easily through the narrow opening at the small or inner end of the funnel it cannot return, and finds itself impounded in the cage; bait is placed inside the cage to attract the fish. These, of course, are common all over the world but not in Madras waters, except occasionally and of small size.

142. *Lines and hooks.*—Nothing special requires note except that the long line with many hooks is very much more used than in this Presidency, though the lines do not attain the gigantic length of British lines because of the small size of the boats; some, however, run up to 1,400 fathoms or about $1\frac{1}{2}$ miles. Barbless hooks are frequently used as they injure the fish less and permit it to live longer after capture. It is also said (Dr. Kishinouye) that hand lines are used in Japan to the enormous depth of 300 fathoms, a depth not paralleled, I believe, even in the Norwegian cod fisheries where 200 fathoms are mentioned as the limit.

143. *Noteworthy methods in catching.*—As on the coasts of France, Spain, and Italy scattered bait is largely used to attract fish; in European countries a quantity of surface bait is used to bring up the shoals of sardines from the depth, while in Japan sardines, fresh or salted, are scattered frequently on the banks frequented by yellow-tail in order to keep the fish on the spot. I have seen no such use of bait on the Madras Coasts, though it is possible that sardine shoals might be brought within reach of the seine by some such practice.

The use of torches on dark nights to attract fish, *e.g.*, sardines and mackerel, is very common; this method is also used on Madras Coasts. An ingenious mode of using the torches is by suspending a large rectangular net, 200 feet \times 60 feet, slackly by a dozen or more ropes from four boats; two boats with torches then row into the area above the centre of the net; when mackerel have gathered to the light, the boats haul in the ropes and enclose the fish in the bag thus formed while the torch boats row out of the area. At the Milan exhibition (1906) in the Austrian Court, powerful lamps (kerosine or acetylene) were shown having reflectors above them, so that strong beams of light are thrown into the depths and thus attract fish like moths to a candle.

For examining the bottom of the sea, *e.g.*, in catching the sea-ear (*Haliotis gigantea*), the use of a water glass is common; however clear the water, it is impossible to see the bottom if the surface is ruffled; by using a wide wooden tube with glass bottom thrust below the surface, it is easy to inspect the bottom at 4 or 5 fathoms and to use the spear or dredge.

144. One of the most useful implements that I saw was the live cage or chest for preserving fish alive until brought to shore or until needed. In paragraphs 7 and 13 of my West Coast Report this

subject is alluded to and suggestions made. In Japan I saw bamboo cages, double coned in shape like a short very stout torpedo, with a trap door in the upper part; these are carried on the boats when going out to fish, and when fish are caught the cages are placed in the water and the live fish put into the cages by the trap door; the sea freely passes through the interstices of the cage so that the fish are readily kept alive; the cages are then towed homeward behind the boat. There were also wooden chests perforated with auger holes and somewhat coffin-shaped; these were either to be towed behind the boats or used as floating chests in the harbour. I am not aware whether these cages are common, but they are in use and similar cages are found in the South Seas. In the Milan and Marseilles Exhibitions (1906) I saw models or photographs of many of these chests, some identical with the double-coned bamboo cage of Japan, from many countries; Italy, France and Turkey showed willow cages precisely similar in design; Germany and Austria showed wooden perforated chests either coffin or closed canoe shaped, the former being rather for storage, the latter for towing behind a fishing or other boat. The matter is specially alluded to here since there is not the slightest reason why such bamboo or rattan double-cone cages should not be used in Madras waters so that the fish, which are mostly alive when caught, might be kept alive not only to the beach but, if there were no immediate demand or the curing yards were shut, till required; fish tainted by the time they reach the shore might then be almost unknown.

THE PREPARATION OF VARIOUS AQUATIC PRODUCTS.

145. The universal use of fish as diet, the necessity for utilising the sea to the utmost owing to the small arable area and the absence of flesh food obtained from the land, and the inability hitherto, from want of quick communications, to carry fresh fish rapidly inland, have begotten a considerable variety of prepared aquatic products both animal and vegetable. To the ancient methods are now added many modern modes of preserving and preparing fish products such as canning, smoking, and pickling, etc., as mentioned *supra s.v.* "Experimental stations." Some account will be interesting and suggestive in a Presidency where almost the only method hitherto of preserving fish has been that of rough salting and sun-drying; the exception is the method of pickling mackerel in Cochin (paragraph 22 of my West Coast Report) and the preparation of smoked bonito strips in the Laccadives. Certain well-known and useful Western methods such as pickling (in brine) have not been practised till of late in Japan; but there are many methods and preparations of novelty and interest.

146. *Shark flesh paste*.—Shark and dog-fish are caught in vast numbers on our coasts and the flesh is readily eaten. In Japan it is

universally consumed especially in the preparation now under description; it is obviously capable, as will be seen, of considerable variation by the addition of condiments—salt, pepper, turmeric, etc.—which would also improve its keeping capacity. The flesh of the shark—or other white-fleshed fish—having been freed from bones and skin, is cut rapidly into shreds which are then pounded in a wooden or stone mortar with a wooden pestle till the whole is reduced to paste; during this pounding a little salt is usually added, and when inspecting the process I was told that no other condiments are added; Dr. Kishinouye, however, mentions flour, sweet wine, white of egg, and a solution of sacchariferous algæ, but this may refer to the paste of white-fleshed fish other than shark or to the practice of other localities.

The paste is then made into semi-cylindrical or other conveniently shaped rolls upon slips of wood, like rolls of butter or curd-cheese; these are then steamed for 20 minutes in a close stove over boiling water; the result is a pure white product which will keep for several days even in summer. This paste is not a delicacy for the rich but is cheap and in general use, and may be seen in all the fish shops of a town; slices of it seemed—*experto crede*—to be invariable additions to the broth served at meals in Japanese inns.

147. *Dried and smoked bonito (Thynnus pelamys) and tunny (Thynnus sibi), etc.*—This excellent product (katsu-bushi) might well be introduced into India as it is economical in use and will keep good for years; the above fish are those generally prepared by this method but other large dark-fleshed fish such as salmon, are, it is said, so treated. The fish is opened and boned and the flesh cut longitudinally into strips or wedges; these are boiled* (or steamed over boiling water, when the fat drops into the water and is collected), and then placed in trays for drying in the open air; the trays are of wood with open-work bamboo bottoms so that air can freely pass under and around the wedges.† When partly dry they are removed on the trays to the smoking furnace; that which I saw was a simple open slow-combustion furnace burning various woods and saw-dust so as to produce plenty of smoke; above the open top are piled a dozen or so

* The boning and boiling are often done on board the boats when far out at sea.

† In my West Coast Report I alluded (paragraphs 24 and 25) to the defective mode of drying fish and suggested barbecues or, rather, drying tables or “flakes.” It is well-known that fish laid on a hard surface, such as a plank or earth, so that the air cannot get at the underside, readily taints on that side while of course it retains its moisture for the same reason. Hence in all Western countries fish are either hung on scaffolds (Norway, etc.) freely exposed to complete perflation of air, or placed on “flakes” which are rough tables of which the tops are of wire-netting or of some open wood work which allows the air to play over and dry the lower as well as the upper surfaces of the fish. The tables need not in this country be high, and the cost may be trifling. This reform in drying is properly one of the essentials of a good product.

of trays so that the whole smoke is forced to penetrate the various layers of fish. At the close of this process the wedges are a dark chocolate brown and hard; they are then trimmed with a knife and given a thorough final drying on the trays in the open air. At one experimental station there was a simple low temperature (70° to 90° F.) drier for drying these and other fish when the weather was unpropitious. This product is absolutely universal and much esteemed; it is pared into shavings and forms the basis for sauces and broths; in India it would be an excellent addition to the usual curry.* The complete drying and penetrative smoking account for the keeping power of the product; Madras salt fish is never thoroughly dry and goes bad on the West Coast in the rains when Persian Gulf fish, which is much more thoroughly dried, will keep good. This is the secret also of the Norwegian stock fish which is dried on flakes or is suspended from scaffolds for some months.

148. (3) *Dried yellow-tail*.—This is also an excellent but more expensive preparation, and will keep good for a long time. The fish is gutted, soaked for two hours in salt water, boned, and the thick flesh scored with deep longitudinal cuts; it is then placed in salt for about a week, washed, and allowed to dry slowly in the shade for about two months. Fine table salt is then sprinkled over the pieces, which are then wrapped in paper and tightly wound round with a straw rope. Thus prepared and hung in an airy place it is said to keep good for many months. To judge by another account the process is sometimes abbreviated, but good salting, slow drying, and final protection from the air by enwrapping the flesh are essential. Grey mullet are also treated in this fashion.

149. *Boiling in Soy*.—Soy is the well-known Japanese sauce without which no meal is complete; it is made from fermented wheat, soy beans, and salt; a favourite method of preserving small fish is in this sauce whether in air-tight tins or not. It requires an education to like fish so prepared and the recipe is mentioned merely to suggest that in this country fish might be preserved in a variety of ways suited to the particular tastes of the consumer, whether with tamarind, chillies, curry stuffs, or the like. The soy, however, adds nutriment as well as flavour, and, in itself, is an excellent condiment.

150. *Fish pickled in vinegar*.—This is an ancient Japanese product of good character and taste; at Milan Exhibition there were special products prepared for the export trade. The method would probably suit this country also; vinegar of good quality is made readily and cheaply, whether from alcohol, molasses or toddy, and fish may be preserved for some time if cleaned, covered with boiling vinegar which may also be spiced, and placed in bottles, jars or kegs.

* A somewhat similar product is said to be prepared in the Laccadives and is occasionally imported into and used in the south of this Presidency.

Preserving in fermenting rice and in saki lees.—These are merely mentioned to show the variety of preserving methods in use.

151. *Canning and other Western methods.*—The Japanese, however, have not contented themselves with old methods, and have developed, partly by the work of their experimental stations, partly by the energy and pushing and progressive nature of the people, a canning industry which is already of considerable dimensions and promises a large and early development. The business was introduced as follows; in 1877 at the Experimental Laboratory started for the encouragement of agriculture, experiments were made in canning fish after the European fashion; next year several Japanese attended and studied the Paris Exposition (1878) and there learnt the correct process; on their return they established canneries at Tokyo with machines bought in Paris under the orders of Government. About the same time the so-called Colonial Government in Hokkaido also started experiments and engaged two Americans who taught the industry to pupils by whom a factory was speedily established; others afterwards started. At Nagasaki a Mr. Matsuba learned the business from a Frenchman there, and opened a cannery which to this day is doing good business in excellent products. Later on, the China-Japan war proved a great stimulus owing to the demand for canned goods, since which time the industry has been progressing and received a further development during the recent war. At the St. Louis Exposition in 1904, eleven experimental stations exhibited a variety of such goods, one (a mere Fishery School) being prepared to supply 50,000 cans of prawns annually, while it mentions “many canneries in these localities where a plentiful supply” can be obtained. Many private exhibitors, associations or individuals, also exhibited goods such as smoked salmon, red herrings, mackerel, etc., in the preparation of which the newest machinery, including plant for solderless cans from Hamburg, was used. At Milan numerous companies and individuals (altogether 40) exhibited excellent goods, five alone exhibiting sardines in oil, besides many others which showed preserved tunny, mackerel, crustacea, pastes of sorts, salted roes, and so forth. Olive oil is imported for the best goods, a rebate of the import duty being given by Government on all exported goods in oil, but the Japanese are already considering the possibility of growing this oil, while, as in America, other oils will also be used for less superfine goods. As already stated, a large company with a capital of from 45 to 75 lakhs of rupees was being formed when I was in Tokyo to develop the industry, chiefly for export. Wet pickling in salt is now being also adopted, chiefly by the example of the experimental stations, and at the Milan exhibition I saw stock fish (cod) of the Norwegian character prepared by four Japanese in the Bay of Okhotsk and shown by a private exhibitor, as well as smoked (red) herrings by three exhibitors, and so forth. The pushfulness of

the Japanese loses no opportunity of ascertaining the world's needs and of trying to supply them.

152. *Fish Oils*.—These are whale oil, cod and cod-liver oil, shark, and dog-fish, herring and sardine oil. Herring oil is easily first in quantity, being above one-half of all oils; it is almost wholly produced in Hokkaido where the herring is steamed and pressed; sardine oil takes the next place, about one-fifth of the total production, cod and shark oil together yield another fifth, and the other oils a tenth. Oil is only refined for home use; the bulk of the oil is exported unrefined. The processes and plant in use are of modern character and the product of an excellent quality; at the Milan Exhibition and in the Agricultural and Commercial Museum at Tokyo I saw many exhibits of the best quality. One Yokohama firm, founded in 1893, which has now many international medals, has a factory covering over $2\frac{1}{2}$ acres with 2 large engines, 20 cooking furnaces, 30 vats, each of 10 tons, for containing the oil, 40 filters, 7 hydraulic and 27 hand presses, 4 depositing vats holding together 350 tons, and employing 95 men and 48 women; its exhibits at Milan were excellent. The crude oil is bought from various places and is refined at the factory or exported: its total annual output averages 10,780,000 lb. Another firm (up-country) established in 1899 deals in whale oil: its boats catch whales in Korean waters, and it has three factories and several receiving stations in Korea; their annual produce is said to average a million gallons. There are many other factories doing a good business. The official statistics of fish oil production seem defective as to total produce; the export however for 1904 seems to have been about 16·7 million lb., value about Rs. 12·7 lakhs; in 1900 it was 16·8 million lb., worth 13·6 lakhs. There is evidently a field for industrial enterprise in Madras.

153. *Manures*.—This is a most important product, fish fertiliser being the most highly valued of all manures in Japanese agriculture (see Agricultural Note). The herring and sardine are the fish almost solely used, herring being enormously in excess of sardine now that the latter fish is more extensively used as food, whether fresh, salted, dried or canned. The herrings are chiefly caught on the coasts of Hokkaido, the summer herring being much fatter than the spring herring which is in spawn. The oil is extracted by steam heating and pressure, and the scrap is then sent out as manure. The annual product is about 110,000 tons, of which nine-tenths to four-fifths are herring and from Hokkaido; the value is from Rs. 112 to Rs. 120 per ton or 20 to 18·7 lb. per rupee, the latter price being the latest (1904) ascertained. The productive as well as pecuniary value of this manure, chiefly nitrogenous but also largely phosphatic, as proved in Japanese agriculture (see Agricultural Note) which consumes practically the whole product, strongly commends its development

on our own coasts and its use on our own fields so sadly defective in the above, but especially in the nitrogenous constituents. Our sardine and mackerel shoals provide abundant food and manure, if properly sought after and taken. Still better, however, would it be to supply the fish mainly as food to the people and thence indirectly as manure to the fields; this is happening in Japan where the demand for fresh and dried fish as food is causing a short output in the fertiliser product; but then, the Japanese take care that after all it is given indirectly through the excreta to the soil; while, in addition, large quantities of bean cake and some fish guano are being imported from Manchuria, etc., and from Siberian coasts.

154. *Other products.*—There is not only a large home demand for various aquatic products but China provides an almost illimitable market in which Madras already shares to some extent but might conceivably develop its trade. Such are shark fins, fish sounds, bêche-de-mer, cuttle fish, ear-shell (*Haliotis*), various shell fish, several preparations of seaweed, iodine, pearl-shell and coral; pearls will be described *s.v.* "Pisciculture." Shark fins and fish sounds are already considerable articles of Madras trade, especially from the West Coast, and need not be further alluded to though developments will be possible with increased catching power; bêche-de-mer also, but, as mentioned below, it is possible that this may be developed by cultivation as is now being tried in Japan. The *Haliotis* is a valuable product both for flesh and shell; the former is salted, boiled, dried in the sun, and exported to China; the beautiful iridescent shell is largely used for ornamentation and is sent in vast quantities to England, Germany, etc.; the export of shell to England alone averaged in the decade 1890–1900, 340,000 lb. valued at Rs. 52,000. Cuttle fish (*Sepia*) and other squid are dried and largely exported to China, though consumed in quantity at home; prawns are boiled, shelled, and dried, and mostly exported to China where the market is practically illimitable; the oyster (see "Pisciculture") besides being eaten fresh is also dried and exported to China; it is now being canned. The razor-clam (*Solecurtus constricta*) is cultivated in immense quantities, its flesh boiled and dried and sent to China; so also the flesh of the mussel. The *Arca granosa* is also cultivated and exported in vast quantities to China. A curious cultivated product is the common barnacle (*Balanus*) which is cultivated on bamboo collectors on muddy tidal flats; the annual yield is stated as 400,000 bushels worth Rs. 45,000, the product being used as manure. Frog skins are a large article of trade, and being of delicate texture, the leather is used for fancy articles.

155. A very distinctive feature in the Japanese economy is the great use made of sea weed or, as one should say, of marine vegetation, for the word "weed" too often obscures or even impugns the value of aquatic and other flora. The Japanese marine flora are particularly

abundant and of various characters owing to the considerable range in latitude and temperature ; at all times they are scattered on the beach, but after storms they are piled up in masses. But the Japanese do not content themselves with what is sent them : a large number of boats are constantly engaged in dragging the algæ from the bottom, even at considerable depths, with implements which experience has shaped ; yet again, not content with the natural harvest they extensively cultivate these marine crops.

156. The greater part of the marine vegetation is consumed as food, and among sea flora the "Laminaria", often of huge size, take perhaps the first place ; under the general name of "Kombu" they are of universal use in the Japanese dietary though they do not commend themselves in general to European palates. The edible is cut up into small pieces, heated in water, and served as a condiment in broths, or after being sugared or salted is taken with various fish. One particular species is said to be an excellent substitute for tea with a particular pleasant fragrance of its own. The importance of the article may be judged by the fact that most of it is used at home and is only exported "to some extent" to China ; yet this export, on an average of ten recent years, annually amounts in a dry state to 57,644,000 lb. valued at Rs. 12,82,550. It is an industry of long standing and occupies many thousands of men, women and children. The total annual value cannot be less than twice the above export value. It was stated in a paper of 1894 by Mr. K. Ito that as the manufacture had become inferior Government intervened and made a rule that all Kombu must be inspected and branded before it is exported : *cf.* the work of the second class of associations, Suisan-kumiai, *supra*, paragraph 118.

157. Another edible sea-weed is the Amanori (*Porphyra tenera*, laver) cultivated in numerous places, usually in shallow flats at the mouths of rivers where the water is not very salt, but especially in Tokyo Bay where the first objects that strike the traveller's notice as he skirts the Bay in the train, are the rows of faggots or fascines of bamboo and brushwood sticking up from the mud on which the weed grows ; these are placed in position in autumn and the crop begins in January and goes on to late spring. Dr. Smith states that the area in Tokyo Bay leased from Government was, in 1901, as much as 951 acres and gave a crop worth Rs. 4,44,000 or Rs. 466 per acre ; in 1903 the same area gave just double that value or Rs. 9 lakhs and Rs. 930 per acre ; while Professor Mitsukuri gives the value in Tokyo alone as above Rs. 15 lakhs. As the industry is found in many other places the gross value must be well over Rs. 20 lakhs, and the product in food by no means negligible. The plant grows rapidly on the collectors, is gathered from time to time, washed, mined, and pressed into thin brown sheets about octavo size ; these are then stuck upon bamboo frames inclined to the sun, and when dry are bundled

and sent to market. These are said to be slightly roasted when used and to give a desirable flavour to other foods. It is used in many ways, such as minced and served in broths; a favourite recipe is the well-known "Sushi" or sandwich composed of boiled rice mixed with fish or pulse flavoured with vinegar and wrapped up in a sheet of nori. An equally common recipe is to serve it with hot rice and Shoyu (Soy) sauce; it is said to be an excellent appetizer. It does not, however, seem to keep well in the hot weather, but may be dried and canned when it will keep indefinitely.

158. A very important product is that called in commerce agar-agar or vegetable isinglass, which is the product of a weed called *Tengusa* (*Gelidium*) and is known as Kanten. The weed is dissolved in boiling water which is then strained and allowed to cool when it solidifies on cooling. This is a whitish translucent substance sold in thin sticks and bars, and is used for bacteriological cultures, for clarifying Hollands, etc., for stiffening cloths, and for food like true isinglass. Cooled with ice and sweetened, it is said to be the most delightful of sweetmeats to Japanese palates. If dissolved by first soaking and then boiling in sweetened water it forms a jelly to which, before it is set, various essences and coloring matters, especially yellow, may be added. A good deal is used in Japan but much is exported to the value, it is said, of over Rs. 15 lakhs annually, to European countries, India, and the United States of America. The largest output is under the control of a number of persons in several provinces who have united into a trade association with head-quarters at Osaka; it is not a manufacturing company but an association as described above in which each individual manufactures on his own account, but the product is lumped and sold by the association which is thus able to place it to advantage and largely commands the trade; the principal manufacturer makes above 100 tons per annum. There are other similar associations but of smaller size at Suwa where, in 1902, above 443,000 lb. were manufactured by various members.

159. Another important weed is that known as *Funori* (*Gloiopeltis*) used as stiffening paste or size for woven fabrics, in putting on wall paper, and otherwise; mixed with lime and sand it forms an excellent cement or stucco. The size or glue is easily made by cutting the weed into moderate sized pieces, boiling it for a short time, and then filtering the mass; the filtrate is the desired substance. The weed grows naturally but is cultivated in certain localities by placing blocks of stone in the sea at favourable spots to which the alga attaches itself; the annual amount has been estimated as 2,425,000 lb. valued at Rs. 5,40,000. Here also, the leading manufacturers have combined into an association, though it is spoken of as temporary.

160. *Iodine*.—Iodine is obtained largely from various algæ including the *Laminaria*; until of late, it was imported from Germany, but

research has developed the industry so that not only does Japan now supply herself with all that she requires but exports her produce. In a recent Fishery Trade paper it is stated that since the Japanese have entered the iodine business the article has dropped more than 40 per cent. in price in the world's market. The proper classes of weeds are gathered, dried in the sun, burned, the ash dissolved and filtered, and the filtrate evaporated; from this product the iodine is prepared by the usual chemical process. Secondary products are common salt, sodium sulphate, potassium chloride, and sulphur.

161. Seaweeds in general are greatly used as manure; in many places I have seen great heaps collected on the beach and met loads on hand-carts going to the fields; though not very valuable it is of considerable aid to seaside farmers.

162. *Coral*.—Formerly this was little worked though banks were known; this was due to prohibitory rules, and though coral was secretly fished, yet most of the coral ornaments used by the Japanese ladies before 1867 were imported from Italy; since the Restoration (1867), however, coral fishers began to dredge the banks, several of which were soon depleted; others have since been discovered and what was formerly an insignificant industry is now an important one especially along the southern coast. In 1871 coral imports weighed 3,600 lb. and were valued at Rs. 70,000, while the exports were *nil*; in 1877 exports began, but till 1887 never exceeded Rs. 15,000 in value, while imports rose in value to Rs. 1,85,000 in 1883, from which time they declined as exports rose, so that in 1902 exports were no less than 55,101 lb. valued at Rs. 6,54,200, while imports were almost *nil*. The total value of the coral fished was said in 1904 to be about Rs. 9 lakhs which must be a conservative estimate, considering the quantity exported. The figures and facts are given to show the rise of an industry, as in the case of iodine and pearl buttons, from nothing to a very large figure, and the gradual substitution of exports for imports. The value of the coral per pound ranges from a special class which may touch Rs. 340 per pound to a class valued at only one rupee or less. The precious coral has been found on the shores of the Rámésvaram island of this Presidency, but whether it exists in quantity on workable banks is a question only to be decided after careful exploration.

The fishing in Japan is very dangerous; for several months it is too stormy and in others risky, while the chances of profit are speculative as may be judged from the varying prices of coral. The boats are mostly open, though some are half decked with crews of from 4 to 8 according to size. The dredge is simply a strong rectangular net about 5 feet square with a 2½ inches mesh from knot to knot, hanging from a bamboo; to the lower edge are attached tufts of old netting and, of late, tufts are attached to the body of the net. The net tears

off the branches of coral while the tufts collect them; it is operated by allowing the boat to drift with the current over the bank, and a good deal of skill is necessarily required. The coral called Momoiro-sango (*Corallium elatius*) is the most valuable and possesses a variety of delicate colours, while the next valuable (Akasango, *Corallium japonicum*) is very seldom anything but red. The exhibits at the Milan exhibition were of great beauty and value whether as specimens in the natural state of the most delicate gradations of colour from ivory to pink, or in worked up ornaments.

163. *Pearls*.—These will be mentioned *s.v.* "Pisciculture".

164. *Pearl shell*.—This article is not only largely in use in Japan, *e.g.*, in inlaying lacquer and many other forms of ornamentation and industry, but is exported in vast quantities to China and to European countries. The chief shells are the pearl oyster (*Avicula margaritifera*), sea-ear (*Haliotis gigantea*, *iris*, and *splendens*), Yako-gai (*Turbo obearius* or *marmoratus*), and Takase-gai (*Trochus niloticus*). The pearl oyster shell is too well known to need any description. The *Haliotis* is a magnificent shell and is annually exported to the weight of about a million lb. valued at upwards of Rs. 1,50,000, of which a third goes to England. But Japan is not content with exporting the shell in its natural state for others to work up, but has developed in the last few years a large pearl button and stud industry in which the above shells, chiefly pearl oyster and *Haliotis*, are used for the manufacture, from the small shirt button to the large iridescent button an inch in diameter; the total weight of shells was said in 1904 to approach 4 million lb. At the Milan Exhibition there was a large show both of the shells and buttons, and the annual produce of buttons alone was valued at above Rs. 2,25,000; the manufactured articles are exported to the chief centres of Europe and America, as well as to India and other eastern countries. The industry is of the simplest character and is one of those requiring the minimum of technical knowledge and skill and the smallest capital; shells, a few crown drills, saws, and polishing apparatus, a little care and skill in cutting the shells to prevent splitting and in the drilling and polishing, are almost all that is needed. Not only buttons and studs (the latter cut from the thicker parts of the shell as cylinders which are then shaped) but slips for fans, knife handles, etc., are also largely cut, while much is used in inlaid work.*

Many shells, even the humble cowrie, lend themselves to a species of cameo work by cutting down through the outer shell to the inner which is often of very delicate hues and colours.

165. The following prices of manufactured goods may be useful as an indication of possible trade: they are mostly those quoted in

* On the Australian coasts and in the Pacific generally, the *Haliotis*, like some other univalves, produces very good pearls in considerable numbers. Whether this is so in Japan I omitted to ascertain.

1904 and may now be slightly different. The word *ken* means district or prefecture, and *gun* means county or taluk.

		RS.	A.
Experimental station ...	Sardines salted in barrels : per kit of 20 lb. fish delivered at Kobe.	3	0
		4	2
Shinojima ...	Sardines in oil : per case of 100 quarter tins at Kobe (5 grades).	15	0
Aichi-ken ...		18	0
Experimental station ...	Mackerel salted in barrels : per $\frac{1}{2}$ barrel at Kobe.	27	0
Susakimachi Takasu-gun ...			
Kochi-ken ...			
Experimental station ...	Anchovies (Sardines) salted : per kit of 20 lb. at Yokohoma.	3	5
Katsu-ura ...			
Chiba-ken ...			
Fishery school ...	Canned prawns : per case of 48 one pound tins at Kobe	17	0
Nakanoseki ...			
Yamaguchi-ken ...			
Experimental station ...	Grey mullet in oil : per case of 50 one pound tins.	18	0
Nakakasai-mura ...			
Kagawa-ken ...			
Experimental station ...	Mackerel in oil : per case of 100 tins (1 lb. ?) at Kobe.	24	0
Matsuyama ...			
Yehimé-ken ...			
Experimental station ...	Pickled eels in jelly : per case of 50 tins (1 lb. ?) at Nagasaki.	16	8
Noboritate-mura ...			
Kumamoto-ken ...			
Experimental station ...	Canned clams : per case of 48 one pound cans at Kobe.	12	10
Hamajima ...			
Miye-ken ...			
Fishery school ...	Devilleed crabs : case of 48 one pound cans at Kobe.	23	6
Ushitsu ...			
Ishikawa-ken ...			
Experimental station ...	Fish pickled in vinegar : per 3 dozen bottles at Kobe—		
Kushimoto ...		Pagrus	18 2
Wakayama-ken ...		Prawns	23 4
		Mullet	18 12
U. Nagashima ...	Green turtle soup at Yokohoma, per 1 lb. tin.	0	12
Chichijima ...			
Bonin Island ...			
Noshiro Industrial Association, Noshiro ...	Red Herring : per case of 5 dozen tins each holding 12 fish at Yokohoma.	75	0
Akita-ken ...			

G. Takahashi ...	...	} Smoked salmon : per tin of 6 fish at Yokohoma.	7	4
Ishikarimachi ...	...			
Hokkaido ...	...			
Takasu Canning Co. ...	...	} Canned mackerel : case of 1 dozen 2 lb. cans at Kobe.	5	6
Futakawacho ...	...			
Hiroshima ...	...			
T. Waki ...	...	} Canned oysters : case of 48 one pound tins at Kobe.	15	0
Otemachi Hachichome ...	...			
Hiroshima ...	...			
Yokohoma Fish Oil Co. ...	...	} Sperm oil per 133 lb. (30 kilos) Ordinary whale oil per 133 lb. (60 kilos).	29	0
No. 1 Zaimokucho ...	...		19	12
Yokohoma ...	...			
(1906 prices) ...	}	Cod liver oil (medicinal), four grades.	25	4	
			to		
				30	0
		Cod oil, four grades ...	11	4	
			to		
				14	0
		Shark oil (various) ...	9	12	
			to (re		
				14	12
		Herring oil (refined), three grades.	12	3	
			8	9	
			9	12	
Herring oil (unrefined) ...	...	...	
Sardine oil (refined), two grades.	11	0			
	and				
		12	3		
Sardine oil (filtered), two grades.	9	12			
	and				
		10	2		
Sardine oil ...	...	...	8	4

PISCICULTURE.

166. Under the head of "Seaweed" the cultivation of certain marine vegetables has been described; the present section will touch briefly on the cultivation of aquatic fauna but only so far as hints may be obtained for Indian use. The pamphlet (1904) of Professor K. Mitsukuri, Professor of Zoology in the Tokyo University, should be consulted for fuller details and illustrations on certain items; the present sketch is derived partly from the above and other pamphlets, partly from personal observation of several piscicultural stations.

167. The animals cultivated are chiefly the carp, eel, grey mullet, snapping turtle, gold fish, salmon and trout, oyster, pearl oyster, the ark shell (*Arca granosa*), razor clam (*solecurtus constricta*), pinna, barnacles, and trepang (*bêche-de-mer*). Of these the gold fish need merely passing mention as an instance of the skill exhibited in breeding; for centuries, Japanese breeders have shown their skill in modifying the forms and coloration of these fish, which in their hands prove to be almost "plastic material": the extraordinary and beautiful results must be seen, as they may be seen anywhere in Japan, to be appreciated, and from a biological point of view, the skill and the results must be of surpassing interest. Dr. Mitsukuri's instructive pamphlet has many excellent illustrations.

168. *Salmon (Oncorhynchus keta)*.—This salmon abounds in Hokkaido (the northern island), the various rivers being, at the season, full of salmon running up for spawning, but, consequent on the development of communications and industry which followed on the Restoration (1867), the catches became so destructive that the need of conservation and artificial propagation was evident, and the Government sent over a local expert to America to study the hatcheries there; after his return, the Chitose Government hatchery was established in 1888 on the higher waters of the stream and has been followed by 17 smaller ones maintained by private associations with some State aid: there are also a few smaller ones on the main island. The Chitose is a tributary of a larger river up which and its branches, as in other rivers in Hokkaido, the salmon annually swarmed in vast numbers; the hatchery occupies $31\frac{1}{2}$ acres, chiefly, of course, ponds in which the fry are reared till liberation, with an annual output up to 15 million fry: all stations together probably liberate between 35 and 50 million fry annually. The system is adopted bodily from America and will therefore not be described here, nor would such hatchery at present be useful in this Presidency; the points for notice are the rapidity with which a river fishery, especially of anadromous fish such as the salmon (and hilsa) may be destroyed by overfishing, the promptitude with which Government noticed the destruction of the fishery and adopted measures for its rehabilitation, and the readiness with which private associations followed the lead. It may be mentioned that so early as 1876 a Government official, seemingly on his own initiative, had studied fish culture in America and started experiments; apparently he was a little before his time as not much came of it except the trout mentioned below. Trout have also been successfully hatched, but seems to have been little successful except that at Chuzenji near Nikko the lake has been well stocked.

169. *The edible oyster*.—As in ancient and modern Italy, so in Japan, the oyster has long been cultivated with great success and though at present the Indian does not care for this mollusc, yet since it provides

an easily grown and most nourishing food and as, in any case, its flesh can be exported either dry to China, or canned to other countries, and as the oysters of this Presidency are good and can probably be developed in hundreds of places with great success, the subject is here adverted to, but it is hoped to deal more completely with the subject in future reports where suitable localities and various methods will be mentioned. The most notable place in Japan is at Hiroshima, where the sea is usually quiet and where large areas of the space between high and low tide, which here runs out to a great distance, is lotted out into thousands of plots each leased by Government, on payment, of course, to persons whose business is that of oyster culture. An official report states that the area is 24 miles in length and that the locality is favoured by abundance of sweet water from rivers, plenty of food, a quiet sea, a wide area exposed at every low tide, and suitable bottom. There are several local methods but the principle in all is the same, viz., the planting in spring (spawning season) of "collectors" which are branches of bamboo, etc., usually in small clumps of 5 or 6 each which are stuck into the muddy bottom of what may be called the nursery; on these the spat collects and is left to grow till next spring, at which time they are uprooted to give place to a new set of "collectors."* The young oysters are then removed from the "collectors" and taken to the growing ground (ikeba) where they are left till the cold weather of their third year, when they are (sometimes but not always) again removed to an enclosure or maturing ground whence they can be selected for market. In some cases the oysters are left for about 20 months only on the original "collectors" and are then sent to market.

Great pains are taken to keep the beds perfectly clean and it is obvious that cleaning and all other operations are greatly facilitated by the exposure of the sea-bottom and oysters at every ebb tide, but there would be no difficulty in dealing with similar areas which though not actually bare are only covered with shallow water.

170. The illustrations in Prof. Mitsukuri's pamphlet show clearly the methods employed, but the most striking is the ground-plan showing the extraordinary way in which every foot of the tidal estuary at Nihojima—the most famous of grounds—is parcelled out: the plan is precisely like an ordinary village survey map of a paddy area, absolutely covered with minute enclosures of which there must be nearly a thousand and, as Prof. Mitsukuri observes, since the surrounding hills are cultivated in terraces to the very top it is difficult

* In the Adriatic the reverse method is practised as shown by models and photographs in the Austrian Court of the late Milan Exhibition; a sort of scaffolding is erected in the tidal water from which hang rows of cords into which are tied rough pieces of stick, small branches, etc.; on these the spat collects and is easily removed at the proper season.

to conceive of a more complete utilization, *more japonico*, of land and water especially as the outside waters are also covered with fishing boats. The mere existence of this complete map of the oyster grounds confirms what is said above (paragraph 111) of the thoroughness with which the Japanese authorities have provided not only against disputes but also for the realization of the license dues both on "enclosed" and on other fisheries.

171. *Pearl oysters (Avicula margaritifera)*.—This culture is believed to be peculiar to Japan and unique in the world; though apparently practised to some extent before the Restoration, and though fishermen have made co-operative regulations against over-fishing, scientific culture and the artificial stimulation of pearl growth are of very recent growth and are due to the zoological knowledge and practical acumen of Prof. Mitsukuri who, after studying the bionomics of the mollusc which is found in many places in Japan, suggested to a practical man the desirability of cultivating it. Experiments were at once begun and the learned Professor then suggested the possibility not only of cultivating the oyster but of stimulating it to produce pearls. The result has been "beyond expectations" and the chief exponent of the system (Mr. K. Mikimoto) has about 1,000 acres of water, nicely sheltered, with three to seven fathoms of clear water where millions of pearl oysters are annually grown and regular crops of cultivated pearls are obtained, some of which are naturally, some artificially stimulated into existence. It is also stated in a paper obtained at the Milan Exhibition that the pearl oyster is cultivated over a distance of 29 miles in the Bay of Ago alone, but apparently the stimulated pearl is produced only by Mr. Mikimoto.

172. As usual there is a breeding ground, viz., shallow areas where spat is found to fall; these are heavily culched with stones of several pounds weight; the spat usually falls in summer, and before winter any stones in very shallow water are removed to at least one fathom of water merely to obviate the effects of cold. In these waters or in the deeper neighbourhood they live for three years, at which time they are taken up, operated on, and replaced at the rate of 8 per square yard of bottom for four years, when they are mature and the pearls are removed. At the recent Milan Exhibition I found from the official report that the annual produce of these pearls on Mr. Mikimoto's farm was as follows: in 1901, 10,465 pounds weight; in 1902, 11,554 pounds; and in 1903, 16,660 pounds. The bulk of these are used in Japan, but in 1902 the declared export value was Rs. 82,500 without counting the value of those privately purchased by tourists which do not appear in exports; in Tokyo in 1906 I saw an ornament of culture pearls bought by a visitor for Rs. 9,000.

173. At present the culture pearls resulting not from the natural cultivation of the oyster but from the artificial irritation set up, are

only half or three-quarter pearls being broadly attached to the nacre of the shell; their size, shape and lustre are however fully equal to those of the natural detached pearl and where the setting does not demand whole pearls they are equally effective; at the Milan Exhibition, beautiful culture pearls very well set and looking like whole pearls, attracted much attention. The defect is due doubtless to the method of stimulation which is the introduction of a foreign body, *e.g.*, a nucleus of mother-of-pearl, or a small natural pearl (the process is of course secret both as to the precise nature of the irritant and the method of its introduction) inserted into the oyster; this being weighty sinks on to the lower shell and is there enveloped by the living nacre. As usual in Japan a special zoological scientist has been employed at the farm for years studying the oyster, and there are hopes of the production of free pearls, doubtless by inoculation with the proper parasite. It is one of the curiosities of nature that the cestode parasite which is probably the irritant cause of most natural pearls and which, as in other cases, demands at least two hosts for its life course, is the immediate product of the pearl oyster's most destructive enemies such as the file fish and the skate; in the latter it finds its full development, and its larvæ, ejected from the skate, are absorbed by the oyster and when possible, sepulchred in pearl. Hence it may result that too great an exclusion of the oyster's natural enemies may develop the oyster to the detriment of the pearl. This seems a field for Indian study, and it is possible that the future of the Indian pearl may lie in secluded bays rather than in the Straits of Mannar infested with every enemy whether the minute boring sponge, the file fish and ray, and other destructive fauna, or the mill-race currents which sweep through the straits and smother the beds with sand. It is hoped hereafter to mention localities for such cultivation; meanwhile local suggestions would be most acceptable.

174. *Arca granosa*.—The cultivation of this shell is worth mentioning: the account is from Prof. Mitsukuri's pamphlet. Here, as in the case of the edible oyster, the flats exposed by the ebb tide which falls some 6 feet are utilized, and the value of associations is shown by the fact that when cultivation was begun in the sixties of the 19th century it was carried on by separate individuals who soon began to quarrel to the probable wrecking of the new industry; they accordingly amalgamated of their own accord in 1856 into a Fishery association (before the law of Fishery Association was passed); in 1890 this became a Joint Stock Company. The annual return on capital on a cultivation of about 830 acres is said to be between 40 and 60 per cent., and the outturn between 75,000 to 100,000 bushels or above 100 bushels per acre. The methods are simple, *viz.*, the raking up from the mud of the tiny shells immediately after the mollusc has quitted its free swimming stage, and strewing these shells, then only about 1/10 of an inch across and averaging about 35,000 to the quart

measure, over the culture ground. In the third year they are of a size such that about 120 will fill a quart and are then exported to China where they are in great demand, or they are kept another year for home consumption; the gradual growth of the shell-fish requires a frequent redistribution so that they may get sufficient food, and this is determined by experience.

175. *Razor-clam (Solecurtus constricta)*.—The flesh of these is dried and exported to China, the demand from which was so great, though the trade only began in 1875, that over-fishing speedily resulted and by 1883 deterioration in the size and quantity of the fish was very marked. Hence the Agricultural Department established an Aquicultural Station at Ariake Bay where the shell was chiefly found, in order to attempt its cultivation, with the result that by 1896 in one part alone of that bay 700 acres were under cultivation, 50,000 bushels of such shell were collected for cultivation, and 112,845 bushels sold for Rs. 1,20,000; the industry is said to be increasing. When collected they are about an inch in length, but increase in three years to about four inches.

176. The culture of the two shell-fish just described is mentioned (1) in view of the possibility of cultivating near Pámban the chank which, a few years ago, produced very far more abundantly and, it is believed, better shells, than at present; the matter is eminently one for an experimental station, the whole cost of which might be defrayed from an increased chank revenue; (2) as showing one instance of the immediate practical utility of such stations especially when founded for definite objects; (3) as showing the ease with which a particular product may be at once exhausted and deteriorated; and (4) as manifesting the rapid growth of a home industry, and of a valuable and new trade in the vast market of China.

177. The *Pinna japonica* is cultivated in only one village and is interesting because it is carried on by the smallest of fisherfolk; there are only 25 houses and each house has a little culture ground not more than 50 by 30 feet! It is an instance of what may be done by poor folk even without scientific experiment or advice; the cultivation is probably limited by the market. Similarly Prof. Mitsukuri was led by his study of the life history of the trepang (*bêche de mer*) the well-known holothurian called *Stichopus japonicus*, to propose particular measures for its protection and cultivation; an expert (Dr. Kishinouye) of the Fishery Department found during his tours that at an out-of-the-way island the people for 100 years had been in the habit of piling up loose stones in the shallow parts of the sea (Prof. Mitsukuri's proposal apparently) and of thus cultivating these holothurians. This product is found in the parts near Pámban (and elsewhere) and its cultivation, if successful, would provide the fishermen with the means of immensely increasing the trade in an

article for which there is an unlimited demand in China to which this produce already goes.

The cultivation of barnacles for manure has been mentioned *supra*, somewhat out of place.

178. *The snapping turtle*.—(*Trionyx japonicus*) a small turtle, seldom above a foot in length and at marketable age only 7 or 8 inches long and weighing little over $1\frac{1}{2}$ lb. This is a very interesting class of culture, and its inception and development owe nothing to the efforts of Government but to private enterprise aided by science; a Mr. Hattori is the originator of the culture being of a family who lived in a suburb of Tokyo full of ponds near the river, and who were long engaged both in ordinary farming and in collecting and selling fish, and in raising gold fish; science was represented again by Prof. Mitsukuri who suggested methods which were of practical service.

As usual the industry began in the smallest of ways, viz., with one female turtle in 1866; even by 1874 there were only 50 and these were kept in a pond of 144 square yards in area. The farm which I inspected is now of considerable size containing a number of rectangular ponds; these are surrounded by a sloping bank at the top of which is a low fence of wooden planking surmounted by a horizontal plank projecting inwards in order to prevent the turtle from escaping; the bottom of the ponds is muddy as this is necessary for turtle life. The eggs are laid in the sloping bank, hatch out after two months and the young ones then proceed to the water, but as they would promptly be devoured by their parents, they are cut off from the pond by a special plank fence, put up after laying is finished, with trap baskets at intervals into which the young find their way and are thence removed to separate ponds.

The best age for marketing is from 3 to 5 years when the weight will be from $\frac{3}{4}$ to $1\frac{1}{2}$ lb., and the value about Rs. 1-4-0 per pound. The animals are fed throughout their life, chiefly on shell-fish which are roughly crushed by a stone roller and thrown into the ponds. It is found advisable to keep carp and eels in the same ponds as they stir up the mud which turtles love.

The matter has no special interest at present for Madras except as a lesson in starting wholly new industries in which science and practice combine to a successful result.

179. *Carp, eels, and grey mullet*.—This culture, which is not of modern origin, is of the greatest interest to this and other parts of India, especially since it has been stated that about 60 per cent. of all the inland fish in this Presidency is of the carp species, and that it is not only easily fed and of very rapid growth but is one of the fish which most successfully survive removal from the water and transportation even as fry. The above three fish are mentioned together

ADDENDUM.

The following extract from the "Fish Trades Gazette" (London) of the 9th March 1907 should be read with paragraph 12 of this Note. It is an excellent illustration of Japanese thoroughness and assiduity:—

"JAPANESE EXPERTS AND CRUMSBY.

Government fishery industry there with own country. These fisheries experiment Nozawa, who holds number of Japanese ideas of fishing from execution of the scheme natives have come sales, packing, and in all its bearings omitted, even to the fish systems. Apart manufacture of fish scope of inquiry, for abounds round the

ADDENDUM.

According to Reports of the U.S.A. Fish Commission, while 3 lb. may be taken as the weight of carp at 3 years of age in *temperate* regions, *e.g.*, Germany, carp will, in the warmer parts of the United States, reach 9 lb. in 2 years; a rate of 1 lb. per month has been recorded and "3 to 4 lb. weight in a year" is given as a general rate. In China properly cared for carp are said to reach 1 lb. in their first year and 25 to 30 lb. at maturity in 5 years. These facts confirm Mr. H. S. Thomas's figures, and it is clear that carp in warm water and with abundant food will give almost incredible yields.

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"JAPANESE EXPERTS AT GRIMSBY.

"At the present time there are in Grimsby two Government fishery experts from Japan studying branches of the fishing industry there with a view of applying similar methods in their own country. These gentlemen are Mr. S. Fujimura, director of the fisheries experiment station, Government of Hokkaido; and Mr. S. Nozawa, who holds a similar office at Sapporo. In late years a number of Japanese students have learned the technical and practical sides of fishing from Grimsby by trawl and by line, and now in completion of the scheme of the Japanese Government these two representatives have come to know more particularly about the system of sales, packing, and general distribution throughout the country. This in all its bearings is a big question to tackle, for nothing is to be omitted, even to the making of kits and boxes and the railway companies systems. Apart from this the curing trade, the salt cod trade, the manufacture of fish manure and fish oil will all come within their scope of inquiry, for practically the same class of fish seen at Grimsby abounds round the coasts of Japan."

for a few weeks, and then earth-worms, crushed shell-fish and all kinds of insect life and some cereal food, usually cooked: in several places I found that the pupae of the silk-worm after the removal of the silk were a principal food, so that in silk districts carp, etc., can be very readily and profitably grown; carp so treated, however, require a special feeding course before marketing. Properly fed carp will grow up to 20 inches in length within two years. Those who know the various temple ponds in this Presidency where fish are well fed and are not killed, know

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180. The first series was near Tokyo, one establishment belonging to the Fisheries Society * (see *supra*), and two others to business firms ; all these are fed by water from the Sumida river which is at that place under tidal influence and supplies rather brackish water. It is said that in this neighbourhood alone about 225 acres of ponds are devoted solely to the culture of carp and supply Tokyo with above 400,000 lb. of fish annually—a quantity which could, doubtless be largely increased ; there is a strong hint for Madras in this suburban fish cultivation considering the immense demand in Madras and the distance from which (*e.g.*, Pulicat) sea fish is brought, often in not too good condition. At the first establishment I was fortunate enough to see the important process of selecting the parent carp and placing them together in ponds for breeding. There is no artificial removal and hatching of eggs, but the ripe fish are simply placed together, about two males to each female, in spawning ponds on the surface of which are floating masses of weed and fibrous matter under which the females lay their eggs which are at once fertilized by the males. Up to the time of spawning the males and females are kept in separate ponds, small and rectangular, for ease of netting, and only 3 or 4 feet deep at most ; at the proper season the ponds are carefully netted, the ripe fish selected by appearance and gentle pressure, and transferred to the spawning ponds ; after spawning they are again netted out and retransferred to their old ponds, the spawn being left to hatch out which occurs in a few days ; or the masses of weed with the adherent eggs are removed to other ponds. The process is therefore of the simplest, and requires no elaborate buildings or plant as in hatcheries ; it is simply nature kept under control. The fish both young and old have, however, to be fed, as the ponds are small and contain little natural food ; moreover the fish are crowded together, at the rate of about one fish of six inches in length per 2 square yards, and so in proportion to size. The food for the newly hatched fry is said to be yolk of egg for a few days only ; after that copepods of various kinds for a few weeks, and then earth worms, crushed shell-fish and all kinds of insect life and some cereal food, usually cooked : in several places I found that the pupae of the silk-worm after the removal of the silk were a principal food, so that in silk districts carp, etc., can be very readily and profitably grown ; carp so treated, however, require a special feeding course before marketing. Properly fed carp will grow up to 20 inches in length within two years. Those who know the various temple ponds in this Presidency where fish are well fed and are not killed, know

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the enormous size to which these fish will attain, as in the old monkish stew ponds, and the number and weight of fish that can be kept in small areas. There is no reason why the practice should not be carried out industrially.

181. The area of the Fisheries Society's establishment was only about 7 acres with three large and eleven small ponds; of these the large ponds aggregating nearly 6 acres were the industrial ponds where fish were grown for market: the others were either experimental or breeding ponds or ponds for maintaining the parents (*reproducteurs*). The three ponds produced last year (it is said) above 20,000 lb. of eels, 23,000 lb. of carp and a large number of mullet, or above 8,000 lb. of fish per acre. This produce is so heavy that there is possibly a mistake in the figures, though the Atsuta statistics (paragraph 183) are equally high, and Prof. Mitsukuri mentions 405,000 lb. of carp as the produce of 225 acres or 1,800 lb. per acre, to which must be added similar weights of eel and grey mullet which are usually grown simultaneously with carp in the same ponds. Hence the above weights for particular ponds are possible and may be compared with still larger American yields mentioned by Mr. Moreton Frewen ("Nineteenth Century", September 1899) in small ponds where cheap artificial food was supplied.

182. A business establishment which was also visited was of great size, apparently above 50 acres, with a number of large as well as small ponds. It seems probable that if Madras ponds were large in size and supplied with the proper class of vegetation, giving shelter to all sorts of small animal life, the cost of feeding might be reduced to a minimum, while the fish would be better, since they would live under more natural conditions.

183. A district establishment (Atsuta), which is the cultural branch of an Experimental Station, afforded me much instruction and suggestion; the area was somewhat over 9 acres, containing 5 large ponds for market purposes where carp and eels are grown for sale and 17 smaller ones for hatching, breeding experiment, and—which is a special feature of this station—the distribution of fry. Last year above 100,000 carp, 25,000 mullet and many thousands of pounds of eels were sold from the market ponds; it is noteworthy that, as this is a silk district, silkworm pupae are an important item of fish food in this station. The yield is almost incredible, but the fish were probably small; the yield in the Tokyo ponds was similarly large. The distribution of fry is gratis and is for a special purpose; in Japan it is customary in suitable localities to place young carp when 1 or 2 inches long, in the paddy-fields in June when irrigation begins; by October, say four clear months, when the paddy is cut these have grown to 8 or 10 inches and are quite marketable; the rapidity of growth is due to the warmth, excellent feeding on minute crustaceae

such as copepods, larvae, etc., in the fields, from which, of course, they are kept from escaping by bamboo gratings. Should the water in the fields fail, the ryot digs a small pit in one corner in which the fish can survive till more water comes down. The rearing of the fish in the fields is said to improve the produce of the paddy since the fish destroy many insects injurious to the plant. This is one of the many instances in which, as is more especially shewn in the Agricultural note, the Japanese allow no waste in space or material; another is the use of the dead silkworm pupae as fish food. The young fry are given away gratis at this station to the extent of very many thousand: they are sent in the usual wooden buckets slung on a *kavadī* over a man's shoulder; each pail contains several thousand, and the fish will travel up to 40 miles in this way if the water be occasionally changed; the shaking supplies sufficient aeration. This station claims to have originated, by its example, several private culture farms, and many persons are continually coming to it for advice as to methods, food, etc.; experiments are being also carried out in improving breeds and introducing new ones such as the Chinese eel, etc. Hence this branch station is useful by way of experiment, advice, example, distribution, and supply.

On the subject of the growth of carp in paddy-fields Prof. Mitsukuri says that in a single village the agricultural society (a point worth noting) represents the *whole* village, utilizes 250 acres of paddy-fields each year for this by-product, and annually breeds 25 million fry to be sold and raised in surrounding villages. He mentions another case where a vast area is irrigated (as in Egypt) by inundation, and the culture of carp in this area, though in its infancy, realized in 1902 no less than Rs. 72,000.

184. The eel and the mullet, though grown in the ponds with the carp, are not spawned therein: they are caught with the net in April in any brackish water near at hand and placed in the pond: the eels may then be in the second year, but the mullet are only fry. They are fed with crushed shell-fish, earth-worms, etc., and the eels may, by July, have doubled or trebled in size and be ready for market; by April following, they are all sold off, and the profit is said to be large. The mullet increase from a couple of inches in April to 10 inches in September when they are gradually sold off.

SUGGESTIONS.

185. Here the descriptive part of this note may end. It remains to make proposals arising from a consideration of the above account, viz., (1) the preparation for an experimental station; (2) carp hatcheries for stocking inland waters other than rivers; (3) minor items; and (4) the provision of experts for carrying out the above and for founding the future Bureau of Fisheries. A separate communication

deals with details of character, cost, position, and management, unnecessary for this note.

186. 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, whether in practical schools or by advice and example, in these processes. 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.

187. As shown in my West Coast Report of the last quarter of 1905, the Madras fishing industry, even on that coast, leaves almost everything to be desired in the methods of capture, preservation, and distribution; cultivation is not yet even thought of; methods are primitive and rude, and the produce far from first-rate, whether considered as food, as an export fit for foreign markets, or as a warrantable manure. On the other hand, there is abundance of excellent fish in the sea for the greater part of the year, and at certain seasons a superabundance; these fish ought not only to be more largely caught but more largely put on the market, and not only more largely but in prime condition and yet cheap. But 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.

188. 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) 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 salt holds or in wells or 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 line, and to keep their catches in such condition, whether in wells or salt, as shall make them marketable goods even weeks after capture; last July in Gloucester (Mass. U.S.A.), I saw absolutely sound, wholesome fish turned out of the hold of a smack which had caught them on the distant cod banks and kept them in her salt-hold from April onwards. 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.

189. 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 sea bottom along our coasts is so generally of a muddy or sandy nature, is so free from rocks, and shelves so gradually, that the use of the trawl is obviously indicated, and this net will also be tried. The long line, *i.e.*, the horizontal line of a mile or more in length, armed with hooks on short vertical lines (snoods) at frequent intervals, will also be adopted; in a small size it is in occasional use on parts of the West Coast, but is not general even there, and on the East Coast is practically unknown.

190. 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 minimize the

* As I write this I note from the ordinary reports of the fish-curing yards remarks such as "the sardine shoals are moving away from the shore" or "the shoals have gone out to sea," etc., remarks which mean, as the figures in the reports show, a cessation of catches till shoals return to shore.

chances of taint before reaching the market or the curing yard. For the inability to convey fresh fish far inland is at least partly due to the poor condition of the fish, to the approach or even access of taint, when it reaches shore, and since taint, once started, cannot be got rid of, though it may be arrested by curing, it follows that the uncured fish taken inland can never be taken far, whilst even the cured fish retains the traces of the original taint, even if it is not altogether spoiled as wholesome food by the rapid progress of putrefaction during the operation of curing. Mr. H. S. Thomas in South Canara expressly mentions the bad condition of much of the fish even when newly landed, and speaks of seeing it "covered with maggots" on being brought to shore, a condition common enough in the curing yard where curing often begins long after putrefaction has started. We require then better treatment of the fish from the moment of capture, for much of the liability to taint is due to want of care and knowledge; *e.g.*, the ungutted fish, flung pell-mell into the bottom of a boat, are bruised and trodden on and, if alive, slowly exhaust themselves to death, all of which are conditions favouring early putrescence, whereas a proper treatment would, if caught alive, keep them alive in basket or other receptacles in the sea or in the boat, and if dead would treat them after modern fashion (*e.g.*, gutting and draining, antiseptic washing, careful stowage, salting in the boat, etc.), to delay the approach of taint.

Again though much of the fish is, when taken out of the boats, perfectly good and fresh, even alive in some cases, yet whether by reason of unnecessary delays, of the rapidity of decomposition in the tropics, of improper gutting and cleaning, of mixing with tainted fish in the salting tub, of ineffective methods of salting or of insufficient salt, of imperfect methods of drying which are even provocative of taint, the product though not always putrescent is always readily putrescible, while in smell, colour, form, and appearance it is not only inferior but would in general be absolutely barred from a European market.

191. The fourth present object of the station should be the more rapid bringing of the fish into the factory or to shore. I have already mentioned that amongst the first objects of a station will be the experimenting in, and demonstrating, correct modern methods for the general treatment of fish in the boat from the moment of capture till brought ashore, so that it may have a better chance of arriving fresh; the object now under consideration is to teach the method of rapid collection at sea and transport to shore.

Dealing first with fish intended for canning when fresh; it is obvious that for a factory it is absolutely necessary that the supply should be both regular and continuous, and that it should be perfectly fresh; now since the shoals come irregularly to the several localities, the supply at any given point is not only irregular in time and

quantity but often *nil*; moreover small fish taint rapidly. Hence, as stated in my West Coast Report, the French canner at Mahé is said to be finding it necessary to have a motor boat in order to secure a sufficient supply of fresh sardines. Secondly, as regards fish which may be cured in salt or smoked; it may be necessary to secure supplies of such, either from boats at sea or at some distance from the factory; *e.g.*, near Tellicherry there is splendid fishing at Sacrifice Rock some 10 miles out at sea, but the canoes take several hours rowing or running home in the afternoon; or again, it might be necessary to visit comparatively distant fishing centres.

Hence I propose the purchase shortly of a sea-going steam or motor boat, of 7 or 8 knot sea speed and with a consequent radius of action for fresh fish of, say, 30 miles even without ice; much more for goods which she can keep in salt. In America the small petrol fishing boat—not merely the pleasure boat or yacht—is already greatly in evidence and there are also a number of fishing boats with petrol engines of considerable power; kerosine motor boats, especially with “Dan” engines, are also now available and are already very numerous, as fishing boats, in Scandinavian waters; in July (1907) there is to be held at Bergen an exhibition of motors and motor boats with all kinds of fishery equipment which I expect to visit, and this will afford an excellent basis for starting an enquiry with a view to purchase. The “Margarita” is not only required by the Inspector of Pearl Fisheries, but is too large and too slow for the purposes of an experimental station and burns far too much coal to be economical anywhere. The ascertained cost of fitting the yawl “Pearl” with a motor is prohibitive and the job would only be an unsatisfactory makeshift.

192. The fifth object is the better curing of the fish. The previous paragraphs deal with the obtaining of greater quantities of fish and the bringing of it to shore and factory in better condition than at present; but State hygiene demands that the food thus provided shall be placed before the people in as wholesome a condition as possible. Possibly it will be found easier to improve the curing process, a more or less mechanical art, than to introduce larger boats and longer voyages and salting at sea, and much weight will therefore be given in the station to experiment and demonstration in curing processes. In my West Coast Report I have mentioned obvious faults or defects in the curing yard, and others may be added as observation in other countries has taught me; a first duty of the station will be to endeavour to correct these faults and teach better practice especially in the methods of drying the fish.

That, however, is not all; we need new methods of curing and preservation for market, such as fish pickled wet in barrels, a process crudely begun in the barrelled mackerel prepared at Cochin for Colombo; hard dried fish like the Norwegian stock-fish, which will keep good even in the rainy weather now so fatal to West Coast salted

goods; smoked fish whether hard-dried and smoked like the Japanese bonito wedges * (“katsu-bushi”) 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.

193. Sixthly, as a special branch of the fifth object, the canning industry should be developed. On the West Coast there are three sorts of sardines, excellent though small mackerel, and many other good edible fish. These, as in other countries, may be preserved not merely in the small tins usually seen in shops and on the table but in large cans holding up to 20 lb. apiece, a matter of importance when we wish to supply not so much delicacies for the rich as plain food for the masses; a 10 or 20 lb. can of fat sardines, plain-boiled in their own fat as in Japan, can be placed on the market at a fraction of the cost of the same weight of fish put up in the usual quarter or half tins whether in oil or otherwise. In India we want our fish sent up-country not only untainted but *in bulk*, and it may easily be possible to supply persons just above the poorer classes with good and cheap food sold retail out of cans such as kerosine tins holding bulk; hence the canning and processes should be of various classes, including modes intended merely to keep goods in absolutely wholesome condition during a few days' transport.†

* Since writing the above I have found that strips of bonito are prepared in somewhat similar fashion in the Laccadives, and are sold in Ceylon and occasionally in the south of this Presidency.

† Indeed, while the art of canning—including the proper treatment of various fishes in various ways and by various recipes to suit high-class demands especially in the foreign markets—must be thoroughly taught in a proper factory as proposed, there is nothing to prevent any intelligent person, with one or two thousand rupees to risk, from setting up a small factory in Calicut, Tellicherry, etc., entering into relations with a few boatmen so as to ensure a regular supply of fish in a fresh condition, purchasing a quantity of sound kerosine tins or other sound cans and a small soldering plant, and after preparing his fish, and filling and closing his tins, despatching them to a convenient market. The preparation might be simple, *e.g.*, brining the fish for an hour or two, draining, partial drying, packing in the tins with a small quantity of boiling oil, closing and processing in a brine bath in the absence of a steam-cooker; the oil may be gingely, ground-nut or if available, cotton seed, all excellent cooking oils and believed to be largely consumed as olive oil; in America cotton seed oil is frequently used in canning in place of olive oil and in the State of Maine is alone mentioned in the law relating to canning. If the sardines, etc., are fat enough as in the cold weather, simple boiling, as in Japan, may suffice. Even if this is open to the objection attached to cooked food (which, however, is hardly the case, since the cooking is only after the tin is closed so that the fish cannot be touched by hand) it would serve for many classes, especially if supervised by “caste” men. Moreover, other processes are available; after treatment with brine and drying, it is easy to smoke the goods lightly and then to can or otherwise pack them. Similarly, instead of kerosine tins small kegs can be cheaply made on the West Coast, and in these the cleaned fish may be packed in salt and brine (pickle) and will then travel well and keep well for many days. However, it is probable that Government experiment and demonstration will be awaited, and it is certain that there is a wide and instant opportunity.

I propose, then, that Government should obtain a small but complete canning plant, for hand work only at first, that this should be installed at the Experimental Station and that students and workmen should be taught not merely the mechanical art of making and closing cans but the main industry of treating the fish from the boat to the cooker. The cost is not great and I can readily ascertain everything in Europe this summer.

194. The seventh immediate object of the station will be observational; the station will be utilised 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 utilise and control the statistics now furnished regarding the catches, appearance and disappearance, etc., of fish by the fish curing-yard returns (No. 11) which will then become valuable, as well as the information now being collected in the new "Information books" at the same yards, and will itself compile full and accurate information on the general statistics, conditions, facts, and needs both of the industry and of the trade. It will also study the backwaters of the coast with a view to develop them as local food producers readily available without sea risks and at periods when sea-going is impossible; at places like Cochin one can hardly fail of being struck by the potentialities of these large sheets of water, and the lessons learnt at this station will be available on the East Coast for use in the vast lagoon called the Pulicat lake.

195. There is much more work to propose, but, for the present, the above will amply suffice for the West Coast station. Nor will I at present, unless so desired by Government, propose other coastal stations, leaving that for further reports. Certain aspects of the fresh fish trade will also be left over till I make, shortly, my East Coast report.

196. *Pisciculture*.—But in the method of Indian pisciculture Japan 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 pond, to the owners of many thousands of acres of paddy fields, and to the controllers of thousands of acres of freshwater reservoirs and canals, and in this matter, little Government aid, or aid costing but little, will be required. Under the head of carp culture it will have been seen that, in from 4 to 5 months at most, carp of $1\frac{1}{2}$ to 2 inches long placed in the Japanese paddy fields will increase to 8 or 10 inches and though still immature are quite marketable,

while culture ponds produce a large outturn per acre. In India, as elsewhere, carp is one of the hardiest, most prolific, and most rapidly growing fish, and, of one kind or other, form, it is said, 60 *per cent.* of the freshwater fish of this Presidency. Madras conditions, indeed, are good for carp which, for their most rapid growth, require a high temperature (80° F. is stated) with, of course, plenty of food, and thrive in shallow water—conditions fulfilled in the Japanese paddy fields and in our own, and in most of the canals, tanks, and ponds of the Presidency. It is to be remembered that carp, especially in the tropics, grow not only rapidly but to a great size; that they seem to be practically omnivorous, are very cheap to feed when artificial food is necessary, and bear transport better than almost any other fish, it being readily possible, in Europe at least, to keep them alive out of water for from 24 to 48 hours if placed in wet moss or straw, or they may be transported in tubs of water with considerable ease.

197. As regards produce; European figures are not of much use, for in Germany where carp are so largely grown, the winter is long and during that period there is practically no growth, and even loss of weight. Still, the figures even there are encouraging; in ordinary ponds or small lakes, the average annual yield of medium quality waters has been stated at about $1\frac{1}{2}$ cwt. per acre; at the recent Milan Exhibition I saw a large map of Bavaria showing groups of ponds aggregating 25,000, of which 90 *per cent.* were carp ponds with a total area of 30,000 acres or $1\frac{1}{8}$ acres apiece; these are worked by the peasants on whose farms they stand. Now the value of the carp annually produced in these ponds averages 4 million marks or Rs. 30 lakhs or Rs. 100 per acre, and if carp be worth as much as six pence (half mark) per pound they must produce at least 8 million pounds or 266 lb. per acre. This is in a comparatively cold climate and the fish get no special nutriment, though doubtless much refuse food (or as in China the draining of the cattle stands, etc.) finds its way to the ponds. In Japan the figures are far larger; as already stated the fry develop in their four months' life in the paddy fields to a marketable size of 8 or 9 inches, and the figures given me of the weights grown in the culture ponds would be almost incredible but for the confirmation of a careful scientist (Professor Mitsukuri) who says deliberately in his pamphlet quoted above that the 225 acres of culture ponds round Tokyo produce annually "405,000 pounds of the meat of this fish" or 1,800 lb. per acre, and since eel and mullet are usually, perhaps, always, grown, as I myself saw, in the same ponds and at the same time as the carp, the annual yield of fish per acre must be something like double that amount or, say $1\frac{1}{2}$ tons. That this is possible is shown by the yield mentioned by Mr. Moreton Frewen ("Nineteenth Century," September 1899) of 6,000 lb. of fish in a year from several ponds aggregating a quarter acre, at a cost

for food of only a small percentage of the value of the product, while the accounts of trout ponds in hatcheries in Great Britain show enormous weights of fish reared in small areas. Of course these large yields are only obtained—except in the paddy fields—by artificial feeding, but in the case of carp which seem to be omnivorous, the food is simple and cheap; in Japan crushed shell-fish, worms, silk-worm pupæ, various larvæ and some boiled barley, are fed to the fish which are also supported by the natural food brought in by the river water which feeds the ponds. In Germany ponds of, literally, only a few square yards and two or three feet deep, are utilized for two or three parent fish, and, separately, a number of young ones; these are fed from any refuse house food, larvæ, insects, etc., and provide a change of diet and a little money for the owners.

198. For Madras we have not many data for want of experiments and observers. But Mr. H. S. Thomas has provided some facts; the classic instance is the (Vallam) pond of 4 or 5 acres, which having been emptied *à sec*, was refilled and stocked with a few measures of fry, probably labeo and other carp costing him Rs. 2; after only 18 months at least 4,000 lb. weight of fish were regularly taken from the pond without affecting its annual production; in this case there was absolutely no artificial feeding. In another case he mentions a pond (size not stated but evidently small) which was netted early in June “down to the last tadpole”; it was filled from the river about the 15th idem, and was fished on the 29th August or within 75 days; the yield to a couple of rods in one day was 180 fish averaging $\frac{1}{2}$ lb. each, and doubtless there were plenty more left in the pond. He states elsewhere that carp and labeo were known to increase from a few drachms to one pound (*quære*, half a pound) in 70 days, and it is recorded by a Mr. Mitchell that *Catla burchanani* have grown from 1 $\frac{1}{2}$ inches to 11 inches, weighing 12 to 14 ounces, from May to September, and to 5 lb. in two years. The yield of tanks which have water for only a few months is considerable, but this is largely due to the murrail which aestivate in the mud; the nature and size of the other fish have not been ascertained. But from the data available and from the fact that the carp in Europe increases its rate of growth with the warmth of its environment, it is certain that, given a proper natural food supply, carp and other indigenous fish will grow with great rapidity; that fish food is abundant in our inland waters is a certain fact, the larvæ of mosquitos alone providing an abundance of food, while other aquatic growths are similarly prolific. We have, then, these certain clear facts: (1) a carp produce of nearly 300 lb. per acre for small ponds, without artificial feeding but probably receiving much natural food, in German farms where, however, there is a cold winter; (2) a very large increase in the size and weight of carp growing, of course without artificial feeding, in Japanese paddy-fields; (3) immense yields of this and other fish when grown in culture ponds

and artificially fed ; and (4) very large yields in ponds in this Presidency wholly without artificial feeding.

199. Premising this much, suggestions may be made for the beginning of cultural work in this Presidency.

200. The inland waters of this Presidency are rarely permanent but Japan shows that permanency though greatly desirable is not absolutely essential for growing great crops of fish, since its ponds and paddy-fields yield harvests of young fish which, though immature, aggregate a vast amount of excellent food. The question is whether the example of Japan suggests practical work in stocking our own waters which will be considered as tanks, canals, village ponds, wells, and paddy fields ; rivers are for the present left out of consideration.

201. The position is this ; water in this naturally arid Presidency is of such extreme value, of such vital importance, that we are bound to utilize it, wherever we have it, in every possible way and season, in crops, fish, and productive trees,* provided only that the major and primary utilities of the water are not injured or diminished by secondary utilities ; if it appears possible to utilize vast irrigation reservoirs and canals as fish sources, without appreciable injury to the irrigation of crops, we are bound to experiment in such waters even at some expense and, at first, somewhat blindly, owing to our ignorance of Indian fish facts and possibilities, till success, or its impossibility, is demonstrated. If there is one clear lesson to be learned from travelling in Japan, it is the utilization of waste or, rather, the absence of waste ; space and material are used almost to the utmost, and the neglect of sources of food supply such as are apparently available in our irrigation sources, would be impossible.

202. *Tanks*.—Under this head I include only irrigation reservoirs. These very numerous sources unfortunately seldom contain permanent water and while the great bulk of them not only hold water for less than four or five months, a vast number are also precarious in supply.

Of tanks with permanent waters there are the Periyár lake, the Kanigiri and other reservoirs under the Sangam and Nellore works, the Rushikulya reservoir, probably the Barur tank in Salem district, and, notably, the Marikanavé tank in Mysore territory. Besides these there are some large and deep tanks which may and often do contain some water for years together, such as Daroji in Bellary, Erratimarajacheruvu, Bukkapatnam, etc., in Anantapur, and others which have been made by bunding valleys. Of these the Periyár and

* See note on Japanese Agriculture and suggestions ; the banks of our great irrigation canals ought to be made more largely productive by the planting of valuable trees which would utilize the seepage water ; a considerable income and still more considerable supplies of food and timber could thus be raised, while the trees and bamboos would yield a large quantity of food for the fish in the canals,

Rushikulya lakes are too distant and ill placed for fishery work; Marikanavé is in other territory; hence tanks with permanent waters are not very numerous, though they may hereafter be increased by projects in contemplation. But such as they are, they should be improved as food sources by direct cultivation and should not be allowed merely to grow a natural crop; at present it appears that the Kanigiri and other great reservoirs are hardly utilized; amongst the suggestions which follow is one for improving the fisheries of these tanks, with the view not only of making *these* tanks profitable, but of obtaining data and displaying examples which may be followed even in temporary sources. Tanks with temporary water vary in capacity from one month's to six or more months' supply; the fishery rights in these are annually let out, usually for small sums, and the mode of fishing is, in general terms, simply the netting of the muddy residue in the tank shortly before the supply is exhausted. Apparently a number of fish, chiefly murrel (Ophiocephalids) have the power of aestivation and, escaping the drag-net, bury themselves in the mud throughout the dry season; hence a natural stock of reproducers is provided and the large size of many of the fish is accounted for; murrel, however, being voracious fish of prey in any case increase readily in size owing to abundance of food, since tank waters are either supplied from rivers in which case they probably contain abundance of fish fry and other food, or they drain from the surrounding cultivation and are also bathing places for cattle. From the results of Japanese practice and from the few data we have of the tropical growth of carp, it is obvious that tanks which usually hold water for four months and upwards may often be usefully stocked, but it would be necessary continually to net out the predaceous fish to the greatest possible extent.

203. *Canals*.--Omitting Tanjore and other systems there are under the Kistna, Gódávári and Kurnool-Cuddapah systems alone about 1,072 miles of main and branch canals, all navigable, except 57 miles, besides nearly 4,300 miles of the distributaries, exclusive of course of field channels. The body of water contained in the main and branch canals at any given moment must be above 1,500 million cubic feet, and the volume of water let into them during the nine or ten months of flow, averages above 300,000 million cubic feet or 11,000 million cubic yards. This vast body of water is probably full of fish food since the rivers drain forests and districts in their course, while the sides of the canals provide a good deal of vegetable life and consequently shelter small animal life of very rapid growth and increase. What this body of water could produce cannot possibly be stated even as a guess; its total area at an average of only 60 feet in width is something over 8,000 acres, but this in no way expresses its productive powers, since the water is continuously changing and therefore, being river water, bringing new supplies of food; hence

these waters will support for the time enormously more fish than an equal area of tank or lake water which changes but seldom. Practically, however, this great volume of water is unutilized as a source of fish; in several journeys I saw absolutely no fishing and there is apparently little fish life; the fishery rentals are nominal or *nil*, and the fish are only taken when the canals are closed and dry up.

204. The annual closure is of course the main reason for non-utilization; when the canals close, every vestige of fish life is captured or dies, and since fish can only enter from the river and since it is probable that the main spawning time is in the cold weather shortly before the canals close in March or April, the fry even if they enter the canals have no time to grow. Nature has not provided for the abnormalities resulting from human action, and it is therefore for human action to attempt to supplement nature; there is an enormous supply of water and presumably of food and consequently of potential fish life, and it is almost criminal to fail to utilize it if it can be done without injury to the primary object of the canals, viz., crop irrigation.

205. Carp including *labeo* are believed to spawn in the cold weather; consequently, if hatcheries, *more Japonico*, were started near the anicuts and elsewhere, viz., a series of breeding and nursery ponds, it would be possible by the end of May to have millions of carplings, etc., of three or four inches long, ready to turn into the canals; at the end of 9 or 10 months these should, at Indian rates of growth, average at least 1 lb. each,* considering the favourable circumstances of a vast abundance of slow moving warm water probably full of food; during the last three months that the canals are open these should be steadily netted and marketed either fresh or dried. A vast number of the young fish would doubtless find their way into the distributaries and fields, but even there they would be caught and utilized as food, while in time the Japanese method of nurturing them in the paddy fields themselves would possibly be adopted; since there are apparently few fish now taken in these delta wet lands, restrictive rules could be more easily framed than in Tanjore, etc., where it has long been customary to trap the numerous fry in the field channels and fields. But in the above great canals with their few sluices and quiet streams and large body of water, the fry would probably evade many of these oftakes and would remain in the main canals. The fact, moreover, that the canals are annually closed, and that only non-predatory fish would be reared and placed in the canals, removes the loss from predaceous fish which elsewhere devour so many times their own weight of other fauna. Hence

* It is recorded that in Ceylon even at an elevation of 5,000 feet, trout have increased from 6 inches in length, weighing a few ounces, to 2 lb. in 9 months ("The Mighty Mahseer," second edition, page 81).

there is considerable chance of rearing a vast mass of edible fish every year, and though the whole of them would annually be captured or destroyed, they would provide a vast mass of food, and their place would annually be taken by fresh swarms from the nurseries. The Engineers, indeed, may find it possible to allow certain reaches to retain water in turns throughout the season of closure, or to clear one reach while retaining water in an upper one, and then passing the water down into the cleared reach; this would give a much longer period of growth and allow of spawning within the canal. These last ideas, however, are only suggested possibilities, and it is not intended to propose at present anything more than the future use of the water during the open season of 9 or 10 months.

206. *Ponds*.—Under this head come the very numerous class of tanks not used for irrigation; generally they are not embanked reservoirs but excavations such as teppakulams and other tanks attached to temples, and drinking-water and bathing tanks in towns and villages. The temple class which are largely those alluded to as permanent waters by Mr. H. S. Thomas, need not be here considered; they can hardly form sources of public food supply. Similarly municipal drinking tanks can only be stocked for angling purposes, and since fish improve the water in which they live by clearing it of noisome impurities, this should be encouraged. Village ponds, however, can be more fully utilized: they are extremely numerous, and, when deep, will keep a supply throughout ordinary hot seasons; during a recent tour I saw many tanks of from half to one acre which, at the beginning of February, were too deep for cattle, except at the edges. Into these ponds drains the water from the village lands, viz., the cultivated fields, the house-site and cattle-stands, etc., while the cattle habitually bathe and stand or lie about in them; hence the supply of food suitable and agreeable to fish is particularly abundant. For the present nothing can be done except to suggest that the smallest co-operative village effort would speedily convert these ponds into most useful sources not merely of water but of fish; if each year for three or four years every able-bodied man would give three days' labour or its value, these small ponds could be deepened to an average of 6 feet, with a deeper pit in the middle; such ponds would seldom go dry and would support a large weight of fish for village food and sport. Those who during the long hot-weather village tours necessitated by jamabandi, have seen the village males loafing for weeks together in their villages, idle because there was neither work in the fields nor other (cottage) industries available, know well that such a voluntary communal *corvée* (such as still exists, though not voluntary, in France and Germany for road purposes) would cost the villagers *nothing* but a little energy. The ponds could then be stocked with a few fry from the nearest source, whether a natural stream or a

hatchery such as will be suggested below. Ponds of this character shaded by fruit trees thriving on the soakage from the ponds and providing fish food by their leaves and by the insects falling from them, would supply a much needed village want in water for cattle, shade, and food; they are to be found in many of our villages and those by no means in areas where rainfall is heaviest; they are generally a village inheritance from past energy or charity, and nothing is needed in thousands of villages except a little present co-operative energy.

207. *Wells*.—By these are meant the great irrigation wells of Coimbatore, Salem, and other districts. In Coimbatore, a district of almost minimum rainfall, inland, and far from marine fish sources, there are some 80,000 of these wells averaging probably 10 yards square or 100 square yards, so that 50 equal one acre of water. Here, then, are 1,600 acres of water which in many cases is absolutely permanent, in very many more it is permanent except in unusual years, while in the least permanent there is usually water from July to March. A few of these wells have one or two fish (murrel) in them, but they are in general not used as stock or stew ponds. They naturally contain a certain amount of fish food in and on the aquatic plants found in them, and in other small life, but it would cost practically nothing to supply food from the fields in the shape of crabs, worms, larvæ of sorts, white ants and various insects, leaves and flowers of certain trees, all of which could be gathered by the children; refuse or surplus food from the house and cattle stall would be both cheap and useful. The return in fish would be astonishing; those who know the weights of fish grown and maintained in small ponds in trout and other hatcheries or in stew ponds of large or small size in Europe, still more those who have seen small bathing tanks, a few yards square, attached to mosques on the West Coast, absolutely alive with hundreds of pounds of fish, will know that the two or three hundred cubic yards of water in these wells will maintain a large weight of fish if food be supplied as suggested. If each well provided an annual weight of only 28 lb., 80,000 wells would furnish 1,000 tons of fish worth from 1.5 to 2 lakhs of rupees, no mean addition to the food supply and income of a district. Since carp or murrel can be readily transported it would be easy for the villagers to obtain a few reproducers or a few chatties of fry from neighbouring sources, especially if either a river or one of the hatcheries to be presently mentioned, is at hand.

208. *Paddy-fields*.—The growth of fish in the fields in Japanese fashion will be a matter of pure experiment; nothing can be predicted save this, that in fields producing a single long crop of rice and well supplied, as in the deltas, with practically unfailing water, carp should succeed at least as well as in Japan; fry may be seen even now in quantity in the fields and some of these escape immediate

capture and grow to appreciable size, but the vast bulk are captured at once by fine woven basket cruives at each drop from field to field. Where fry are found naturally, as in the Tanjore and West Coast fields, it will only be necessary to substitute bamboo gratings for cruives at the exits from the fields so as simply to retain the fry in the field instead of snaring it. When fry are not naturally found it will be part of the hatchery experiments to supply suitable fields with fry to test the feasibility of the Japanese method. Whether small fish thus reared would escape the numerous paddy birds and other enemies, is of course a question.

209. *De minimis relatio*, for that is precisely what Japan strongly teaches, viz., that the utilization of trifles, of waste spaces and materials, whether sea shore bottoms or hill-tops, whether ponds or paddy-fields or back-yards or even roofs, is essential. Not trifles either except individually; multiply a pound weight by a million and the result is important; multiply 100 lb. by a million and the product is immense, and the aggregate produce, however individually small, of the village pond, of the irrigation well or gunta, of the paddy-field, may run into many millions of pounds. Moreover it is precisely *because* these matters are individually small that they are important; a big departure can only be carried out by a large and organized expenditure; a village experiment of the simplest of natures, can be tried in a hundred places at once with a minimum of individual expense. In a vast number of cases the experiment could be tried at absolutely no cost save that of obtaining a few fry; in many others simply by a small exercise of village co-operative energy which any intelligent well-wisher of his village could ensure. After all nothing is too small for profit; a pond will produce *gratis* a hundred weight of fish, a tamarind tree in a backyard will pay the kist of a field; Tamulicé "Even the corner of a field will produce (the cost of) a cloth"; the pond, the tree and the backyard have not yet been properly exploited in Madras.

210. *Hatcheries*.—The Government share in the stocking of inland waters is the establishment, *more japonico*, of hatcheries or sources of fry at convenient places. It is proposed, if the Public Works Department see no objection, to establish the first near Nellore at the Kani-giri reservoir. This is a real lake of about 20 square miles in area and 21·5 feet deep at the sluice at F.T.L.; at its lowest in the hot weather it has an area of about 2 square miles with about 114 million cubic feet of water; though it contains large fish, such as freshwater sharks, murrel and other predaceous fish, it produces little in the way of food supply, the fish rental for the past three years averaging only Rs. 410 though the netting of the shallow water of the hot weather is very easy. Its cubical contents at F.T.L. are not less than 6,000 million cubic feet; at the minimum rate of 50 cubic yards per pound

it would maintain 2,000 tons of fish, and being not only tropical but containing abundant fish food from the drainage of several districts and having its water entirely renewed at least once from the river, local drainage, and rainfall, it should maintain a much larger quantity. Should Government approve, a site will during this year be selected near the reservoir, the necessary ponds will thereafter be dug, reproductor carp and labeo will be stocked, and broods of fry produced and nurtured from hatching time, probably in the cold weather, till a convenient season for turning them into the lake. Meanwhile, during every hot weather especially the first, the lake will be steadily netted with the aid of boats and trawls or drag-nets to decrease the predaceous fish which devour so many times their own weight of other fish and destroy the productivity of the water; this will be easy as the lake is then shallow. The hatchery will be able eventually to supply not only Kanigiri but other similar reservoirs under the same works. The increased produce in fish, if the experiment is successful, should more than pay the cost of the hatchery which, moreover, will be a place of example and instruction.*

211. A second hatchery should be established, probably later on, for the Kurnool-Cuddapah canal. This canal is favourably situated for experiment; there is a long reach of canal without much offtake for irrigation, and this mostly through tanks; hence young fish would enjoy a large area undisturbed and if drawn off would largely go to tanks which maintain a considerable supply. The district being far inland is badly supplied with fish, while the population is one which will readily eat animal food. The length of the navigable part of the canal is 190 miles, besides 315 miles of main distributaries and the area of the tanks supplied from it; the average offtake of water through the head-sluice averages in round figures 1,000 million cubic yards. The canal probably contains at any given moment, when full, at least 11 million cubic yards of water which is therefore changed some 90 times during the season so that abundant food is furnished for fish. As the canal is closed every year in the hot weather, fish have no chance of growing to a large size; *per contra* there can be no predaceous fish.

A carp, etc., hatchery placed at or near Kurnool could be supplied with water from the canal, and rear in spring a large supply of well-grown carplings for stocking the canal in June.

212. The other canals, being very much larger and nearer to the sea, may wait upon the results of this experiment, which may also afford data for work upon the Cauvery with hatcheries at Erode, the Grand anicut, and, still better, the great reservoir now projected

* See Appendix I for a possible mode of dealing with Marikanavé and other similar reservoirs.

above Bhaváni (Nerinjipet) which should by itself be of immense value as a source of fish. Small experimental hatcheries should be established at Madras and at the new Agricultural station at Coimbatore in view to ascertain the fish best suited to minor operations such as the supply of carp fry for wells, ponds, paddy-fields, etc., and to ascertain those facts relating to the food, life, rates of growth, etc., of fish, of which we are at present profoundly ignorant.

213. *Minor proposals*.—With the sanction of Government the nucleus of a Fisheries Museum and Library will be formed by the purchase of models and photographs of boats, nets, apparatus, hatcheries, etc., connected with the various branches of the industry. Modern models show boats and nets in actual operation and are extremely instructive even to unskilled observers; the exhibits will be useful for display at the next Industrial Exhibition and can then be located at the Experimental Station which will, of course, be freely open to visitors and enquirers.

214. It is also proposed to initiate various minor industries relating to sea products, and, as a beginning, to purchase the very simple apparatus needed for the manufacture of ordinary pearl buttons. The industry as it has sprung up of late years in Japan, is alluded to *supra*, paragraph 164. The apparatus is so small and simple that it may be made a household industry, as in America, and will, at first, be conveniently located at the Experimental Station on the West Coast until a second is started at or near Pamban.

215. The necessary details for carrying out the above proposals for an Experimental Station, hatcheries, the purchase of models and button machinery will be found in the letters which accompany this note.

216. For the above operations, slight and tentative as they are, it is obvious that we require a provision of experts; non-experts however well-meaning and well informed can effect little in work of a severely industrial and manufacturing character. It is equally obvious that at present not one expert is available save, perhaps, my Assistant Mr. V. V. Ramanan who being already an experimenter and observer in natural history will be able to take charge at once of the initial experiments in hatchery work as proposed. But of the men who will conduct the sea and shore practical operations of the experimental station as described above, of those who can be put in as managers of hatcheries, we have not one. *A fortiori* we have not the men who will be the numerous experts required in the near future for extended work; the scientific yet practical observers, like Professor Mitsukuri and Dr. Kishinouye, of marine or aquatic biology, on whom will largely depend future administrative action; the men who can design as well as sail the new boats, make as well as use the new nets; the industrial experts in the various branches of the curing industry; the men

trained in the varieties of marine culture such as oysters and other shell-fish, pearls and sponges, crustaceans, etc.; the teachers of the necessary industrial or other fishery schools; the men of wide fishery knowledge and of practical ideas gained from world-wide enquiry and study.

217. The preparatory or foundation work of a novel industry or of wholly novel developments of an industry, necessarily occupies years, if work is to be placed from the outset on a proper foundation. Japan began serious preparatory work about 1831, formed its earliest Bureau in 1885, but was unable to start its first experimental station till 1894 though the first training school was begun in 1888 by the Fisheries Society, and Japanese delegates had largely studied abroad. With her experience before us, while we need not be unduly troubled by reasonable delay, it is obviously necessary to begin providing experts as soon as the necessity is demonstrated; it is claimed that the example of Japan applied to our own conditions *has* fully demonstrated that necessity.

218. Now for Government there are only three practicable methods of providing the necessary experts; the first is to call in foreign experts from the various nations who have progressed furthest in the several branches of the industry; the second is to wait till foreign merchants and manufacturers have set up their works (and got hold of the cream of the business) and to trust for indigenious progress to the object lessons provided by their enterprise and to the training of apprentices and others in their factories; the third is to send our own men abroad for training.

219. The first method is too cumbrous and expensive, for the experts would have to be well paid men from Europe or America and yet each would only deal with part of one branch, for the scientist could neither trawl nor can, the trawler is not a drifter or liner, the canner is not a pickler or salter, the trout or carp culturist cannot grow oysters or lobsters or pearls. Then the practical experts of the working industry are not usually of the class desirable or capable as instructors, and while necessarily of an age not very suitable for coming newly to India, would be absolutely ignorant of the country, its people, manners, languages, and conditions, and for various reasons would be sparsely capable of adapting themselves to their surroundings and pupils. There are other obvious objections.

220. The second plan may be put out of court at once, for though the coming of European enterprise is possible or even probable, it would be less than fair to wait its arrival and capture of the trade in order to save the trouble or expense of training men. In the matter of canning which individual European enterprise has already begun on the West Coast, a proposal will be separately made for the early

training of young men. It may possibly happen, moreover, that larger opportunities *will* offer in the not distant future for training men under this second method.

221. The third method, that of sending Indians abroad for training, appears in every way the most suitable; a delay of two or three years may be regrettable but is necessary *pour mieux sauter*, and the method lays a solid foundation for the indigenous working of an indigenous industry.

The ordinary Government of India scholarships are not suitable for the training required; in the first place there is no European or American institution capable of giving the necessary training at once highly technical, practical and comprehensive, while to send un-instructed young men to Europe or America on a general mission would be to court failure. We need a place where young men can be deliberately and systematically trained all round, each in the particular branch of the business which he takes up, viz., catching, preserving, cultivating, trading. I know of no place outside of Japan where such all-round instruction is or could be given; technical fishery training institutions are, so far as I know, non-existent in English-speaking countries, and students would require to learn their work by rule of thumb in the variety of factories or fishing ports which are scattered along the coasts, a method at once imperfect and not very accessible. European and American fishery study is technically profitable where a man, already properly prepared, intends to learn by practice a particular item or sub-division of the industry, like the Japanese fishery graduate at Yarmouth who was mastering the Yarmouth herring and bloater trade. It is, of course, also highly useful for widening general knowledge after a man has acquired a large and definite experience in his branch of work; before that a man could only get a superficial or general knowledge of great directive or advisory value but of little use in the actual working of a practical industry which demands not merely a knowledge of principles but a complete grasp of technical working details of the industrial processes and actual manual skill.

Hence I do not advocate the despatch of students to Europe or America for the preliminary technical training which we require, while the expense would be almost prohibitive at Government of India scholarship rates for the number of men who ought to be sent in the next few years.

222. On the other hand, as shown above in paragraphs 50 to 72, the Imperial Fishery Institute in Tokyo, is an institution remarkably complete in everything that can train men in the principles and in all the practical details of each of the three great divisions of the fishing industry and trade; staff and plant, mental and manual training, are alike thorough, and all is taught, so to say, almost under one roof; the

Institute has its own laboratories and workshops, its culture ponds, its fishing vessels and boats, and everything necessary for turning out instructed and practical men, while it has the use of or *entrée* to other factories and stations where its students can get further knowledge. Moreover it seems that its graduates will soon be able to take a high scientific course at the University (see footnote to paragraph 49), and in any case there are now special post-graduate and pelagic courses.

223. The Institute is no mere school; it embodies the "*mente manueque*" principle of the late lamented Cooper's Hill, but with more attention to practical work than even that college gave. I know of no other institution in the world where men are thus trained in the science and technique of the industry; Dr. Smith (U.S.A.) also says that it is unique; nations such as the United States, Great Britain, Canada, and the European countries do not require such institutions owing to the advanced condition of the industry and the universality of wealthy private enterprise, while less advanced countries have not thought of them: Japan has created the institution to meet the special needs of her industry. At present there is not sufficient scope for such an Institute in India; the persons interested are not generally advanced or eager enough for such education; hence it will suffice to utilize, if so permitted by the Japanese Government, an existing though foreign institution for the purpose of training a few men who will become the teachers and experts of Government stations and institutions or the managers and assistants in private concerns. The Japanese Institute is thoroughly practical, and since the processes involved are comparatively simple, passed students are well able to carry out personally or to teach and supervise the ordinary labours of fishermen, curing factories, or culture grounds.

224. It is therefore proposed that enquiries shall at once be made in Tokyo whether students will be admitted to the several courses of the Imperial Fisheries Institute, and if so, that Government shall send three students forthwith for a complete course, one in the catching branch, one in the preserving (curing, canning, etc.) branch, and one in the culture branch. It will be remembered that each course lasts three years and that a student can only take up one course at a time; hence the necessity for three students simultaneously. But as the courses are intended for youths of moderate education (Middle School), much of the work would not be required by Madras University graduates whom alone I would propose, and in that case they would probably be allowed through in two years from next September when they would have to enter.

Details regarding negotiations with the Japanese authorities, stipend, etc., etc., will be found in one of the letters which accompany this note, and further proposals will hereafter be made for subsequent batches of students.

PRIVATE ENTERPRISE.

225. *Fresh fish trade.*—The above suggestions are intended for Government work only, and presuppose that private enterprise will wait on Government experiment, seeing that there is no sign of new activity amongst those interested in the industry as merchants or employers of labour, while the fishermen themselves are obviously not in a position to make new departures of any importance. Yet as in Japan there are many opportunities both in large and small enterprise; *e.g.*, the new Salt rules for duty-free salt taken to sea should encourage local merchants in the building of boats of an improved Ratnagiri pattern, or in hiring Ratnagiri boats, to keep the sea for some days cleaning and salting their catches on board preparatory to curing on shore; there are many merchants who could, singly or in syndicate, arrange this. Then the introduction of the better treatment of fish when caught and especially the keeping of live fish in cages, chests, or wells, is a matter requiring little except thought and arrangement. The introduction of a motor or steam carrier, of no great size but of some speed, would enable fish alive or recently dead to be brought in at any time and with the least possible delay either for transport inland as fresh fish, or to the curing-yard without the delay which is now so often fatal; the use of ice on such a carrier is possible, and there is already an ice factory at Calicut which could be utilized and the prices of which could be lowered if there were a better demand; such a carrier would begin an organized inland fresh fish trade which the railways are believed to be ready to meet by the provision, if sufficient traffic is guaranteed, of cold storage or even of special refrigerating cars or motor vehicles.

226. To anticipate an item of my East Coast Report: the Madras City fish market is poorly supplied with fresh fish, poorly, that is, compared with the actual and still more with the potential demand; at present much of the evening fish is caught at places such as Pulicat and brought to shore in the morning by 9 or 10 A.M.; it is then transferred to kavadis and so to light open boats on the Buckingham Canal which are then towed by men to Ennore; here they are again transferred to jutkas which bring the fish to Madras by 3 or 4 P.M., the fish having been dead and exposed to sun and heat for some six hours. There must be enough enterprise and capital and organizing power in Madras to put on a proper footing the fresh fish trade of a city of half a million people with thousands of well-to-do persons ready to buy fish almost daily at prices which would well remunerate liberally spent capital: better and larger boats and nets and lines, for drifting, trawling and long-lining, used further out at sea where the fish are less disturbed by the frequent passage of great steamers with their noisy propellers or by the incessant catamaran; provision thereon for live storage; the rapid carrier; the ice factory; these combined should do much for the Madras fish supply: even a small motor boat on the canal with proper

cold storage or used, as in Europe, to draw a train of canoe-shaped live-chests, would do much to improve matters and to develop deep-water fishing off Pulicat, Ennore, etc.

227. *Canning and curing*.—Irrespective of the possibilities of an export trade a large amount of canned fish is used in India, not merely by Europeans, and yet a solitary French canner is the sole representative of the industry; his products are cheap and said to be good and provide an example for imitation; the factory industry itself is simple and requires but a moderate amount of capital and training; the experimental stations and scores of petty factories in Japan turn out excellent goods. There is nothing to prevent the early establishment of such an industry save the knowledge and enterprise which will organize not merely the work on shore but the more difficult yet absolutely essential business of ensuring a supply of fish absolutely fresh from the sea so as to avoid obvious risks to health.

228. *Manure and oil*.—The manure and fish oil industry is one which should heavily repay capital and benefit agriculture to an untold extent. In Japan this industry—the two are of course combined since herring and sardine are the chief manure fish—has taken on an immense development since the Japanese are well aware of the high manurial value of fish. Here, in India, its value is practically unknown; cocoanuts and tobacco occasionally get sardine manure, especially offal, on the West Coast: on the East Coast I have found no trace of its use except that the brine in which sardines have been salted is, in one place, said to be used for tobacco. Hence the introduction of fish manure to Madras fields awaits the use of an agricultural demand, and this can only be shown experimentally on the Government farms unless the district associations or well-to-do farmers will take up the matter in view of developing the double industries of agriculture and fisheries. Seeing that dried sardines can be frequently had in vast quantities on the shore at from Rs. 20 to Rs. 25 per ton, and that there is rail communication along both West and East Coasts, there is an obvious field for enterprise wholly irrespective of the export trade which ought, however, only to be utilized if an Indian demand cannot be worked up. One obstacle to trade is in the gross adulteration of the article with sand; this is partly unintentional as the fish are dried on the loose sand, some of which is gathered up with the fish. But Dr. Lehmann states that whereas the average of sand was 6 per cent. a few years ago it is now far higher averaging 39·56 (? 34·56) in 1905–1906, and a sample shown me in London had 44 per cent.: these figures show wilful and gross adulteration which will damage the trade and crush the demand just as the Cuddapah indigo trade was similarly spoiled: one obvious result of an organized trade would be the stoppage of this adulteration and the production of a warrantable article. Probably the enterprise demands such knowledge, organization, and capital that European firms will at first alone

tackle it, but there is nothing inherent in the business to keep Indian manufacturers from learning and extending it.

229. More simple developments of the industry may be readily attempted in new modes of curing fish, such as pickling in salt, smoking, etc. : these involve less expenditure of capital and less risk of spoiled goods. The risk run is in the possible loss of money should the public fail to accept goods of the novel character proposed.

230. In these industries knowledge is required which is not at present possessed by local capitalists ; the very ideas are novel while the technical knowledge necessary for working the ideas into going industries and the practical and business knowledge needful for pushing the *trade* are entirely wanting. Hence it is that Government has been called upon to experiment and demonstrate. But if the example of Japan has any weight, surely it is for Indian capitalists to follow it, *viz.*, either by visiting foreign countries in person or by delegate to observe and to learn, or by hiring foreign experts to teach on the spot. By learning is not meant mere study even at the best technical school, still less that dilettante dabbling in industries which is sometimes mistaken for the mastering of the art and trade : it is *more Japonico*, the apprenticeship of men, with a proper educational grounding, to the business in all its details, the long drudgery which combines the study of the principles and bases of an industry with the strenuous, coat-off tackling of the practical work of the factory, the trade, and the market, after the fashion of the educated young Japanese who, for two years, had been living and toiling as an ordinary sea-going fisherman and curing hand at Yarmouth in view to master the details of the Yarmouth herring industry.

231. Possibly for Indians the best, if the more expensive method for private enterprise is to enlist foreign experts as the Japanese have done just as readily as they have gone abroad ; for many years well-paid foreigners hired for the purpose, worked, supervised, taught the various Western methods as in engineering of various kinds, ship and railway building, canning and pisciculture, weaving and spinning, and so forth, till the Japanese felt that in each case they could stand alone. It is now for Indian capitalists to study the marine and inland fisheries of this Presidency in all details, the catching, manufacturing and culture branches, the trade openings whether in fresh fish or in cured fish or in manure and by-products, the inland market and the openings for export. The Indian merchants who so largely conduct the internal trade of the country and who skilfully and profitably trade in various branches with many parts of the East and West should be perfectly capable of studying what should be the second or third industry of the country, and, if convinced of Indian possibilities and needs and of the markets available whether internal or foreign, of combining both to obtain experts and implements and to send selected students abroad for thorough practical training in each specific branch.

Government is playing and doubtless will play its part in initiating and assisting investigation and experiment both by direct and indirect action, but the future really lies with capital, enterprise and foresight, and if Indian capital is not awake and alert the industry will presently pass in its most lucrative forms into non-Indian hands

232. *Pisciculture*.—As regards pisciculture the matter is somewhat different; the larger, more difficult and uncertain enterprises such as the stocking of Government reservoirs and canals which annually dry up either wholly or nearly, must be the subject of Government experiment as already proposed. But the “*petite culture*” of the water may readily be undertaken by those who similarly cultivate the soil; the matter is of the simplest, and what Government can do can be even more easily and cheaply done by the villager with but slight instruction and help; it is precisely a case for that small-scale effort on the potential benefits of which I have elsewhere dwelt.* It is a case where the possessor of a tiny pond of a few yards square, can experiment practically without cost, and may be practically certain that favourable results will be equally true of larger areas; possibly indeed, the larger area will give better results since the fish will live under more normal conditions. The cost of the experiments in the small experimental ponds would be nothing but that of half a dozen parent fish; as suggested above, refuse or insect, etc., food can be cheaply supplied if the ponds are small and destitute of natural food—which is improbable—and fish are numerous, but in such cases the value of the fish should far outweigh the cost of the food. Hence well wishers of rural progress may easily attempt small culture with a knowledge that success would be readily imitated and spread throughout the country.

233. It is certain that in India an acre of average water will, with proper care, produce as great a *weight* of food as an acre of average land, while its *money value* will be much greater; hence wherever a pond naturally perennial or which may be cheaply made so, is available, it should be utilized, it being remembered that the utilization of ponds by pisciculture not only costs less than arable culture, but is far less liable to seasonal uncertainties, while the water is still available for other purposes and is even improved by fish growth; even in a season of drought the harvest does not fail since the whole stock of fish can be taken as the water dries up; finally, such ponds if triennially dried and cultivated with cereals will, for one or two years, give enormous crops and at the same time be improved for subsequent reversion to pisciculture.

234. Now, not only are there many small ponds, as mentioned above, but these could be deepened and enlarged at small cost; a pond usually exists just because it is already in a low and favourable place for the gathering of water, and deepening merely increases its

* Convocation address, 1900.

storage power. Moreover there exist thousands of low swampy places which might be excavated and embanked at small cost ; such are the marshy places often found at the lower end of an irrigated area, which now breed only mosquitoes and malaria but which might produce human food ; as I write, the latest Fish Trade Journal mentions a Swedish morass which is being turned into a magnificent hatchery. Along the Kurnool and other canals there is a vast amount of seepage so that at the toe of the bank there are often similar wet marshy places ; in the *unirrigated* area bordering certain Kistna Delta canals I found in February that the undisturbed water level was but 4 feet below the surface of the ground and that steady baling only temporarily reduced the level to 5 feet. In all these cases it would cost but little to excavate and embank ponds, and it is well known that in many parts, *e.g.*, in Bengal, it pays to buy irrigation water to supplement the natural supply in fish stock-ponds, especially just before the setting in of the hot weather. It is, of course, obvious that old ponds should be prepared for experiment by the absolute exclusion of all fish, especially predatory, except those which are to be reared ; this can be obtained by careful and repeated netting or still better by complete dryage of the pond in the hot weather.

235. *Delegation of Students to Japan.*—Finally, it may be suggested that of the Indian students who decide on studying in Japan, at least one per annum should seek to be enrolled in the Imperial Fisheries Institute, Tokyo, and to undergo complete training there ; in the first year or so two or three should enter annually since a student may only take up during his three years' training one branch, *viz.*, either the catching, the preserving (curing, etc.), or the culture of fish. Most of the industries which students have attempted to study in Japan, *e.g.*, glass, have the grave disadvantage that they do not already exist in the Presidency, that an effective demand for the products of such industry is uncertain, that the very existence of the necessary raw materials is often problematical, that their existence in the necessary quantity, quality, position, and cheapness is unascertained, that there are no data for estimating the probable cost of the goods, and that there are no workmen already skilled in the novel industry : these disadvantages form a serious, often a fatal handicap. But in the case of fishery products the case is very different ; the industry is in general existence though in a primitive condition ; the product is a valuable food which all meat-eaters—say, a possible 90 or even 75 per cent. of the population—will accept ; the raw material exists in enormous quantities everywhere along the coasts and is even abundant inland wherever circumstances permit of growth ; no elaborate machinery or complex scientific processes needing a life-long training are needed either to obtain or to preserve the raw material ; workmen skilled in the industry so far as it has gone, are everywhere numerous and ready for employment. Hence students trained in

theory and practice like the Japanese graduates from the Fisheries Institute, could be certain of a field for the exercise of their knowledge. Nevertheless, it is still urged that private students who go to Japan for the purpose of this training, should go as the delegates of some person, syndicate, or company, who will give them beforehand a reasonable certainty of employment on their return,* unless in the rare cases where the students are able, by fortune or otherwise, themselves to take up on their return, as a personal venture, such branches of the industry as they may master. In general a student with assured prospects will work far better not merely because of the certainty of employment on his return but because he is working with a definite aim and because of his responsibility to his principals.

236. *Fisheries Society, etc.*—Finally, private enterprise may form a Fisheries Society for the awakening of interest in the subject, for the purpose of gathering and spreading trade and technical information, and for small experimental effort. The example of Japan in this matter is eminently one to be followed, and though much of the best intellect of the Presidency is naturally uninterested in the question seeing that it concerns a food distasteful to vegetarians, yet there are a vast number to whom such questions are of grave importance. There are educated and well-to-do men in Madras and elsewhere who are ancestrally connected with the business, and to whom it is almost a duty at least to push forward a knowledge of the industry even if they no longer care to handle the business personally.

F. A. NICHOLSON.

* It is very regrettable to see students going to Japan not only without any previous training or preparation for a particular industry but without the least certainty of subsequent employment. Far more regrettable, however, is that aimless drifting of students to that country with a vague hope of learning some industry (*nesciunt quid*) or other which may possibly avail them on their return; there were newly-arrived students who told me that they did not know what industry they would take up; one had actually to be prompted to reply that weaving was his object. Not only so, but the chances of obtaining even manual, low-grade employment in a factory is always problematical; a Japanese employer naturally prefers a sturdy labourer of his own country to a foreigner who can barely understand the simplest orders. As for admitting students to participation in the higher branches of an industry, it is hardly to be supposed that a shrewd, farseeing race of remarkable secretive capacity, struggling with all their might to attain supremacy in arts and industries which have cost them such time and energy and money and even life will, at all events without very heavy premia, part with their knowledge and trade secrets to foreigners who may become and who in weaving and spinning matters already are, industrial rivals in the Eastern trade. Equally regrettable is the short-sighted procedure of taking up an industry especially those of a complex and most costly nature, without first ascertaining the existence of suitable and accessible supplies of material without which the projected industry could not only not compete with Europe but could not even exist.

APPENDIX I.

THE MARIKANAVÉ LAKE.

WITH the object of examining Marikanavé lake as a possible source of fish, I recently visited the tank, which will have an area at F.T.L. of above 30 square miles with a depth at the dam of 130 feet; at its lowest the tank can never fall below about half the above area nor, except for silting, can there ever be less than 60 feet at the dam since the sluices are placed at that level above the bed; the lake at F.T.L. will hold 1,100 million cubic yards of water. This enormous body of water is supplied with vast quantities of fish food both from natural growths in the shallower areas which from the configuration of the lake are extensive, as at Kodayar in Travancore and the Periyar lake and from its catchment area of 1,000 square miles; if stocked with productive classes of fish such as carp and properly worked the lake would speedily become a very prolific and inexhaustible source of food.

The proper way to treat the lake would be for persons of knowledge and capital to lease the fishery rights from Government for a long term of years, to provide spawning and nursery ponds so as to stock the reservoir annually with millions of the proper fry at an age when they can look after themselves, and to employ power boats with trawls and other nets and also large fixed or pound nets as in lake Biwa (Japan), to gather in the harvests which would practically be continuous. Owing to its distance from populous centres a large fresh fish trade would probably be difficult at present though the railway is within a very few miles of its shallow parts and might make special arrangements for a guaranteed supply; but the fish could readily be dried or otherwise preserved, and sent to the various markets, while the offal, including heads and guts, would be useful as manure in the irrigated (sugarcane) land under the tank.

It has already been suggested that the warm Indian waters are far more prolific of fish food and consequently of fish, especially carp, than the cold European waters where, moreover, carp practically hibernate for half the year; in Europe a warm summer *appreciably* increases the carp harvest. But even in European lakes where fish subsist solely on the natural food supplied by a lake and its sources, $1\frac{1}{2}$ cwt. per acre chiefly of carp (180 kilogrammes per hectare) is considered a medium annual yield, and if this figure be adopted the annual produce of 20,000 acres would be 1,500 tons. Taking another method of calculation; in Europe a lake is considered stocked (with carp, etc.) if it holds fish at 1 lb. per 50 cubic yards; assuming throughout the year an average depth available for fish life and food of only 30 feet or 10 yards, the lake of 20,000 acres at F.T.L. will provide about 960 million cubic yards; allowing for the periodical shrinkage by irrigation demands, etc., an average of only 600 million may be taken as available for fish life; this volume would therefore safely nourish 12,000,000 lb. of fish

or 5,360 tons; if only one-fourth were annually fished, 1,340 tons would be the harvest. It is certain then that at a low estimate 1,200 tons of fish could annually be taken from that lake.

Now the whole of this fish, taken daily in moderate quantities, could be brought alive or but just dead, to the curing house, so that the preserving process could be begun before any trace of taint had appeared; hence a product of the first quality and good keeping power could be ensured especially in a climate of such great dryness as that of the neighbourhood where the annual rainfall averages from 12 inches (Hiriyūr) to 18 inches at the lake. Allowing a loss in weight of 25 per cent. by the removal of heads and guts, and of 40 per cent. of the remainder by dryage, the product in prime dried fish, almost the whole of which would be edible, would be 45 per cent. of the above weight or 540 tons, worth at two annas per pound, Rs. 280 per ton; at only Rs. 225 or 10 lb. per rupee the annual value would be Rs. 1·2 lakhs *plus* the value of about 150 tons of by-products for manure on the irrigated area.

These figures could certainly be greatly increased by proper manipulation of the lake as for instance by fencing in some of the shallow parts and using them as stock ponds, and so forth; it must also be remembered that if Mr. Thomas's figures are taken, even with large deductions, as a basis of fish growth, the natural outturn should be far larger; if $1\frac{1}{2}$ cwt. per acre yield 1,500 tons or even 1,000 tons on the average area, then 1,000 lb. per acre such as Mr. Thomas obtained from the Vallam pond, mean nearly six times that quantity, while even the Bavarian rate of nearly $2\frac{1}{2}$ cwt. per acre would mean something like 2,400 tons. Since even 1,000 tons of fish mean 75 lb. of fish annually for 30,000 people, the importance of the utilization of this lake as a food supply is evident while it would provide an important local industry.

Of course this lake is merely cited as an example; as shown in the text there are large areas of other permanent waters, actual or potential, which may be utilized in similar fashion, while of non-permanent waters there is a notable area.

APPENDIX II.

FISHERY LAW, JAPAN, 1901.

Section 1.—In this law the word “Fishery” means the catching or cultivation for profit of aquatic fauna and flora.

The word “fisherman” means one who engages in or possesses the privilege of fishery.

Section 2.—This law does not apply to private waters except where expressly so provided.

Section 3.—Any person desirous of obtaining the right to fish (*a*) either by establishing any fixed engine in a fixed position, (*b*) or by enclosing a particular area of water shall obtain a special Government license; the Minister of the Department shall determine the kinds of fishery requiring special licenses.

Section 4.—A Government license must also be obtained for the exclusive right of fishing within a given area. Such license shall only be granted on the application of a fishery association (*Gyogyo-kumiai*) intending to use for such exclusive right the shore of the locality where such association is established, or in cases where such right has acquired the sanction of long usage.

Section 5.—The license mentioned in section 4 shall determine the limits of the fishery when granted to an association or shall recite such limits when granted in accordance with long usage.

Section 6.—Licenses shall not exceed 20 years in duration. But periods of suspension under section 9 shall be excluded in determining the expiry of the license.

Section 7.—Rights of fishery may be the subject of inheritance, assignment, common property, or mortgage. But the transfer of exclusive use of an area of the sea can only be sanctioned by the authorities.

Section 8.—The right of fishery may be cancelled when such right is not exercised within one year of the issue of license, or except on special sanction where a fishery has not been carried on for two whole years. But suspensions under section 9 shall not be taken into count in the above periods.

Section 9.—The authorities may limit, suspend, or cancel any fishery license when required for the protection of aquatic products or by the public interests, or when a fisherman breaks this law or the regulations issued thereon.

Section 10.—Owners of land shall not hinder entry on their land or the use thereof when so required for establishing marks for fixing the boundaries or bearings of fishing grounds, provided that the sanction of the authorities shall have been duly obtained.

Section 11.—The authorities may order the establishment of such fishing marks.

Section 12.—Any loss or damage caused by the entry or use of private land as mentioned in section 10 shall be paid for upon a claim being made.

Section 13.—With the sanction of the Minister of the Department prefects may issue orders on the following matters:—

(1) The limitation or prohibition of catching or selling marine products;

(2) The limitation or prohibition of particular methods of catching or using boats or implements;

(3) Limitation of the number of fishermen engaged in a fishery, or fixing their qualifications;

and (4) Limitation or prohibition of the discharge into the water of substances injurious to aquatic products.

Where such orders are violated all fishing implements and the products fished shall be liable to confiscation.

Section 14.—The Minister may limit or prohibit the placing or building in any particular locality of any construction that may interfere with a passage of fish up a river.

He may also order the modification of any such existing construction.

Section 15.—In cases falling under the second paragraph of section 14 compensation shall be payable by the Minister, such compensation being recoverable from any fisherman upon whose application the modification was ordered.

Section 16.—The three preceding sections shall be applicable to private waters when such waters communicate with public waters.

Section 17.—(Not important in India.)

Section 18.—The fishermen residing within definite limits may, with the sanction of the authorities, form a fishery association: the territorial limits of the association shall be definite sections or hamlets of a town, village, or fishermen's quarters. In Hokkaido the limits may extend to those of a county.

Section 19.—Such Fishery Association shall be the owners of the fishery rights and privileges in the given locality, but shall not itself (that is *quod* association or company) conduct fishing operations.

Section 20.—When such association has obtained a license for the exclusive use of the sea adjoining its place of habitation, it shall cause its individual members to conduct the fishery on rules laid down by the association.

Section 21.—The Minister of the department shall issue regulations for the establishment, management, and supervision of fishery associations.

Section 22.—Fishermen or persons engaged in the manufacture or sale of fishery products may establish a Marine Products Association (*Suisankumiai*) or Chamber of Fishery for the improvement and development of fisheries, for the protection and cultivation of marine products, or for increasing the advantages derived from the industry. Such Chambers shall be regulated by the Law for Industrial Associations (*Juyō-bussan-dōgyō-kumiai*).

Section 23.—Any one to whom the issue or modification of a fishery license has been refused or who may consider himself aggrieved by any decision under sections 8 or 9 or paragraph 2 of section 14 may present an objection petition to the authorities.

Any person aggrieved by the decision on such objection petition may appeal (file a suit?) to the Civil Courts.

Section 24.—Any person considering himself injured by the wrongful issue of a license or by a wrongful modification thereof, may file a suit in the Civil Courts.

Section 25.—In case of disputes between fishermen as to the boundaries of fishing grounds or the limits of any fishing rights or methods, the parties may apply to the local authorities for the decision of such dispute. Either party may sue in the Civil Courts against such decision.

Section 26.—Any person fishing without a license in cases where license is required, or during any period of suspension of such license or in contravention of the conditions or limits settled by such license, shall be liable to fine not exceeding Rs. 150 (100 yen), and to the confiscation of all fishing gear employed in such illicit fishing and of the products thereof.

Section 27.—The owner or possessor of the right of fishery shall be held responsible for the acts of his employees, and penalties due under section 26 shall be levied from him.

Section 28.—Any person trespassing upon rights of fishery conferred by sections 3 and 4 shall be liable to fine not exceeding Rs. 150 upon the complaint of the owner or possessor of the rights trespassed upon.

Section 29.—Any one destroying or removing marks denoting a fishing ground shall be liable to fine not exceeding Rs. 45.

The above law is supplemented by 75 sections of regulations issued by Government for the due carrying out of the law.

APPENDIX III.

LIST OF TRANSLATIONS.

FISHERIES.

- (1) Fishery Law of 1901.
- (2) Rules for giving effect to (1).
- (3) Specimen maps of fishing grounds.
- (4) Regulations of 1899 for the establishment, etc., of Prefectural Fishery Stations.
- (5) Regulations of 1899 for the establishment, etc., of Prefectural Fishery Schools.
- (6) Law of 1899 for the grant of subsidies to Prefectural Experimental Stations (Agricultural including Fishery).
- (7) Rules for giving effect to (6).
- (8) Law of 1899 relating to the establishment, etc., of Industrial Schools (including Fishery Schools).
- (9) Rules for giving effect to (8).
- (10) Rules for the education of teachers in Industrial Schools.
- (11) Regulation of 1901 (Department of Education) relating to Fishery Schools.
- (12) Regulation of 1902 (Department of Education) relating to Supplementary Industrial Schools.
- (13) Regulation of 1902 (Department of Agriculture and Commerce) governing Fishery Associations (Gyogyo-kumiai) established under section 18 of the Fishery Law (1).
- (14) Regulation of 1902 (Department of Agriculture and Commerce) governing Chambers of Fishery (Suisan-kumiai) established under section 22 of Fishery Law (1).
- (15) Prefectural Regulation of 1903 relating to the Fisheries of Aichi Prefecture.
- (16) Papers relating to Fishery Associations and Chambers of Fishery.
- (17) Specimen articles of a Chamber of Fishery (Suisan-kumiai).
- (18) Statement of work done by such a Chamber.
- (19) Statement showing number, finances, etc., of Fishery Associations in June 1906.
- (20) Articles, budget, etc., of a specimen Association.
- (21) Financial statements of two specimen Associations.
- (22) Reports showing work done in 1889-1901 by the "Fisheries Society of Japan."
- (23) Law of 1905 for the encouragement of Pelagic (deep-sea) fishing.
- (24) Rules for students selected for deep-sea training.
- (25) Reports of results of (23).

- (26) Reports showing number, work, expenditure, subsidies, etc., of Fishery Experimental Stations, schools and itinerant teachers.
 - (27) Results of experiments in such Stations.
 - (28) Report of instruction given in 1902 by Experimental Stations.
 - (29) List of subjects assigned for experiment to Stations by Central Government (Department of Agriculture and Commerce).
 - (30) Scheme showing experimental suggestions for future work.
 - (31) Report of recent Conference of 79 Directors of Prefectural Fishery Experimental Stations, Fishery Schools, Fishery Officials, etc., for the improvement of fishery work.
 - (32) Statement relating to Fishery Schools of all classes.
 - (33) Reports relating to three Fishery Schools under the Department of Agriculture and Commerce.
 - (34) Report of a School of Agriculture, Forestry, and Fishery.
 - (35) Annual report of the Imperial Fishery Institute, Tokyo.
 - (36) Statistical report of the Kanagawa Prefecture for 1904 (Agriculture and Fisheries).
 - (37) Two articles by Prof. Matsubara and Dr. Kishinouye on sea fishing.
 - (38) Miscellaneous.
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