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Author(s): Vernon L. Kellogg
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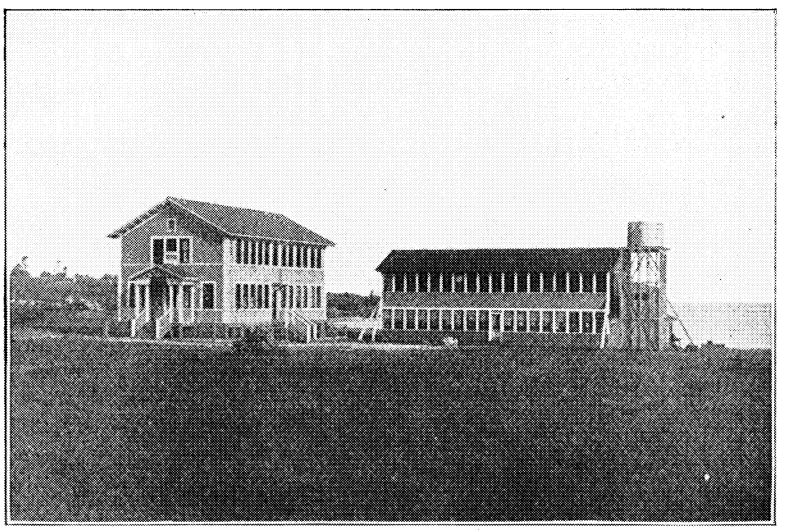
THE HOPKINS SEASIDE LABORATORY.

VERNON L. KELLOGG.

THE Leland Stanford Junior University was formally opened to students Oct. 1, 1891. It is situated on the great Palo Alto estate, whose eight thousand acres carry this unusual college yard from the salt marshes of San Francisco Bay across the intervening valley and over the lesser hills to the foot of the climax of the Santa Cruz Mountains. In the summer recess after the first college year, Stanford had its marine laboratory ready for habitancy. A friend of the university, Mr. Timothy Hopkins, whose practical friendship has been especially enjoyed by the biological departments of the university, provided the money for building and equipping the laboratory, which, in honor of the founder, is officially named "The Hopkins Seaside Laboratory of the Leland Stanford Junior University."

The location chosen for the laboratory by the directors, Professors Jenkins and Gilbert, is the bay side of the promontory, Point Pinos, which is the southern limiting point of the Bay of Monterey. The bay is a great, shallow indentation of the coast line, which offers little protection from the sweep of the open ocean except in its southern part.

Here, on a cliff by the water's edge, are the laboratory buildings. They are two two-story buildings, one sixty feet long by twenty feet wide, the other forty by twenty-six feet. Two large salt-water tanks stand near by. Within, the space is divided into large and small laboratories, rooms for investigators, lecture room, photographic dark room, aquaria, concreted basement rooms, etc. The collecting equipment comprises the necessary dredges and nets, and instruments for sounding and for taking below surface temperatures. The



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laboratory does not own a launch, a sailboat and rowboat having proved, so far, sufficient for the needs of the collectors. The collecting of fishes is chiefly done by Chinese fishermen, of whom a villageful lives but half a mile from the laboratory.

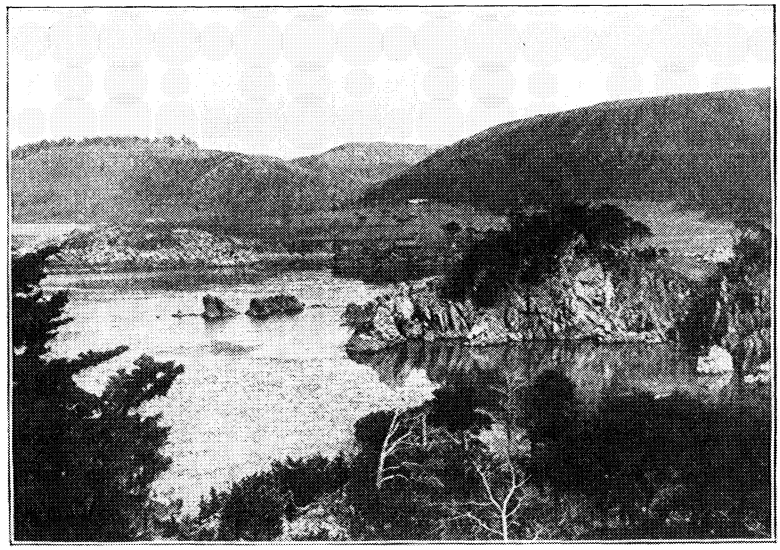
In addition to a fauna more or less peculiar to itself, the Bay of Monterey, being a middle point between the north and south zones of the Pacific coast, finds itself possessed of a number of sub-tropical and sub-boreal types peculiar to the two regions. The Pacific coast of the United States has but few bays; it is a straight coast line bathed by the great swell of the open ocean. In the aggregate the east coast, with its intricate coast line, will present a greater abundance of bay-

shore life, but area for area, the collecting ground about the Hopkins Laboratory is probably unapproached by any spot on the Atlantic coast. A well-known and experienced biologist of the University of Chicago, who spent a summer at the Hopkins Laboratory, has said that Monterey Bay and the Bay of Naples are much alike in the abundance and representation of species. It will be of interest to naturalists to be told in some detail of the actual faunistic conditions of the bay and ocean shore near the Hopkins Laboratory. The laboratory has been long enough established, and the observation and collecting diligently enough prosecuted, to make it possible to undertake this with some confidence. For the statements regarding the invertebrate fauna, I am presenting very largely the observations of Mr. Harold Heath, assistant professor of zoölogy in Stanford University.

The sponges are extremely abundant; in certain localities they encrust the rocks over a large area. There can be no less than thirty species represented. Among the hydroids two or three species also are very numerous, literally covering the rocks at extreme low-tide mark. Sea anemones are plentiful. Certain forms which cover themselves with shells and stones occur between tide marks closely packed together to the number of many thousands. Annelids are numerous, as are certain star worms (Gephyrea), but the vermian class has been as yet little studied. A species of Cirratulus, which lives in the cracks of the rocks, extends its long, thread-like tentacles up through the sand, so that in their abundance and massing they look like tufts of delicate seaweed.

Certain groups of mollusks are unusually well represented. Four or five species of Haliotis are abundant, and are used for food by the Chinese. Many are dried and shipped to China. Limpets are particularly well represented, as also are the nudibranchs, of which thirty or forty species have been noted. About thirty species of Chiton have been found, among them the giant Cryptochiton, six to ten inches long, the only one of the group with a concealed shell. Mytilus forms great beds at low-tide mark, and is used to some extent as food. Among the cephalopods certain species of Loligo are so abun-

dant that the catch of the Chinese fishermen for a single night, when spread out on the ground to dry, will cover five or six acres! The Chinese boats go out by night with nets and pitch-pine torches, which are hung over the boat's side to lure the squid. The squids are dried and shipped to China to be used as food. It is said also that the dried squids are used in China as fertilizer. The duty on fertilizer in China is very low, the duty on salt very high. By mixing a little dried squid with a great deal of salt, and calling it fertilizer, a considerable amount



COAST NEAR THE HOPKINS LABORATORY—VIEW FROM POINT LOBOS.

of salt finds its way into the Celestial Kingdom at a very low duty rate. The giant squid, *Ommatastrephes californica*, and a species of Octopus (punctatus, probably) occur, the latter quite common, and the former not infrequent during the summer, when the rock-cod are young and readily caught.

Crustacea are well represented in certain groups. Amphipods literally swarm everywhere. Isopods, particularly two species of Idothea, are very common. The Brachyura are represented by twenty to twenty-five species, while the Macrura are represented by three or four very numerous hermit crabs and an Alpheus. Copepods are numerous, wonderfully

so in the plankton. They are largely the cause of the phosphorescence of the ocean here. The water sometimes has a light rusty color, which is due to the occasional abundance of Noctiluca.

About sixty kinds of echinoderms have been found. The sea urchins cover the rocks in the strip of land from extreme low tide out for thirty to forty feet, and for distances of miles along the coast. Some of them are of enormous size. *Holothuria californica*, a sea cucumber from ten to twenty inches long, is abundant. A great orange-red Cucumaria, three feet long, is not uncommon. Serpent stars fairly swarm in the sand, together with Synapta. The starfishes are numerous, and there are many large and strikingly colored ones. The Chinese fishermen collect, can, and send to China, to be used as food, large quantities of the reproductive glands of the sea urchins.

Ascidians are as numerous as the sponges, and are found in the same places, encrusting the rocks over about the same areas. The compound forms are especially numerous, but large simple ones suitable for study are not so easily procured.

The fish fauna of the Bay of Monterey and adjacent waters presents numerous special features of interest. Hag-fish and Chimæra are easily collected in large numbers. The rock-cod, a group of peculiar oviparous forms, are abundant in species and individuals. The viviparous surf-fishes, found elsewhere only in Japan, are numerous. The embryos, when they issue from the body of the mother, are surprisingly large in proportion to the size of the adult female. The fish fauna is an unusually large one because of the presence of a number of sub-tropical forms, and many northern forms, in addition to the forms peculiar to the region.

At the extremity of Point Pinos peninsula, and along its rock-bound western or ocean side, there are a number of "bird rocks." These isolated rocks, rising twenty to forty feet above the water, are fairly covered at times with cormorants, pelicans, and gulls. In the breeding season the larger ones are occupied as rookeries by various sea birds. As there are no storms in summer, an excellent opportunity for observing the life of these sea birds is offered, and some extended studies,

especially of the migration of ocean birds, have been made here by Mr. Leverett M. Loomis, of the California Academy of Sciences.

The botanist, too, finds much of unusual interest on this bit of Pacific coast and in the bay and ocean waters of the shore. The Monterey cypress and Monterey pine, two conifers so restricted in their range as almost to warrant the statement that they are to be found naturally only on this little promontory, are the characteristic trees of the region. The cypress is, indeed, found only here, but the pine has a range of a hundred miles, perhaps, along the coast. Point Pinos is, however, the center and the principal point of its occurrence. In the shore waters the botanist is at once impressed with the abundance and enormous size of the brown kelps. *Macrocystis pyrifera* grows to the length of 1000 and 1500 feet; Nereocystis is nearly as large. A number of these brown kelps are monotypic, and are found only on the Californian coast. Among these forms is the interesting sea palm, Postelsia, which grows abundantly on the surf-swept rocks. The red algæ, too, are present in great abundance. In fact Professor D. H. Campbell says that in his acquaintance with the shore waters of America, Europe, Japan, and the West Indies he has found nowhere else so great a number of species, nor so enormous an abundance of individuals, as are displayed in these waters.

The laboratory's regular sessions are held in June and July of each year, but investigators and students working without instruction may continue their work through the summer. Courses in general zoölogy, embryology, and cryptogamic botany are regularly offered, with special courses and lectures depending upon the personnel of the instructing force. The instructors are chiefly members of the biological faculty of Stanford University. Students taking the regular courses are charged a fee of twenty-five dollars; investigators prepared to carry on original work are permitted the use of the laboratory and its equipment free of charge. There are seventeen private rooms for investigators.

The Hopkins Laboratory has a point in common with the Naples Station, which should not go unremarked. The laboratory can be used to advantage at any time in the year. The mid-year holidays always find a group of workers there.