

REPORT OF PROF. W. E. RITTER as DIRECTOR of the San Diego Biological Laboratory for the summer of 1903, to the Marine Laboratory Committee of the Chamber of Commerce of San Diego.

THE LABORATORY BUILDING AND ITS EQUIPMENT.

It is well known to all members of the committee that a portion of the old boat house on Glorietta Bight at Coronado, belonging to the Coronado Beach Company, has been used for the laboratory building during the summer.

In almost all respects the building has answered its purpose well. Space has been ample, light and ventilation good, location both with reference to water and living quarters convenient and sufficiently secluded. Only two drawbacks in any wise consequential have been encountered. The building is not steady enough for microscopic work with high magnifying lenses, and the absence of running sea water in the laboratory has made it impossible to carry on some kinds of work that would have been prosecuted to advantage but for this lack.

Of the equipment of the laboratory and vessel, the microscopes, library and most of the glassware were brought from the University. Most of the collecting tackle and some laboratory apparatus came from the old laboratory at San Pedro, while the equipment of both the laboratory and the vessel have been renewed and added to to some extent from the funds provided by this committee for the present summer work.

Mr. Manuel Cabral, a Roseville fisherman, with one helper and in charge of the schooner "Lura" has been in constant service as a collector, and I can hardly speak in terms too highly commendatory of the way this work has been done. In order that the entire time of the scientists might be devoted to their specific investigations, the handling and care of the tackle was wholly intrusted to Mr. Cabral, and the charge has been met with the greatest faithfulness and skill and intelligent interest.

Barring the necessary limitations of a sailing vessel for such work, particularly on a coast like this where the

summer winds are so light and uncertain, the "Lura" has been entirely satisfactory.

The scientific staff proper has been:

Professor C. A. KOFOID, Ph.D., whose time has been devoted chiefly to the Protozoa;

Instructor H. B. TORREY, Ph.D., whose whole time has been given to the Coelenterata;

Mr. CALVIN O. ESTERLY, A.B., who has been engaged for the most part upon the Copepoda;

MR. JOHN F. BOVARD, B.S., who has worked under the direction of Professor Kofoid on the Protozoa;

MR. H. M. EVANS, a senior student of the University who has made the hydrographic observations and has also acted as a preparateur; and

Professor WILLIAM E. RITTER, Ph.D., whose scientific work has been on the tunicata and enteropneusta, has been director of the station.

In addition Dr. A. Carlson of Stanford University has used the laboratory in carrying on his investigations on the comparative physiology of the heart of invertebrates.

Professor B. M. DAVIS of the Los Angeles Normal School and candidate for Ph.D. in the University of California, has been engaged upon the problem of flotation of marine organisms.

Miss Marian Hubbard, A.B., of Wellesley College and the University of California, has carried on general studies on marine zoology and besides has done special work with Professor Ritter on the protochordates.

Miss Margaret Henderson, a student of the University of California, has worked with Dr. Torrey on the jelly fishes and polyps.

SCOPE AND CHARACTER OF WORK DONE.

In order to correlate the work this year with that previously done by us and others in this area, and also to adapt it best to the facilities at command, it was deemed wisest to direct our efforts this year chiefly though not wholly to the plankton, i.e. to the organisms that swim free in the waters, as contrasted with those fixed along shore or at the bottom.

GENERAL SUMMARY OF RESULTS

Hydrographic work has been limited to the determination of temperature and specific gravity of the water. These observations were made at regular intervals and at fixed stations both in the Bay and outside. About 150 determinations of each kind were recorded.

A number of interesting and rather surprising facts have come to light from the observations, but fundamental as they are to many of the most important biological questions, they are still altogether too few and were extended over too limited an area to admit of safe generalizations as to their significance.

The following may profitably be presented here. The temperature of Bay water, as for example, at the mouth of Glorietta Bight, is, as might be expected, considerably higher than that of ocean water, both being taken at the surface at the same time of day. Thus the average for the Bay was 24.34 degrees C. (75.86 deg. F.), while that for the ocean was 19.33 deg. C. (67.38 deg. F.). The average of ocean water at 70 fathoms 15.03 deg. C.

A quite inexplicable fall in the temperature of the ocean water at Coronado wharf took place on July 27th. Up to that date the average had been 20 deg. C. (68 deg. F.) while on that date it was 16.2 deg. C. (61.16 deg. F.). This low temperature lasted about three days when previous conditions were gradually restored. A slight decrease in the specific gravity accompanied this lowering of the temperature.

The work done by Professor Kofoid assisted by Mr. Bovard has shown the plankton to be very rich in one celled organisms of the groups Peridiniidae, Tintinidae and

Radiolaria. 122 species have been already identified, of which 21 are certainly new to science, while a half dozen or more others may be new but must be studied farther, before certainty can be reached.

Among the species observed that had been previously described, a number were known from the Mediterranean, from the Red Sea and from the North Atlantic. None of them had been reported from the Pacific Coast of North America, and few from any part of the Pacific Ocean. Some had been taken only by the Challenger expedition in depths of 2250 fathoms or more.

The observations seem to indicate that on the whole the relationship of the local pelagic protozoan fauna is that of tropical waters, though some far northern forms appear in the lists.

The group of Coelenterata, comprising the jelly fishes, hydroids, anemones and corals, is represented, according to Dr. Torrey, in the waters of the San Diego area by at least eighty-six species, more than half of which had not been found here until this summer.

Of the twenty species of jelly fishes observed, only five had been previously reported and some of the twenty are undoubtedly new to science.

At least four new species of hydroids were obtained, and eleven species that had not been reported from this region heretofore.

Many of the species of jelly fishes are represented by one or a very few individuals, some of which were immature and some fragmentary so they could not be identified accurately.

Six species of corals were obtained, none of which are new, but so far as can be determined at present, all are peculiar to the Pacific Coast.

Mr. Esterly's work on the copepods or "water fleas" brought to light 27 species that were already known. Of these 5 had not been previously reported outside of the

Mediterranean Sea; four are new to North America, and fourteen had not previously been reported from any portion of the Western coast of either of the Americas. It may be mentioned incidentally that perhaps the chief interest in this group of animals is that they are by far the most abundant in numbers and most uniform in their distribution of all organisms of the sea. They constitute the staple food supply of most of the free swimming fishes and other higher marine animals. In the economy of the sea they correspond pretty well to the forage grasses of the land. To them is due, furthermore, much of the phosphorescence of the sea.

In the groups of organisms on which I have myself been chiefly occupied, the following results may be properly mentioned here.

Of Enteropneusta three species have been obtained, one of these being undoubtedly new to science and another hitherto known only from a few specimens found ten years ago at Santa Catalina Island. This latter has been secured in such abundance this summer as to enable us to considerably extend our knowledge of its habits and structure.

Of the Tunicata or "Sea Squirts" a total of 23 species have been identified, 9 of these belong to the pelagic division of the group and 14 to the shore and bottom dwelling. Of the nine pelagic swimming species, at least one is new to science and another is new to the Pacific Coast. Of the fourteen fixed species, probably none are wholly new either to science or to this region, but four are still undescribed and are known by only a few specimens.

The information and material obtained during the summer will contribute very substantially to the monograph of the Tunicata of the Pacific Region which is now in course of preparation.

From the report on the several groups thus presented the zoologically sharp members of the committee will note that several of the great subdivisions of marine animals are wholly left out.

The starfish - sea urchins - sea cucumber tribe; the enormous worm and molluscan tribes; and the crab - lobster - shrimp tribe have been, because of a lack of workers, wholly neglected so far as any real scientific attention is concerned. Of course, we have gathered a good many of these animals and seen many interesting things about them, but that sort of thing does not count scientifically.

SAN DIEGO FOR A PERMANENT LABORATORY.

And now what can we say on the strength of our experience thus far, about the fitness of the San Diego district for a permanent marine biological laboratory?

We Californians are much in the habit of not wanting anything to do with anything that is not the biggest and best of its kind on earth. I lived so many years on a Wisconsin farm where modesty is one of the easiest of all virtues to cultivate, that even Southern California will probably never wholly obliterate the quality from my constitution. I am not going to report now that San Diego is unquestionably the best place on earth for such an institution. I am simply going to say that it is undoubtedly an excellent place - from several points of view one of the very best.

As regards conditions for the investigation of the physics and chemistry of the sea in their relation to marine biology; of many problems of planktology; and of several important problems of deep sea biology, I do not see how any region can be more favorable than this.

The climatic conditions are such that a small vessel can work not only with perfect safety, but also with comfort and the maximum of efficiency at all times of the day and night and almost every day for at least ten months of the year. To the experienced marine biologist this means much. The plankton is certainly very rich and varied. The bottom fauna over a large area in comparatively shallow water is also rich and varied, so that easy dredging and trawling are sure to yield rich returns. Again the abyssal depth of the sea can be reached at short distances from shore, and this I regard as of very great importance.

The least favorable element in the situation is the rather limited extent of rocky shores. This source of material, being the most easily and inexpensively accessible, is probably the most important source for most marine laboratories, particularly where schools are conducted and general biological researches are the chief function of the laboratory. With, however, a laboratory so located and so equipped with boats as to make both Point Loma and La Jolla as accessible as possible, this defect should not be serious.

There can be no doubt that a laboratory capable of great things for biological science might be built at San Diego.

ACKNOWLEDGMENT.

There remains only the pleasantest of all my duties of this summer - that of acknowledging the services of those who made the laboratory possible and who did its work.

If any one name is to head the list of those to whom credit is due for the existence of the laboratory, that, all will agree, must be Dr. Fred Baker. His proposal it was that the laboratory should be brought to San Diego this summer and his energy and devotion it was also that was foremost in backing up the proposal after it had been made. Indeed I have all the time felt myself to be merely the superintendent of one of Dr. Baker's numerous enterprises.

But how would Dr. Baker have got along with fund gathering for his enterprise without the knack of this business of Mr. H. P. Wood, Secretary of the Chamber of Commerce, and the other members of the Committee of the Chamber, Dr. Burnham and J. N. Newkirk, to help him along. And how could the funds gathering committee have done anything if the fundgivers had not been found? As a matter of fact, it is impossible even had we the disposition to deprive a goodly list of the good citizens of San Diego from responsibility for the laboratory. Here is the list: E. W. Scripps, Miss Ellen Scripps, Homer H. Peters, Coronado Beach Co. by E. S. Babcock, Mgr., Mrs. Fannie Keating, U. S. Grant, Jr., Geo. W. Marston, San Diego Electric Railway Co. by W. E. Clayton, Mgr., and H. W. Putnam.

The interest taken in the work by San Diego merchants should not be overlooked for in every instance when we made purchases liberal discounts were given.

As to the scientific work, good taste forbids my saying much in laudation of it. This is too much a matter of my own family - scientific rather than consanguineous family, to be sure, but family none the less. This much, however, may, I am sure, be said without violence to propriety: That no company of seekers after wisdom in all the ages of wisdom gathering could ever have worked together with a greater measure of harmony and zeal than has characterized our little company this summer.