Marine Biological Research in India.

By Lt.-Col. R. B. Seymour-Sewell, M.A., SC.D., F.Z.S., F.A.S.B., I.M.S.,
Director, Zoological Survey of India, Calcutta.

"THE outstanding fact about India is the poverty of the people and the prospect of this becoming steadily worse with the enormous growth of the population until, failing wars or pestilence, starvation itself steps in to adjust the balance. No one is doing anything about this." So writes Mr. Arthur Moore in his article on "Beloved India" in the *Fortnightly Review* of October last; and he goes on to add that "it ought to be possible to devise a great Indian plan .. ...to organize her (India's) agriculture and her other industries, so that her people shall get the benefit in good wages and a higher standard of living and increased consumption of her own products."

To anyone who has had any experience of Indian fisheries and who has been able to compare the conditions that exist in India with those that pertain in almost every other part of the world, it is abundantly clear that the marine resources of India are at the present time almost untouched and that an almost inexhaustible supply of cheap and wholesome food, as well as of other marine products that form the basis of trades, such as button making, etc., remains for the most part unexplored and unexploited. The occupations of fishing or dealing with fish is regarded throughout India as one to be carried on only by low caste people and as a result the entire fisheries are left in the hands of those who are not in a position, either intellectually or financially, to develop them, while in every main centre the actual marketing of these supplies has become concentrated in a close "ring", part of whose system is to see that the actual fishermen are kept in a continued state of debt on account of funds advanced to them by the members of this "ring" for the purchase of gear, etc., and who frustrate any attempt to increase the supply of fish by a refusal to purchase the catches made by any organization that is not under their immediate control. From time to time abortive experiments in marine fishery work have been carried out by certain Provincial Governments, such as the investigations of the Bengal Marine Fisheries by the "Golden Crown" in 1908-09 and those of the Bombay coast by the "William Carrick" in 1921-22, and in each case the conclusion reached was that there is an ample supply of fish in Indian waters that could be caught by such trawling methods but that to be a commercial success much greater facilities for the distribution and sale of the catches would be necessary. As Dr. Amirthalingam has pointed out in his letter to *Current Science* (Nov. 1932) it by no means follows that the methods of catching fish that are at the present day employed in European waters will prove to be most suitable or successful in Indian Seas, and one line of research that is much needed is the scientific investigation of those methods that have been employed in tropical waters in other parts of the world, especially those in use among the Japanese and Chinese fishermen.

Such investigations clearly cannot be undertaken by the fishermen themselves and although it may be possible in the future to educate the members of the fish "rings" in the large ports of India sufficiently to enable them to recognize that improved fishing methods will lead to increased markets and, therefore, to increased profits, and thus to enlist their financial support for such marine investigations, as has been done in England and other countries, it is clear that in the main one must look to Government aid for these purposes. Unfortunately at the present time the Governments, both Provincial and Imperial, appear to be far more interested in Agriculture than in Fisheries and, although in the past these two subjects have been administered by the same department, so little attention has been paid to the latter that, with the single exception of Madras, there is not a single province with a Fishery Department worthy of the name. Indeed, in certain provinces there has been a very retrograde movement, as, for example, in Bengal, where in 1915 there was a Fishery Department of Bengal, Bihar and Orissa employing a Deputy Director, two Superintendents and one Assistant, whereas there is at the present only a single Fishery Officer; and other provinces appear to be in like case.

If ever the Fisheries are to be improved and placed on a proper basis, it is clear that scientific research on both the fauna itself

and the conditions under which the fauna is living is the first essential. In 1920 a Committee was appointed by the British Association for the Advancement of Science to consider the question of Marine Biological Research in India and they reached the conclusion that it was only by the erection of a Marine Biological Station that any considerable improvement in our knowledge could be made, while at the same time they drew attention to the need of providing increased facilities for the biological work of the Surgeon-Naturalist on board the R.I.M.S. "Investigator". As regards this latter recommendation it may be pointed out that, far from increased facilities being granted, on the transfer of Lieut.-Colonel (then Major) R. B. Seymour-Sewell, I.M.S., from this post to that of Director of the Zoological Survey of India, the post of Surgeon-Naturalist was held by Major R. W. G. Hingston, I.M.S., during one survey season, from October 1925 to April 1926, after which he proceeded on leave and later retired from the service and no scientist has ever since been appointed to succeed him. There has, therefore, been a complete cessation of this branch of study, and indeed at one time there was considerable danger of the post itself being actually abolished by the Government, who appeared to be under the impression that the work of the Surgeon-Naturalist was of neither actual nor potential value. As no suitable scientist could, under present conditions, be provided by the Indian Medical Service, the Secretary of State agreed to the post being transferred to the Zoological Survey of India but so far no officer has been appointed, nor is there any likelihood that one will be appointed in the near future owing to financial difficulties. Thus this line of scientific marine research has come to an end at any rate for the time being.

In 1920 a detailed scheme for the erection of a Marine Biological Station was submitted to the Government of India by Dr. S. W. Kemp, who was then the Superintendent of the Zoological Survey of India and who had been deputed by the Secretary of State to investigate the Marine Biological Stations of Europe during a period of his leave. A similar proposal for the erection of a Marine Biological Station under the Madras Fishery Department was put forward in the following year by Mr. Whitehouse, of the Central Training College, Lahore. Dr. Kemp's proposal was for the erection of a station in Port Blair in the Andaman Islands, where the fauna is known to be particularly rich and where, owing to the geographical position of the islands, oceanic conditions are present; but in 1926 the proposed site of this station was changed to Karachi, as it was felt that Port Blair was too inaccessible and that Karachi would offer a more accessible site to which advanced students from all the Universities of Northern India could easily come and where, further, the scientific staff of the station would be in close touch with fishery work and commercial fishing. Although at one time it appeared possible that the Government would erect this station and full plans were drawn up and a suitable site allocated, their actual sanction was postponed year after year until the present financial position of the Government renders its fulfilment beyond the bounds of hope.

It is, therefore, with all the greater satisfaction that one welcomes the suggestion made by Dr. S. B. Setna that a Marine Biological Station should be erected in Bombay; and one sincerely hopes that he will be enabled to raise sufficient funds from among the far-sighted inhabitants of the city. The work of such a station falls into two categories, namely, the purely scientific and educational side, and the economic aspect; and of these the first is, at any rate at the outset, by far the more important, since no real improvement of the fisheries themselves can be made without a scientific basis and the data required for such a basis may take several years to obtain, especially in such a country as India, where the number of trained zoologists is comparatively small and where there are such marked differences in the conditions under which the fauna is living along the extended coast line of the Indian Peninsula. As has been pointed out by Kofoid in his *Handbook to the Biological Stations of Europe*, the great research stations of that continent "are supported largely and often almost exclusively (except in Great Britain) by State and local funds. This is made possible in European countries by the recognition on the part of the State of the relation of research to higher education in biological sciences." One of the main questions that must be faced if a Marine Biological Station is to be established is the provision of funds for its upkeep, when it has actually been established; for it is clear that it would be perfectly useless to go to the expense of building such a station, if in a year or two

it would have to be closed down for lack of financial support. In the selection of an appropriate site for such a station one must of necessity take this factor into consideration, as well as others such as the abundance and variety of the local fauna and flora, the ease of access, the varied types of environment, the tidal amplitude, climatic conditions and, last but by no means the least, the purity and salinity of the water; and this last consideration will present very considerable difficulty in such a port as Bombay. On the other hand, it is only in such a centre, where there is a large and well-educated public and where in this instance there is the added advantage of having in the city such a well-known and widely influential scientific society as the Bombay Natural History Society, that there would be any probability of being able to raise sufficient support locally to ensure the maintenance of the station. Should the station be started, there is little doubt that many of the Universities would contribute towards its upkeep in the same manner as is done in Europe and other countries by renting "tables", to which advanced students can be appointed for the purpose of carrying on research; other lines along which additional funds may be obtainable are by the supply of material to colleges for the practical instruction of classes within the Universities themselves, but in this case the new station will have as a rival the already established branch of the Madras Fishery Department, that now supplies most of the wants of the Indian Colleges. Finally there will doubtless be a large number of visitors, both educated and uneducated, the latter especially during the pilgrim season, who will pay to come and see the Aquarium, that must necessarily form a part of such a station; but in this connection it must be remembered that the admission fee must be kept as small as possible or many of the poorer people will not be able to afford it. From a careful consideration of the whole matter it seems that only one conclusion regarding the financial outlook is possible and that is that such a station cannot, at any rate at first, be self-supporting and it is doubtful whether it would ever be, even after it had succeeded in proving beneficial to the fisheries of India and, therefore, might naturally expect to obtain some financial support from those who in the future will be exploiting the fisheries of India for their own private or public profit.

Sewage Farming in India.

By Dr. V. Subrahmanyan, D.Sc., F.I.C.,
Professor of Biochemistry, Indian Institute of Science.

ALTHOUGH a considerable amount of highly valuable research has been carried out on land disposal of sewage, yet the available scientific information with regard to the utilization of sewage in agricultural practice is comparatively limited. As the result of this and the general impression that the problems connected with sewage belong to the domain of sanitary science, we find hardly any mention of sewage farming in books on agriculture. On the other hand, utilization of sewage or sullage, as the case may be, plays a very large part in agricultural practice, particularly in the Far East, and, in view of the valuable fertilizing ingredients present in it, deserves to be even more widely adopted than in the past. It is no doubt true that popular sentiment has generally been against the use of sewage, but there is, as yet, no sound scientific evidence to support such an impression: in fact, the remarkable success achieved on certain experimental farms and by several private individuals, particularly market gardeners, would clearly indicate that, with judicious handling, sewage would be the cheapest and, at the same time, one of the best fertilizers used by man. In this direction much valuable information is available from the reports of some of the sewage farms in India and the object of the present contribution is to present a brief account thereof and to draw attention to certain lines along which further scientific work has to be carried out to place sewage farming on sound, economic and, at the same time, hygienic basis.

There are several sewage farms in India and some of them are very old, dating back to the middle of last century. Unfortunately, most of them do not either possess proper records or have not been carefully maintained, so that the considerable amount of what might have been valuable information,