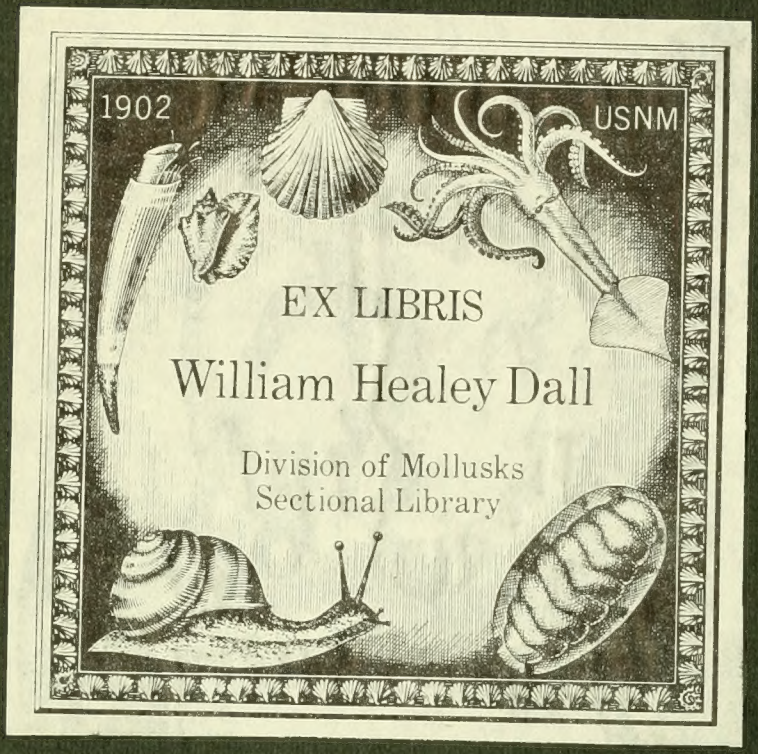
Laguna Marine Laboratory

Laguna Beach
California

Pomona College
Claremont, California
May, 1912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FIRST ANNUAL REPORT

of

THE LAGUNA MARINE LABORATORY

at

LAGUNA BEACH, ORANGE COUNTY, CALIFORNIA

POMONA COLLEGE
MAY, 1912

Published by
THE DEPARTMENT OF BIOLOGY, POMONA COLLEGE
CLAREMONT, CALIFORNIA

DR. A. J. COOK
STATE HORTICULTURAL COMMISSIONER
SPONSOR

THE LAGUNA MARINE LABORATORY

PERSONNEL FOR 1911

[1]DR. A. J. COOK, *Sponsor*
[2]MISS C. K. RICE, *Chaperon*
PROFESSOR C. F. BAKER, *Director and Editor of Report*
CHARLES W. METZ, *Manager*

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[3]CHARLES W. METZ [4]DAVID L. CRAWFORD
[5]BLANCHE E. STAFFORD [6]VINNIE R. STOUT
[7]MABEL GUERNSEY
[8]HARRY V. M. HALL [9]JOHN GUERNSEY
FRANK R. COLE LEON GARDNER

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1 Now California State Commissioner of Horticulture at Sacramento.
2 Now Mrs. A. C. Dyer of Kinsley, Kansas.
3 Later fellow-assistant under Dr. David Starr Jordan at Stanford University; now appointee to fellowship in Columbia University under Dr. Bashford Dean.
4 Of this group, but with table for the summer of 1911 in Pomona College Biological Laboratory. Later fellow-assistant under Dr. Vernon L. Kellogg at Stanford University, and assistant in State Horticultural Commission. Recently appointed an assistant in Cornell under Dr. J. G. Needham.
5 Fellow-assistant, 1911-12, Department of Biology of Pomona College and candidate for master's degree. Later appointed fellow-assistant in University of California under Dr. C. A. Kofoid.
6 Fellow-assistant, 1911-12, Department of Biology of Pomona College and candidate for master's degree. Later appointed fellow-assistant in Cornell University under Dr. J. G. Needham.
7 Appointed fellow-assistant for 1912-13 in Department of Biology, Pomona College.
8 Appointed scholar-assistant for 1912-13 under Dr. Robt. H. Walcott in the University of Nebraska.
9 Accepted candidate fellow-assistant for 1912-13 under Dr. W. A. Setchell in the University of California.

As a matter of contemporaneous history, and of general interest to many who are deeply concerned in all that pertains to this work, it may be mentioned that during the years 1910-12 the following Pomona graduates also pass on into advanced biological work: Elizabeth Heald and Sarah R. Atsatt to fellowships in Zoology under Dr. Kofoid in Berkeley; A. S. Crawford, to a fellowship in Cornell Medical; John A. Prizer, to post of Entomological Expert to the San Diego Land and Town Company; R. S. Vaile, to Horticultural Commissionership of Ventura county, California; A. R. Baird, to Horticultural Commissionership of Inyo county, California; E. O. Essig, to Secretaryship of California State Horticultural Commission; H. A. Weinland, to an assistant in the State Horticultural Commission; John E. Graf, to an Assistantship-in-charge at the Government Entomological Station at Compton, California; C. F. Stahl, to assist Graf; H. H. Warner, to student assitantship in plant breeding under Prof. Babcock at Berkeley; A. R. Davis, to a research fellowship in the Shaw School of Botany of Washington University at St. Louis.

Dedicated to the men who, having seen a great, new opportunity to do something worth while in the world, wasted no time, but seized upon it with avidity and stayed with it—to the men with whom originated the idea of a permanent Marine Laboratory at Laguna Beach, and to whom is due the practical development of the larger possibilities for the project:

James T. Smith
L. N. Brooks
J. N. Isch
N. Philbrook

and to these other pioneers, who, accepting the challenge of a great public service, have been the first in addition to those mentioned above, to give of their means towards the founding of this institution:

The Laguna Beach Co.
S. A. Burroughs, Pres.
H. G. Heisler, Gen. Mgr.

Charles P. Low
James Irvine
And others

OUR PROFESSION OF FAITH IN THIS WORK

I.

A man's education most perfectly adapts him for the greatest success in any phase of human endeavor only when it has included thorough training in scientific method—accurate observing, truthful recording, and logical correlating.

II.

Biology—the study of life—as an element in education (and so in the progress of the human race) represents one of man's most intimate and fundamental intellectual activities—it is the study of his own life forces and of the myriad influences that determine his own setting in nature.

III.

The sea, that limitless fountain-head of immeasurable life, which without cultivation has yielded so much to the nurture of the human race, which with cultivation can yield as much food as our best agricultural lands, and which, one day, when the land is crowded with teeming millions, will go far toward feeding the then existing peoples —the sea, I say, presents a multitude of pressing problems of infinite importance to the future of humanity, and is the preeminent biological laboratory of earth, which every year is attracting an increasingly greater number of students, and enlisting an ever warmer and more active human interest.

C. F. Baker.

PROLOGUE

FOR many years groups of Pomona College students in Biology, had made annual visits with Dr. Cook, head of the Department of Biology, to the neighboring coast, usually to Deadman's Island at San Pedro. The single day spent there each year, among the rich displays of life accessible at low tide, had kept alive the intention of the Department, growing stronger year by year, to spend portions of each summer on the coast, with a selected group of interested Pomona students. After many attempts* to organize such a project, early in 1911, Dr. Cook, Professor Baker, and Mr. Charles W. Metz, at a final conference, decided to go, regardless of obstacles, for one season's trial, and to take with them a group of students interested in the work solely for the work's sake, and to share with them alike in all expenses of whatever nature. The selection of a location was left to Professor Baker and Mr. Metz, and these two, during the Spring of 1911, worked over, largely on foot, most of the coast from Redondo to Laguna. The latter locality was settled upon without any question, as by all odds the most desirable for our immediate purposes—studies on the fauna and flora of the tidal zone and its immediate neighborhood. The varied topographical and ecological conditions—the high promotories, the acres of rocky tide-pools exposed at low tide, the numerous small sand beaches, all equally accessible—together with the varied beauty of all the natural surroundings, showed this to be a most uniquely favorable place. We immediately rented a large house from Mr. James T. Smith, and June 21 found us in possession with all the necessary outfit for the proposed work.

Miss C. K. Rice (now Mrs. A. C. Dyer of Kinsley, Kansas) had kindly consented to serve as chaperon, and the following students joined the party: Blanche E. Stafford, Vinnie R. Stout, Harry V. M. Hall, Mabel Guernsey, John Guernsey, Leon Gardner, and somewhat later, Frank R. Cole. David L. Crawford, who was also one of this group, carried on his work in the Claremont laboratory. With

*In connection with these attempts, grateful acknowledgments should be made to Miss M. Hathaway and Mr. Llewellyn Bixby.

the energetic assistance of Mr. Metz as business manager, and the active co-operation of all, everything was in readiness for housekeeping and laboratory work by the 26th of June. Three tents in addition to the house were found necessary to accommodate all the work proposed.

Every day thereafter to the end of the summer was full. Low tide hours were used for collecting and work on the beach, and this often took a party out at five a. m. or earlier. Every foray yielded

The 1911 Laguna Company

On porch at back, Miss Rice and Mr. Guernsey. In front, left to right, Professor Baker, Mr. Hall, Mr. Cole, Mr. Metz, Mr. Gardner, Miss Baker, Miss Stafford, Miss Stout, Miss Guernsey, and our host, Mr. James T. Smith.

loads of valuable material that required all the remaining hours for study and preservation. Every day was rich in discovery and incident, and every nightfall marked substantial progress in the work of everyone connected with the laboratory. An hour given every day to a plunge in the surf kept the health of all in prime condition. All the varied work of the laboratory and house was well organized and progressed with a rare smoothness and lack of friction. Sunday was given to rest, to writing letters, to reading, to strolls along the cliffs, and to regular but informal ethical and religious discussions.

We consider that all accomplished in 1911 amounts merely to a cursory preliminary reconnoissance—an effort to get acquainted with a few of the most salient features of the local field. Some work was done on the life of the fore-shore, more thorough work on the distribution of life between tides, and a good deal was accomplished in the tide-way with the tow-net. Mr. Metz was very active in the collecting of tide-pool and shore fishes, extending his operations a number of miles up and down the coast, working out the pools thoroughly, and also getting a good many things by line and net. He also visited Newport, and through the marked kindness and interest of an expert power-boat fisherman, Mr. J. E. Souder, made several trips off-shore, for the purpose of visiting the gill nets and jigging, and also made arrangements for the saving of various rare things to be found in the fishermen's nets and traps. Mr. Souder also loaned to the laboratory a skiff for use at Laguna, a favor for which he has our heartiest acknowledgments. To him are due several of our most valuable finds during the summer.

Of the many thousands of specimens gathered during the summer, and preserved in best of order, not one small part has as yet been worked up, though work is in progress along many lines, either by students on the Coast, or by well known specialists elsewhere who are co-operating with us. The results presented in this report are to us simply a beginning—a breaking of the ground. We have to acknowledge the kindly assistance in this work of many specialists throughout the world, including Prof. J. M. Aldrich, of Idaho University, Prof. Walter K. Fisher of Stanford University, Dr. M. Bernhauer of Austria, Mr. J. H. Paine of Stanford University, Mr. S. S. Berry of Stanford University, Dr. W. A. Setchell of California University, Mr. Julius Hurter of the St. Louis Academy of Science, Dr. Wm. A. Ritter of the San Diego Marine Laboratory, and others. Large collections of marine worms and of sponges are still untouched, and will be at the disposal of interested special students.

Acknowledgments should also be made to many friends at Laguna, notably our host, Mr. Smith, whose kind and helpful interest was with us always; to Mr. Isch, our banker and merchant; to Mr. Brooks, who gave us many a boost; to Mr. Trefern, on whose patience we drew heavily, and to others. Col. Coulter, whose untimely death has lately been announced, was a frequent visitor to the laboratory, and

was one of Mr. Smith's first converts to the idea that the laboratory ought to be a permanent institution in Laguna. Our stay in Laguna was marked by this kindliness on every hand. Laguna, unlike any other place on the coast, possesses the rare charm of a quiet and homelike country village—an unusual and valuable asset which in itself is much sought and highly prized by great numbers of people. Just this feature is doubly inviting, when the village happens to be at

A view of the building used for Laboratory in 1911, with surroundings. Professor Baker's tent at left, with Mr. Metz's tent back of that. Mr. Guernsey and Mr. Hall had tables on the upper porch, others had tables in the larger room on the first floor. Mr. Gardner's tent was placed back of the house to the right.

the most desirable point on the coast. We are hoping that nothing will ever destroy that unique atmosphere.

During the summer several hundred visitors went through the laboratory, expressing keenest interest in all they saw there, and to them we took pleasure in extending every courtesy. Among these visitors we were delighted to number many of the friends and alumni of Pomona College. We were also visited occasionally by men from government institutions, and from neighboring educational institutions.

Especially does the laboratory group feel deep gratitude for his constant, helpful, and inspiring influence as sponsor of the whole enterprise, to Dr. Albert J. Cook, now State Commissioner of Horticulture, then Professor of Biology in Pomona College, an earnest friend of all who strive, an active laborer for all things good and true, and an ardent believer in the possibility of the ultimate realization of all the highest in human hopes.

Within the laboratory group, perfect kindness and good fellowship was the great distinguishing feature. A spirit of interested helpfulness pervaded all, and this constant and watchful co-operation vastly increased the possibilities of the summer work. Indeed the future watchword for this enterprise might well be

Co-operation!

C. F. Baker.

The channels just north of Laguna. These channels are very deep and contain a magnificent display of kelps (Eisenia and Egregia). This whole area is exceedingly rich in life.

REASON FOR BEING

THERE are now a large number of marine laboratories in the world. These include several on our own East Coast and also several on the West Coast. Almost without exception they have been established for purposes of advanced university research of the most formal order. Reference is here made only to those laboratories which are confessedly part of great educational enterprises. A number of others have been instituted wholly or in

Showing one of numerous small bays with sand beaches. At low tide, between the rocks in foreground and the point at left, a large bed of Phyllospadix is accessible.

part, in connection with fisheries investigations. We are now adding one to the interesting list of marine laboratories, though this one is organized on a somewhat different basis than any that we know of, and for somewhat different purposes. We purpose to maintain a number of unique features in connection with this laboratory, as long as it shall exist as an annex of Pomona.

There have been constantly in our minds the possibilities that such a laboratory might have for advanced college students. Having become thoroughly convinced of the immense importance and usefulness in the last years of a college course, of what we have been calling "junior research work," and having been long aware of the tremendous effectiveness of "living interest" as a pedagogical tool, we have done our utmost to give advanced students the opportunity to try out their several abilities and capacities in scientific methods of thought and work, on some simple little piece of live investigation that they might easily carry through by faithful effort. The response to these great opportunities among our students, has been little short of marvellous. Advanced students of some special ability and capacity have constantly sought these opportunities and given to them unlimited amounts of time and energy—largely in their own outside free hours, and usually without college credits. Their results have, as a rule, been highly commendable. For instance, the work by Hall on Acarina, Crawford on the Psyllidæ and Thysanoptera, and Metz on the bees, is (according to some of the best authorities in this country and Europe) as good as any work of the same sort ever done in this country, and in some respects better.

Uniformly we have encountered a great purpose on the part of the students to make their work "as good or better than anything done before"—this has been their working principle. Naturally there would never be time here to develop anything more than simply some promise of their possibilities. Even when their maiden efforts are not so admirable, every day sees great and steady growth—with inevitable response to the great ideals of endeavor which seem to permeate everything at Pomona. One of our students who has been a constant contributor to the Pomona Journal of Entomology for several years, still shows striking improvement in every article published, and this spirit of "getting better all the time"—the spirit of "going on," has characterized all of this "junior research work." In the face of such spirit as this, it may be imagined that our professors have spared no effort to furnish opportunities where they were earnestly sought by capable students. Our college curriculum being a crowded one, we had early conceived the idea of a summer marine laboratory, and have worked steadily towards it, with the result of its partial materialization in 1911.

In all of this work there has been no idea of aping the university to the slightest degree. Many years of experience as student and teacher in a number of colleges and universities, have convinced me that the American college has a destiny uniquely its own. I believe that there are greater possibilities in the Christian college for the building of individual character, and for laying the broadest and soundest foundations for true culture and great scholarship, than anywhere else on earth. Just so, I also believe that tremendous

Showing the tide pools at Mussel Point. Here are immense colonies of mussels, barnacles, sea urchins and coralline algae. This place is exceedingly rich collecting ground.

ideals of really adequate and sane high school work can easily be built up without overlapping the college in any way, and I came to this belief while associated in practical high school work with two masters of that subject—Prof. Bryan, now Assistant Superintendent of the St. Louis schools, and Miss Ernst, now Principal of the Cote Brilliante School in St. Louis.

Our work in Pomona College, and all connected with it, has been developed along strictly college lines, with all of the intimate individual interest and assistance, and all of the varied and endless sacri-

fices for the sake of the students, that mark the best traditions of the Christian college. There is nothing proposed or carried out in our work that does not articulate perfectly with real university work—mark my expression—with *real university work!* For it must be remembered that our universities in their present variedly undeveloped state, receive in their undergraduate courses students of exactly the same grade as those coming to Pomona or other real colleges with equally rigorous entrance requirements. Whether the university—under university conditions—is able to do *true college work,* is a very debatable question, and one not germane to the point at issue here. I have repeatedly made the statement, and have heard it made also by some of our best university men, that coming up through the well organized basic system used with such splendid effect at Pomona, together with this final chance at "junior research," students could be broadly fitted for graduate work at our American universities—in *real university work*—who would give as fine results in certain lines at least, as students from any other possible sources, and this has worked out most conclusively in actual practice. Some of these considerations are of unusually great moment at Pomona, where, as recently shown by President Blaisdell—some sixty-eight per cent. of our graduates are now "going on" into advanced training.

Our method of teaching in college biology has been one as free as possible from mechanical and minutely prescribed routine, rich in laboratory and field work, full of first-hand training and of personal discussion and guidance, in every phase of the work, for every student. This opens up that higher and better college possibility of handling students, not in groups, en masse, by the ordinary "class" system, but as individuals, each for his own sake, and with methods adapted to his own peculiar needs and capacities, and by this inviting avenue we shall pass onward and upward to some of the greatest possibilities in modern education. Finally, among our lines of "junior research," we have included a great deal of work in limited aspects of comparative anatomy—which invariably furnishes great treasures of deep interest to all of our students, numerous simpler possibilities in ecology, life histories, economic relations, faunal, floral, and distributional studies, many of these being capable of the finest possible treatment at the hands of advanced college students

who have had the necessary basic training. Of course, all subjects requiring extensive apparatus, complicated technique, great numbers of highly specialized courses, or more than ten to fifteen hours per week, are taboo here and belong to the real university. For such work as we undertake, our equipment is unusually adequate, and will be so maintained.

Some of the best students we have are earning their way through college, wholly or in part, and are desperately crowded for time throughout the semesters. For these and for others with a limited number of extra hours, a great opportunity in the summer is a God-send! The Marine Laboratory at Laguna Beach gives us exactly the fullness of possibility in this direction that we formerly lacked. The professorial staff gives unlimited time to this seaside enterprise without tuition charges, even standing on the same basis as the students in matters of running expenses, bearing their share of the burdens of support as well as of work, and thus placing the opportunities within the reach of any who may desire them. This attitude has established an "esprit du corps" that is remarkable in its sincerity and intensity. When an educational enterprise is put on foot and carried forward on the strength of free-will interest and desire in a group of students, the success of its work will be assured.

So we submit this report and the principles it involves to the kindly criticism of the world of science and of education, above all other things as a study in practical pedagogy and more natural methods of instruction.

C. F. Baker.

FOR THE FUTURE

ACTING on the suggestion which originated with Mr. James T. Smith, a movement was started by the people of Laguna looking towards the permanent establishment of a marine laboratory at that place. This would involve, first of all, the erection of a suitable building, with aquaria, with facilities for the handling of a small stream of salt water, and with adequate laboratory facilities for students. The Laguna Improvement Association took the matter up, and has pushed it along with most commendable perseverance. Their efforts were most generously met and supported by the Laguna Beach Company—this company offering to give a large plot of land and one thousand dollars towards a fund of four thousand to set the enterprise on foot and get the building started. The Laguna Improvement Association set out to raise the additional three thousand, and this has been partly subscribed. A tremendous effort is now being made to complete this amount.

The matter of the publication of results was taken up at a joint meeting of the Laguna Improvement Association, representatives of the Laguna Beach Company (Mr. Bumstead and Mr. Jahraus) and representatives of the College (President Blaisdell, Dr. Cook and Professor Baker), and funds were at that time pledged, sufficient for the first year—Dr. Cook, with his splendid optimism, assuming the heaviest share of this pledge. In the raising of his share of the pledge, Dr. Cook has had the support of his friends, Mr. C. E. Harwood, Mr. N. W. Blanchard, Mrs. Renwick, Mr. C. C. Reynolds, the Kingsley, Mason and Collins Co., and three others. The Laguna contribution to the publication fund came from Mr. H. G. Heisler (for the Laguna Beach Company), Mr. L. N. Brooks, Mr. J. N. Isch, and Mr. James T. Smith.

After a building becomes a reality, then we shall take up the fight for proper facilities—especially aquaria, books and boats. More than any other one thing, we shall need a strong, large, power boat, for extending the radius of our activities up and down the coast, and for work in the deeper waters off shore. We shall need most urgently a fuller equipment of nets, traps, tangles, and other collecting devices. We shall need a fuller equipment of aquaria than we can get

with funds in sight. An immediate necessity facing us is the need for books, the larger works of reference, standard works on marine exploration, the reports of other marine laboratories, and many special papers. All of these things we shall push hard for, and we are hoping that all friends of such work will stand with us loyally in this great effort.

We hope to establish important co-operative relations with other laboratories of the sort, exchanging publications and material with them, and perhaps also, table facilities. There is not a point on the whole coast where the great west coast lobster (*Panulirus interruptus*) could be better investigated, or where abalones are more abundant, and none better for investigations along many other lines of marine biology, so that we hope to interest the Fish Commission in our efforts, get them to contribute full sets of their invaluable reports and bulletins, and perhaps to co-operate in other ways.

The future is big with possibilities for this enterprise, educational and otherwise. It will take energy and hard work to realize these possibilities, but we are confidently expecting that many who appreciate great effort in great educational enterprises, will participate in it with us. We invite all such to join us!

C. F. Baker.

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Showing region just north of pier at low tide. A large area of rich tide pools are very accessible here.

THE FISHES OF LAGUNA BEACH, CALIFORNIA, I.

CHARLES W. METZ

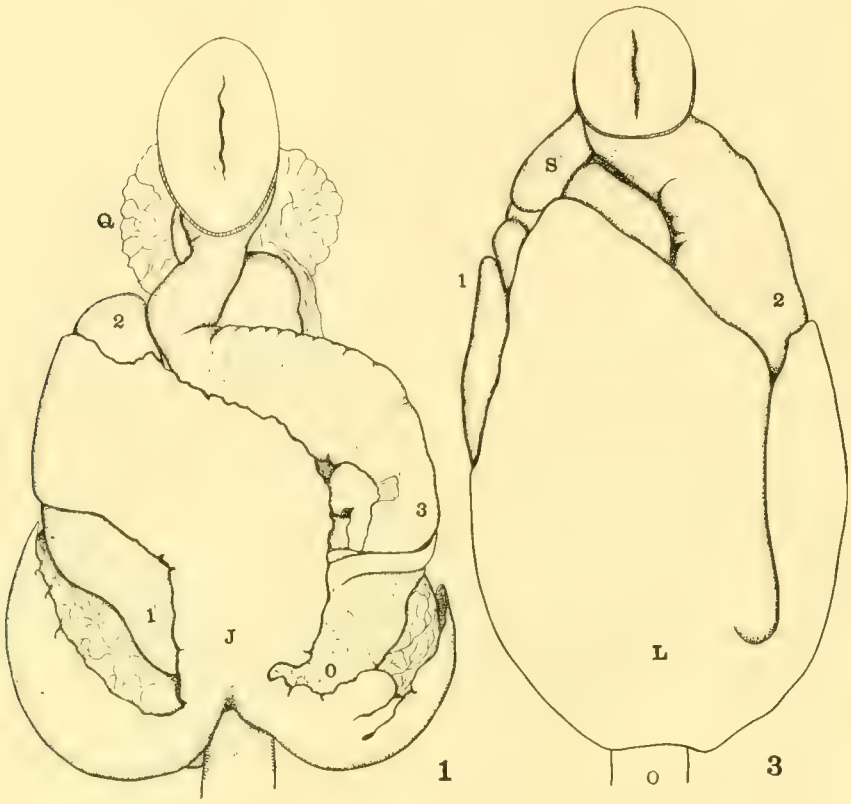
The present paper is a result of a study of the tide-pool and in-shore fishes found in the vicinity of Laguna Beach and Newport Beach, Orange County, California. The material for the work was obtained during July and August, at the 1911 session of The Laguna Marine Laboratory. The main object of the study has been to make as complete as possible a survey of the local shore fishes, together with observations and dissections bearing on their ecological relations. In the immediate vicinity of Laguna Beach is an unusual abundance of tide-pools, large, varied, and rich in aquatic vegetation, offering exceptional opportunities for shore work. For this reason an especial effort was made to work the pools and in-shore waters exhaustively throughout the limited time of our stay. No attempt has been made to cover the deep water fishes, or fishes that are not typically shore forms. Occasionally, however, representatives of the deep water species were brought in by fishermen or accidentally taken near the shore, and these have been mentioned in their places. Likewise a few notes on species taken at other localities along the coast have been included when they were of especial interest.

Most of the work in this study was done at the Laboratory in Laguna Beach, under the direction of Professor C. F. Baker, to whom the author is greatly indebted for assistance in many ways. Portions of it, however, have been since completed at Stanford University; and I am indebted to Dr. Gilbert, and Professors Starks and Snyder, of that institution, for kindly suggestions and advice. It is with pleasure, also, that I take this opportunity of thanking Mr. J. E. Souder, owner of the fishing launch "Ruth" of Newport Beach, for his hospitality, and his active interest in the work of collecting during the summer.

The nomenclature here followed is that of Starks and Morris, in "The Marine Fishes of Southern California," except in a few cases where changes have been made since this appeared (1907). Any such changes are noted in the text.

During the course of the work at Laguna the author became considerably interested in the gross visceral anatomy of the local fishes, especially where this related to the food and habits of species. Time did not permit of extensive investigations along this line; nor did the

available material allow comprehensive work on any one group. Consequently the accompanying notes and figures relate to many widely separated species, so that little comparison can be made except in a general way. Since, however, none, or very few of these common forms have ever been studied or described from the point of view of internal structure it is thought well to include herewith all the information gathered. It is interesting to note, even in what is included, the many modifications and variations that arise. Some of these are easily explained by the habits or food of the species, as for



Figures 1 and 2. Rhinobatus productus

Fig. 1, Ventral view of entire viscera, in natural position. Fig. 2, Same with organs separated to show form. The liver is thrown back, the alimentary canal stretched out, and the uro-genital organs pulled to one side. J, Liver. O, Ovary. Q, Kidney. D, Oviduct. R, Rectal gland. X, Spleen. Y, Pancreas. Numbers refer to corresponding regions of the alimentary canal.

Figures 3 and 4. Aetobatus californicus

Fig. 3, Ventral view of viscera entire. Fig. 4, Same with organs separated. A, Vent. D, Spleen. E, Pancreas. G, Pyloris. K, Kidney. L, Liver. M, Leydig's gland or Epididymis. O, Oesophagus. R, Rectal gland. S, Sperm sac. T, Testis. V, Vesiculae seminalis. W, Wollfian duct. Numbers relate to corresponding parts of the alimentary canal.

instance the similarity in internal structure of the "bat-fish" (*Aetobatus californicus*) and the "shovel nose shark" (*Rhinobatus productus*), whose viscera are correlated with bottom living habits and similarity of food, rather than body structure or form. Other modifications, on the other hand, such as that shown in the peculiar diverticulum or cæcal appendage of the stomach in *Gymnothorax mordax,* are not so readily understood, and offer interesting fields for speculation.

In only one family, the Blennidæ, were enough species obtained to allow any comparative study. But in this one alone some remarkable modifications are found, as shown in the accompanying figures. In this one family several extremes are typified, in regard to both form and structure of the visceral organs. The most peculiar of these is the great divergence from the comparatively short, compact viscera, with the long, coiled alimentary canal in such forms as *Heterostichus* or the *Gibbonsias,* to the extremely long, drawn out viscera and perfectly straight alimentary canal of the eel-like *Xererpes fucorum.* That this is not due solely to external form is shown by the intermediate visceral structure of *Xiphidion rupestre,* which in body form is extremely long and eel-like, just as is *Xererpes fucorum.*

Unfortunately only enough has been done to show a few of the extremes, and not enough to indicate relationships between genera. But even this indicates that a comprehensive study of this large and varied group in its entirety could not fail to bring out some important and interesting facts in regard, both to individual species and to their inter-relationships.

Family EPTATRETIDAE

Eptatretus stouti (Lockington). Hagfish.

Not common. A few specimens taken on set lines, or brought in by fishermen at Laguna.

Family CARCHARIIDAE

Mustelus californicus Gill. Dog-shark, Oil-shark.

Abundant at Newport and common at Laguna.

Triakis semifasciatus Girard. Little Leopard Sharp.

Found commonly in the vicinity of Laguna and Newport, but never abundant. Taken on set lines close to the shore at Laguna.

Carcharias laminella Jordan and Gilbert.

Two specimens seen at Newport are thought to be this species.

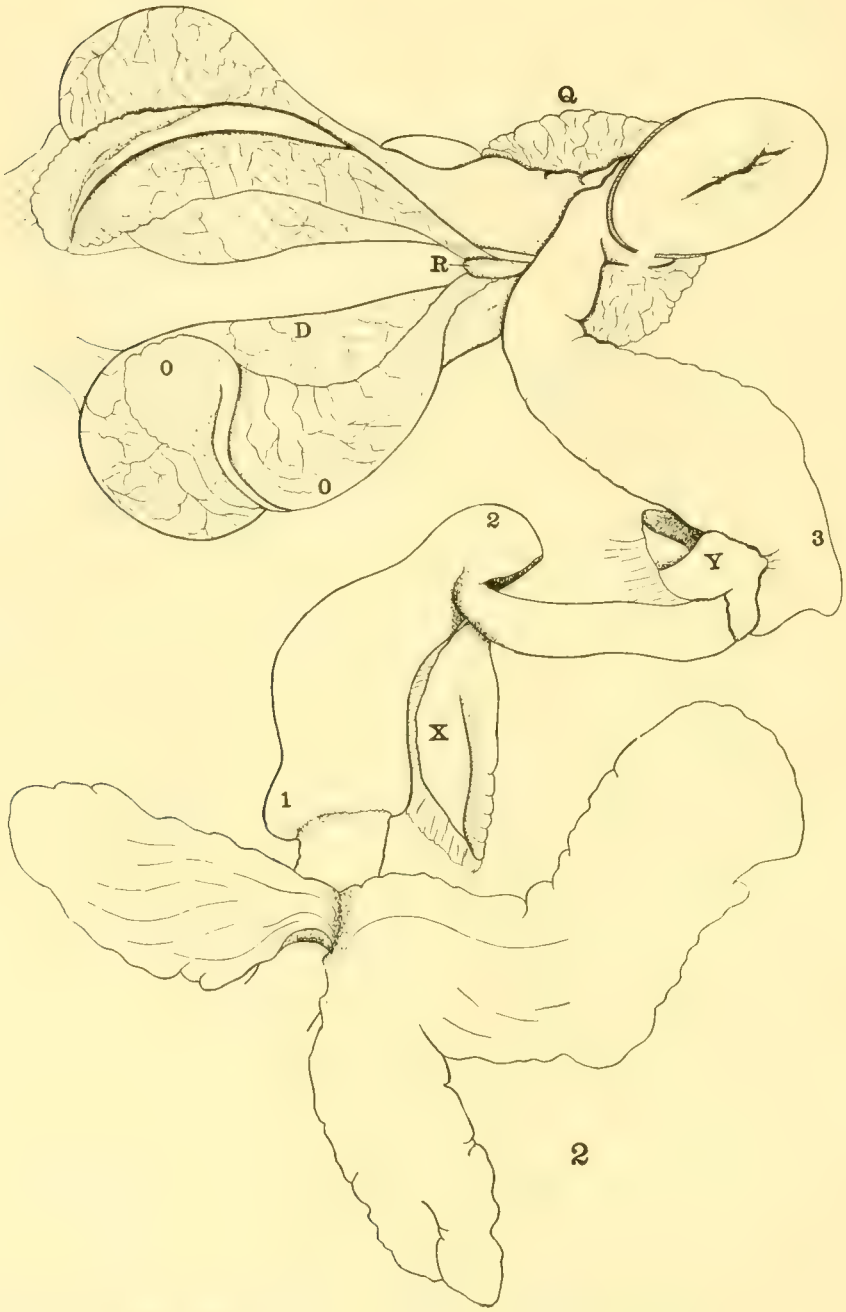


Figure 2. Rhinobatus productus; female. (Explanation under Figure 1)

Family LAMNIDAE

Lamna cornubica (Gmelin). Mackerel Shark.

(Plate II, Figure H)

One specimen, 4½ feet long, taken about ten miles southeast of Laguna in a barracuda drift net on July 26. This species is not recorded by Starks and Morris, but is said to be, "not rare in California," (Jordan and Evermann, Fishes of N. and Mid. America, Vol. I, p. 49). The specimen taken near Laguna was brought ashore and kept for some time, so there can be no question as to the identity. The accompanying photograph shows the general appearance of the fish.

Family SQUATINIDAE

Squatina squatina (Linnaeus). Angel Shark.

Several specimens of this species were taken by the fishermen in rather deep water off Newport.

Family RHINOBATIDAE

Rhinobatus productus Ayres. Shovel-nose Shark, Guitar Fish.

(Figures 1 and 2, and 2 A)

This was the most common ray found in the vicinity of Laguna. At Newport Beach a favorite sport of the "Sunday fishermen" is catching these large rays from the pier, where numbers take the bait and are hauled up every day.

The following notes were taken on a female specimen four feet long. Measurements in hundredths of body length. Snout to posterior apex of pectoral, 38; snout to ventrals, 18; snout to first dorsal, 59; distance between dorsals, 10½; tip of snout to vent, 41; breadth across pectorals, 34; height of first dorsal, 7.3; second dorsal same; length of abdominal cavity, 19.5. The abdominal cavity is very broad, the anterior two-thirds being nearly square. Posteriorly it narrows decidedly, both dorso-ventrally and laterally, due to the intrusion of the vetebral column and pectoral fin cartilages. This shape is well shown by the outline of the viscera in the accompanying figure (Figure 1), which is taken from this specimen. Figure 1 shows the viscera entire, in its natural position as found in the body cavity. Figure 2 represents the same with the various organs separated from one another sufficiently to show their individual forms. The alimentary canal is severed just in front of the liver. In Figure 1 a somewhat distorted appearance is given to the viscera by the enlarged oviducts, each of which is swollen with a well developed egg. The liver is trilobate, the lateral lobes extending a short distance

along the sides, partially covering the oviducts and ovaries, the middle lobe extending mesially an equal distance, then lapping over the left side, covering the stomach. The alimentary canal is very definitely divided into œsophagus, stomach, pyloric tract, spiral valve (or colon), rectum and cloaca. Both spleen and pancreas are well developed, the former lying along the right side of the stomach,

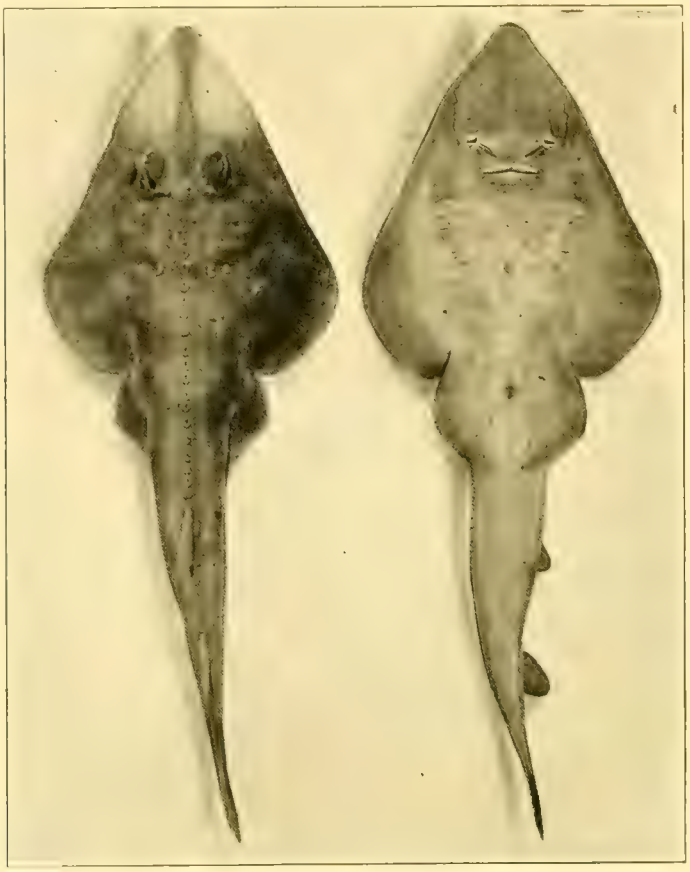


Figure 2a. Young Rhinobatus productus

the latter fastened to the intestine at the anterior end of the colon. The spiral valve in this species makes eleven complete turns, the bore in the first two or three being quite large, after which it is uniformly small to the end where it broadens out considerably in the rectum and still more in the cloaca. Exactly even with, and below the opening of the colon into the cloaca is the similar oviducal aperture,—a single aperture since the two oviducts coalesce just before reaching

Figure 4. Aetobatus californicus; male. (Explanation under Figures 1 and 3)

the cloaca. Along the base of the oviducts on each side (dorsally) may be seen the kidneys (Figure 2 A), each of which gradually diminishes in size, ending about the middle of the oviduct. Along the anterior and ventral side (appearing on top in figure) of the oviducts are the ovaries, attached throughout their anterior part to the oviducts and posteriorly to the rectal gland, (Figure 2 R). The ovaries and oviducts appear entirely out of proportion in the figure on account of the large ova in the latter. Aside from this the relationships of the various organs may be seen from the figures. The oviducts, instead of being separated as shown, normally extend dorsally over the stomach (as the fallopian tubes) and then down around the œsophagus in front of the liver, fusing below except for the common opening into the abdominal cavity.

The male urogenital organs of *Rhinobatus productus* resemble in general those of the same sex of *Aetobatus californicus,* as noted under that species, except that in the specimen examined the testes are well separated and distinct throughout their length.

On August 14th a female of this species was taken just as she was about to bear young. In fact, two of the latter were just emerging from the cloaca. The brood consisted of four males and one female, all of the same size. The mother was a large specimen, measuring 119 cm. in length, and 38½ cm. across the pectorals. In addition to the five young she contained seven well developed ova, each as large as a hen's egg. It is possible that she had already given birth to some young in the water before being caught.

The following notes were taken on the five young secured: All were alive and normal; the tail of one and head of another were protruding from the cloaca at the time of capture, indicating that they may be born either head or tail foremost. Only this one individual, however, appeared tail foremost. All five were of the same stage of development, with no signs of yolk-sac or other embryonic attachments. One of the males gave the following characters, with which the others essentially agreed: Measurements in mm. Length, tip to tip, 238; to spiracles, 35; to eyes, 37; to base first dorsal, 145; to mouth, 47; to base second dorsal, 180; to posterior tip of pectoral, 104; width mouth, 16; interorbital, 11; breadth across pectorals, 88; tip snout to first gill opening, 56; to vent, 112; length ventrals, 36; height first dorsal, 13; second, 13; length caudal, 34; distance between two anterior gill openings, 39; two posterior, 26; length clasp-ers, 16, not quite reaching ventrals. Twenty-two spines along back in front of first dorsal; seven more between dorsals, and two small ones behind second dorsal; two spines on each shoulder opposite fourth dorsal spine, about on a line with inner and outer borders of orbit respectively; a row of six spines above inner margin of orbit,

and three irregularly placed spines in front of these; a row of twenty-two spines along each rostral cartilage, ending opposite orbit. Above tip of the snout is a broad flap or tentacle, with five short lobes on its apical margin. Skin smooth, and mostly mucus covered, except on inter-orbital where it roughened with minute prickles. Outer margin of pectorals translucent, the rays plainly visible; rostral cartilages converging for most of their length, then diverging at tip, but nowhere confluent. Claspers very small, not reaching tips of ventral rays. In the other specimens the number of dorsal spines along the back varied from twenty to twenty-five in the series before the first dorsal, and also varied a little in the series around the orbits.

Food—Stomachs of adults of this species all contained small Crustacea (crabs, shrimps, etc.), and a number of polychaet worms. No other food was found.

Platyrhinoides triseriatus (Jordan and Gilbert). Hornback.

Three specimens were secured in rather deep water off Newport, where it is reported common.

Family RAJIDAE

Raja inornata Jordan and Gilbert. Common Skate.

A specimen seen at Newport was identified as this species. Its abundance could not be determined.

Family DASYATIDAE

Urolophus halleri Cooper. Round String Ray.

Common at Newport and probably at Laguna, although no specimens were taken by us at the latter place.

Pteroplatea marmorata Cooper. California Butterfly Ray.

One specimen of this species was taken at Newport. No information could be obtained as to its abundance.

Family AETOBATIDAE

Aetobatus californicus Gill. Batfish.

(Figures 3 and 4)

Fairly common at Newport and Laguna.

The following notes with accompanying figures were taken from a male specimen 470 mm. in length, and 790 mm. across pectorals: Measurements in hundredths of length. Tip snout to base ventrals, 81; to mouth, 12; to eye, 5.5; interocular space, 16; width mouth, 14; length abdominal cavity, 49 (230 mm.); breadth same 28 (130 mm.). The backbone makes a deep ridge in the posterior dorsal part of the abdominal cavity, leaving a deep groove on each side in which the

kidneys lie. The general shape of the abdominal cavity may be seen from that of the viscera (Figure 3), which conforms to it in outline. As may also be seen, the shape quite closely resembles that of *Rhinobatus productus,* in spite of the extreme difference in external form of these two species. It is interesting to note that in the batfish, having a breadth one and seven-tenths times its length, the abdominal cavity is even narrower and longer than in the "shovel nose" with a breadth of only one-third the length. Evidently the shape of the abdominal cavity is not determined by the external form in these species, but rather is coincident with the depressed body and similar habits of the two.

The alimentary canal, liver, spleen and pancreas will be seen to closely resemble those of *R. productus* except that the liver is bilobate and somewhat larger. In Figure 4 the spleen is shown attached to the pyloric tract of the stomach, but in reality it lies between and against the two divisions, as it does also in *R. productus.* The spiral valve in this species has twenty-two turns (just double the number of *R. productus*), each being quite narrow, as shown in the figure. The pyloris is much farther in advance of the spiral valve than in the latter species, also.

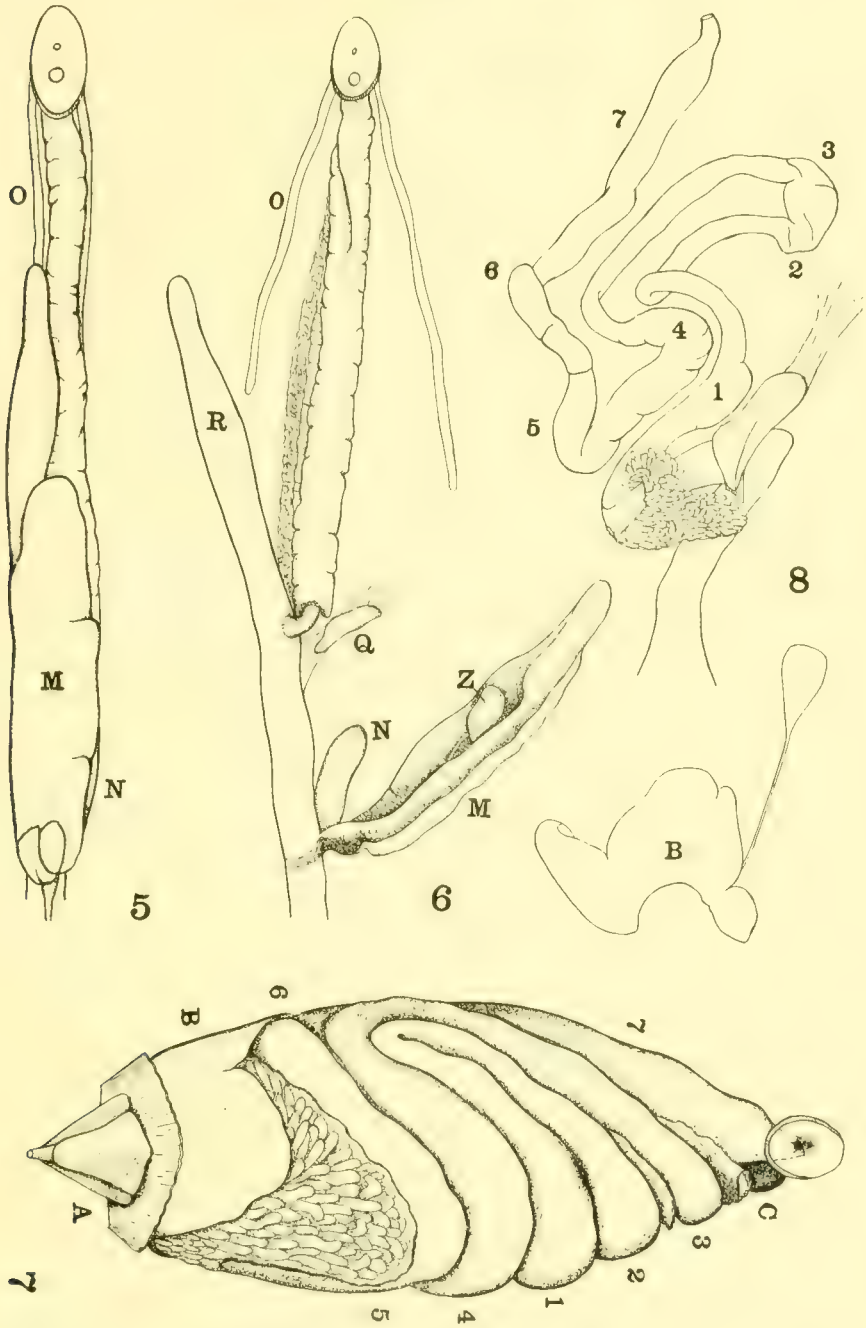
The urogenital organs are best shown in the figure (Figure 4). The testes in this specimen are united throughout the posterior half of their length, attaching at the common end to the rectal gland. Whether or not this is the normal condition of the species was not determined, as only one specimen was dissected. Dorsal of the middle of the testes extend the kidneys and Wolffian ducts, the former mainly developed posteriorly, as shown, the latter extending forward to the œsophageal region, where they unite with the vasa efferentia from the testes. Posteriorly the Wolffian ducts (vesiculæ seminalis) and the sperm sacs open into the cloaca by a single pore, the urogenital sinus, which is well beyond the anal opening of the alimentary canal. Other relationships may be seen from the figure.

In the stomach of this specimen was found a considerable amount of meat, but so chewed up as to prevent identification, except that the remains of several polychaet worms were recognizable. No chitinous or bony remains were found, and apparently this specimen had eaten no crustacean or vertebrate food.

Family CHIMAERIDAE

Chimaera colliei Lay and Bennett. Chimaera, Ratfish.

One specimen brought in by fishermen at Newport; presumably from deep water.



Figures 5 and 6. Gymnothorax mordax

No. 5, Ventral view of viscera in their natural relative positions. No. 6, Same, with organs separated. M. Liver. N, Air bladder. O, Gonads. Q, Spleen. R, Caecal pouch or diverticulum from stomach. Z, Gall bladder.

Figures 7 and 8. Girella nigricans

Fig. 7, Viscera entire, ventral view. Fig. 8, Alimentary canal removed. A, Heart. B, Liver, with gall bladder. C, Urinary bladder. Numbers refer to corresponding regions of the alimentary canal.

Family MURAENIDAE

Gymnothorax mordax (Ayres). Moray, Eel.

(Figures 5 and 6)

Very common along the shore, especially the rocky stretches. Specimens of this species were taken in tide-pools, were found under rocks both in and out of the water, were often caught by rod fishermen and were occasionally taken on set lines at moderate depths.

In visceral anatomy the "Moray" shows striking characteristics, when compared with the typical teleost forms. The most peculiar of these is probably the modification of the alimentary canal, producing an extremely long extension of the stomach beyond the pyloris, so that the intestine connects with the stomach near the middle, instead of at the end of the latter. The pyloric connection is very distinct in both form and texture from either the stomach or the intestine, being a short, narrow "elbow-like" tube, thick walled and muscular. The stomach is comparatively thick walled, and definite in shape, while the intestine is thin walled and lax. Other characters may be seen from Figures 5 and 6. The organs shown as the base of the liver in Figure 5 are the divisions of the heart, and are not indicated in Figure 6.

Family CLUPEIDAE

Sardinella caeruleus (Girard). Sardine.

Abundant at Newport and Laguna. Young individuals occasionally taken in tide-pools.

Family ENGRAULIDAE

Anchovia compressa (Girard). Anchovy.

Very common at Newport, and probably off Laguna also.

Engraulis mordax Girard. California Anchovy.

Only one specimen taken at Newport, but reported by the fishermen as being common.

Family SYNODONTIDAE

Synodus lucioceps (Ayres). Butter Fish.

One specimen, seventeen inches long, taken at Newport.

Family BELONIDAE

Tylosurus exilis (Girard). Needle Fish.

One specimen taken at Newport. Reported by the fishermen as being fairly common.

Family EXOCOETIDAE

Cypselurus californicus Cooper. Great Flying Fish.

Common in the channel between Santa Catalina Island and the mainland. Seen occasionally along the coast near Laguna. One specimen, (photograph Figure 4a), caught in a drift net at Laguna.

Figure 4a. Cypselurus californicus

Family ATHERINIDAE

Atherinops affinis (Ayres). Smelt, Pescadillo Del Ray.

Abundant at Newport and Laguna throughout the summer.

Family SPHYRAENIDAE

Sphyraena argentea Girard. Barracuda.

Very common off the coast of Southern California, usually running in schools. This is the main market fish taken at Newport during the summer, when it is caught in drift nets, and by trolling, or "jigging" as the fishermen call it.

Family SCOMBRIDAE

Scomber japonicus Houttuyn. Mackerel.

Very common in deep water. Often taken by the barracuda fishermen.

Thunnus thunnus (Linnaeus). Tunny, Tuna.

Several taken by fishermen at Newport and Laguna.

Germo alalunga (Gmelin). Long Finned Albacore.

At certain times during the summer these were locally taken in abundance by the fishermen on "jigs," or troll lines.

Scomberomorus sierra Jordan and Starks. Spanish Mackerel.

Common. Often found in the market, but not valued as food.

Family CARANGIDAE

Seriola dorsalis (Gill). Yellow Tail.

Often taken by the fishermen off Laguna and Newport, where it is prized as food.

Trachurus picturata (Bowdich). Horse Mackerel.

This, in company with the Spanish Mackerel, often found in the markets, but used even less than the Spanish Mackerel for food.

Family STROMATEIDAE

Peprillus simillimus (Ayres). California Pompano.

A few specimens taken at Newport. Apparently not very common.

Family SERRANIDAE

Paralabrax nebulifer (Girard). Rock Bass.

One specimen, twelve inches long, taken in deep water off Newport. Apparently not abundant.

Paralabrax clathratus (Girard). Cabrillo.

Caught by fishermen at Newport, where it, like *P. nebulifer* and others, is known as "Rock Bass."

Family KYPHOSIDAE

Girella nigricans (Ayres). Green-Fish.

(Plate I, A, and Figures 7 and 8)

This is the most common fish in the tide-pools near Laguna, especially those pools having little or no vegetation in them. In the high, shallow pools the young are often found by hundreds, and are easily distinguished as they swim about, because of the conspicuous light spot on each side of the back. In the larger, lower pools older

specimens are found, some ranging to over a foot in length. The older ones, however, do not commonly remain in the pools, but live in deeper water around the rocks and beds of algæ. In individuals over three or four inches in length the light spots on the sides are obsolete.

Many specimens of various sizes were taken. The accompanying figures and notes were made from a specimen 220 mm. in length. Figure 7 shows the contents of the body cavity with all the organs in their natural position. The great number of pyloric cæca, and the long convoluted alimentary canal are very conspicuous features, relating to the food habits of the species. Figure 8 (reduced to one-half the scale of Figure 7) is an outline of the alimentary canal, removed to show the nature of the convolutions. Corresponding numbers in the two figures refer to corresponding parts of the canal. The stomach is not so conspicuously differentiated from the rest of the canal as it is in many of the lower fishes previously noted. As seen by the figure, the œsophagus, stomach, spleen, etc., are all covered ventrally by the intestine, which winds back and forth in a devious course below them. Instead of extending in a series of turns from the anterior to the posterior regions, the intestine appears well back (Figure 7 I) and after doubling across and back it makes a sharp turn (2 and 3) and then runs well forward around its last turn to (4) where it makes another sharp turn anteriorly (5), crossing over near the liver (6) and then down along the left side (8) to the anus. In Figure 8 the liver and gall bladder are shown separated from the rest. The gall bladder lies far back near the urinary bladder in the posterior part of the abdominal cavity, and is connected with the liver by its long, tube-like duct.

The alimentary canal in this specimen measured 550 mm. in length, or two and one-half times the total body length of the fish. The food, as one would expect, is entirely vegetable, so far as known. Specimens dissected contain only pieces of kelp, red algæ, etc. One large specimen twelve inches long had eaten several large chunks of kelp several centimeters in length.

Family SCIAENIDAE

Seriphus politus Ayres. Queen-Fish, White Croaker.

One specimen taken at Newport. No information as to its abundance was secured.

Sciaena saturna (Girard). Black Croaker.

Fairly comman at Newport and Laguna.

Genyonemus lineatus (Ayres). King-Fish.

Many specimens of this species were taken at the Newport pier by rod fishermen during the summer. These were used for both food and bait.

Umbrina roncador Jordan and Gilbert. Yellow-Fin, Yellow-Tailed Croaker.

This species is taken in abundance at Newport, where it is valued for food.

Menticirrhus undulatus (Girard). California Whiting.

One specimen secured from Newport fishermen, who took it in deep water.

Figure 4b. Cymatogaster aggregatus

Family EMBIOTOCIDAE

Abeona minima (Gibbons). Perch.

This species was common at Laguna during the summer. Several young specimens were taken in the lower tide-pools.

Cymatogaster aggregatus Gibbons. Viviparous Perch, Silver Perch, "Punkin Seed."

(Figure 4 B)

Abundant at both Newport and Laguna. Young occasionally found in tide-pools.

Embiotoca jacksoni Agassiz. Black Perch, Red Perch.

(Plate I, B)

Very common in shallow water. Several large specimens of this species were taken in one of the larger tide-pools at Laguna. All were of the reddish brown variety.

Family POMACENTRIDAE

Chromis punctipinnis (Cooper)

Quite common at moderate depths around the kelp beds near Laguna, where it was easily caught with hook and line.

Hypsypops rubicunda (Girard). Goldfish.

The "Sunday fishermen" catch numbers of goldfish from the rocky points and coves along the coast. A few adult and young specimens were seen in the larger tide-pools near Laguna.

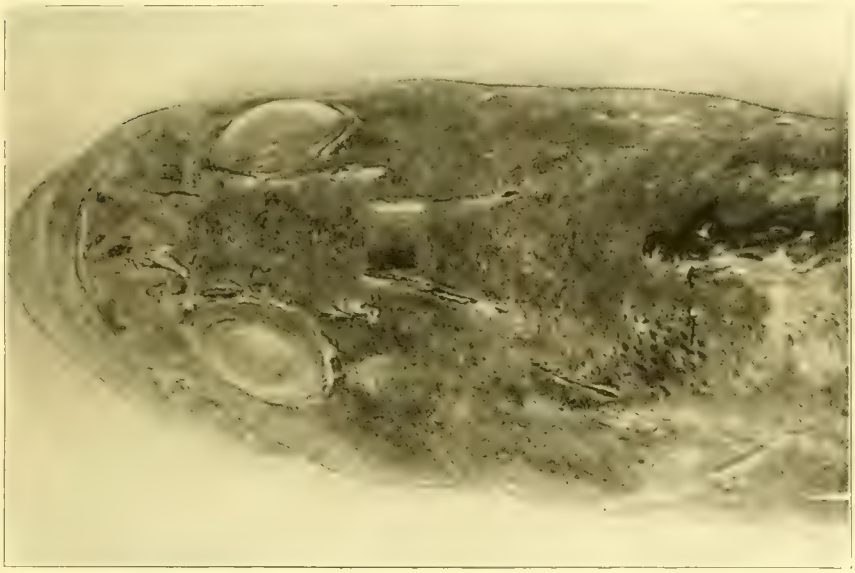


Figure 8a. Sebastodes rastrelliger

Family LABRIDAE

Pimelometopon pulcher (Ayres). Sheep's Head.

One of the commonest species taken by anglers fishing from the rocks along the shore.

Halichoeres semicinctus (Ayres)

Abundant near the rocks and in the kelp beds. Commonly taken by rod fishermen. It can be easily distinguished by the large black blotches, one on each side just behind the pectorals.

Oxyjulis californica (Günther). Kelp-Fish, Senorita.

Abundant around the kelp beds near Laguna, where it is easily caught on hook and line. Occasionally young specimens get into the tide-pools, but normally the species is found beyond the pools.

Family SCORPAENIDAE

Sebastodes rastrelliger (Jordan and Gilbert). Rock-Fish, Sting-Fish.
(Plate I, C, and Figure 8 A)

Fairly common near the rocky shores. All the species of Scorpænidæ are commonly known as "sting-fish," "spine-fish," or other names referring to the pungent dorsal spines.

Sebastodes carinatus (Jordan and Gilbert).
One specimen taken in moderately deep water off Laguna Beach.

Sebastodes serriceps (Jordan and Gilbert)
One very dark colored specimen taken near Laguna Beach.

Scorpaena guttata Girard. Sculpin, Scorpene.

Besides the mature fish, which are fairly common along the shore near Laguna, one young, brilliantly colored specimen about three inches long was taken in a tide-pool. The photograph shown in Figure E and the accompanying color notes are from this specimen.

Ground color cream or grayish, but almost entirely concealed by the numerous markings. Chocolate colored markings appeared as follows: Large blotch or stripe on cheek below eye, another on posterior margin of opercle; broad bar across base of pectoral, and another half way between this and tip; four broad irregular bands across body, extending on vertical fins, the last including caudal base; broad band, broken by darker spots near apex of caudal; large blotches covering basal half of anal and ventrals. Band across apex of all fins, and belly behind ventrals pink. Interorbital, and numerous spots on dark areas of fins, rufous. Caudal membrane yellow. Premaxillary, lower jaw, branchiostigals and throat spotted with silver. Membrane of ventrals blood red, except near apex. A large, irregular ocellus with black center and rufous border on base of 4-6 rays of dorsal, extending down on back. Median light bands on pectorals and caudal, and light bands on body cream color. Dark areas more or less spotted with cream or gray, and light areas with brown or silver. The variegated pattern is shown by the figure.

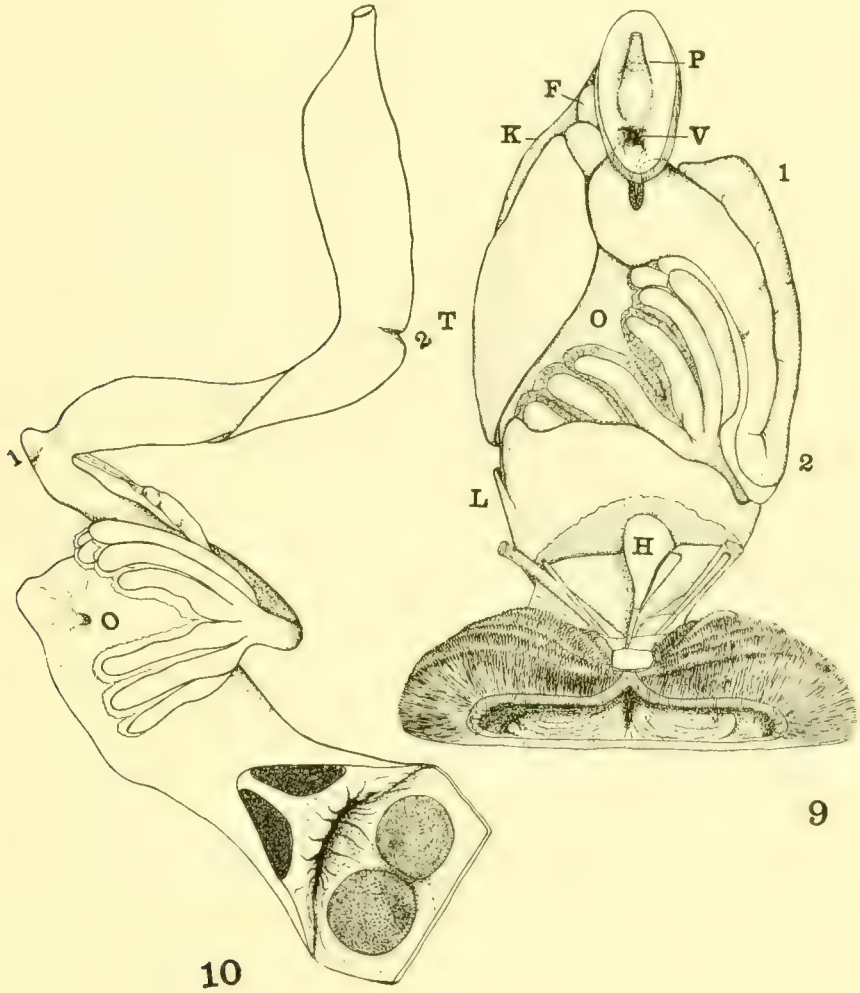
Family COTTIDAE

Scorpaenichthys marmoratus (Ayres)
One large specimen, twenty inches long, taken at Laguna.

Clinocottus analis (Girard). Rock-Fish.
(Figures 9, 10 and 10 A)

Next to *Girella nigricans* this is the most abundant fish in the tide-pools near Laguna, and in the darker pools, and those without vegetation it is the most abundant. The pools within a quarter of a mile

of Laguna contain thousands of individuals, so that large numbers were taken at different times during the summer. Considerable interest attaches to this species because of its remarkable color variations. In the open, lighter pools specimens are very light; among the green algæ in certain pools they have a greenish color; in pools containing a variety and abundance of plant life they are usually mottled and blotched, often with brilliant colors; and in the deep, narrow pools they are almost invariably dark. It would be impos-



Figures 9 and 10. Clinocottus analis

Fig. 9, Ventral view of visceral and branchial organs. Fig. 10, Alimentary canal removed. Showing pharyngeal teeth. H, Heart. L, Liver. T, Testis. O, Stomach. K, Kidney. F, Urinary bladder. V, Vent. P, Papilla. Numbers refer to corresponding regions in the alimentary canal.

sible to describe all the various shades and markings found in a random series, but a few of the main color types are here given.

Although the fishes vary in a rough way to correspond to the pool in which they live, yet it is by no means true that they all agree in any one place. The light and dark shades are almost uniformly found in the pools corresponding, but in color pattern and brilliancy of marking no particular correlation to surroundings holds consistently. Especially is this true in pools with luxuriant algæ and coralline growths, where all sorts of color patterns are found intermingled. No evidence of a so-called voluntary change of color by individual specimens was observed. Change in surroundings seemed to have no immediate effect on the color of any individual.

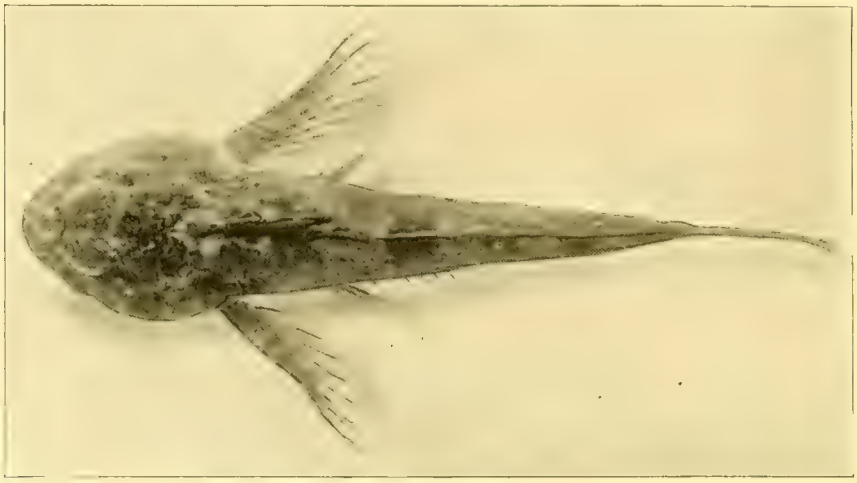


Figure 10a. Clinocottus analis

The general body color pattern of this species consists of five or six dark bars extending down on the sides, and usually an irregular dark area covering the upper part of the head. The fins, except ventrals, are all barred with narrow, dark, transverse bands on the rays. Below the body is variously speckled. In other respects there is no uniformity in coloration.

No. 1. Taken from a specimen three and one-half inches long. General color dark; bands on dorsum not conspicuous, faded out in a few minutes. Ground color of under parts pale bluish green, broken by numerous round silver spots. Dorsal fin with an apical row of blood red spots on the membrane between the rays; caudal salmon color with an apical row of red spots like that of dorsal; pectoral with a row of silver streaks on the base of rays, remainder streaked with brown. Cheeks with numerous dots and stripes of salmon pink.

No. 2. Female, three and one-half inches long. Light; entire surface presenting a very speckled appearance. An apical band of yellow on spinous dorsal; no red spots; membrane of soft dorsal greenish; caudal faint salmon color. Spots on sides and belly salmon and silver mixed.

No. 4. Very dark; body bands almost black; fins and entire body except region around pectorals dusky; entire head, cheeks, and throat nearly black. (In other forms the throat is almost invariably light).

Not only is this species extremely variable in coloration, but it shows the same tendency, though perhaps not to such an extent, in other characters. The following tables will indicate some of these:

Fin Rays of Fifteen Specimens.

D. IX-16; A. 13, (four specimens).
D. IX-17; A. 14, (five specimens).
D. IX-17; A. 13, (six specimens).
Pyloric cæca usually 7-8, often 9 or even 10.

Alimentary canal in length of fish in six specimens as follows: 1, 1.12, 1.2, 1.24, 1.36, 1.45. In the last case it is seen to be almost one-half longer than in the first. In spite of the difference in length, however, the general position of the canal in the body cavity is fairly constant, the extra length being given by small kinks here and there. The other visceral organs are also quite stable in form and location. (Note the contrast with *Gibbonsia elegans,* which, like this species, has many variable characters).

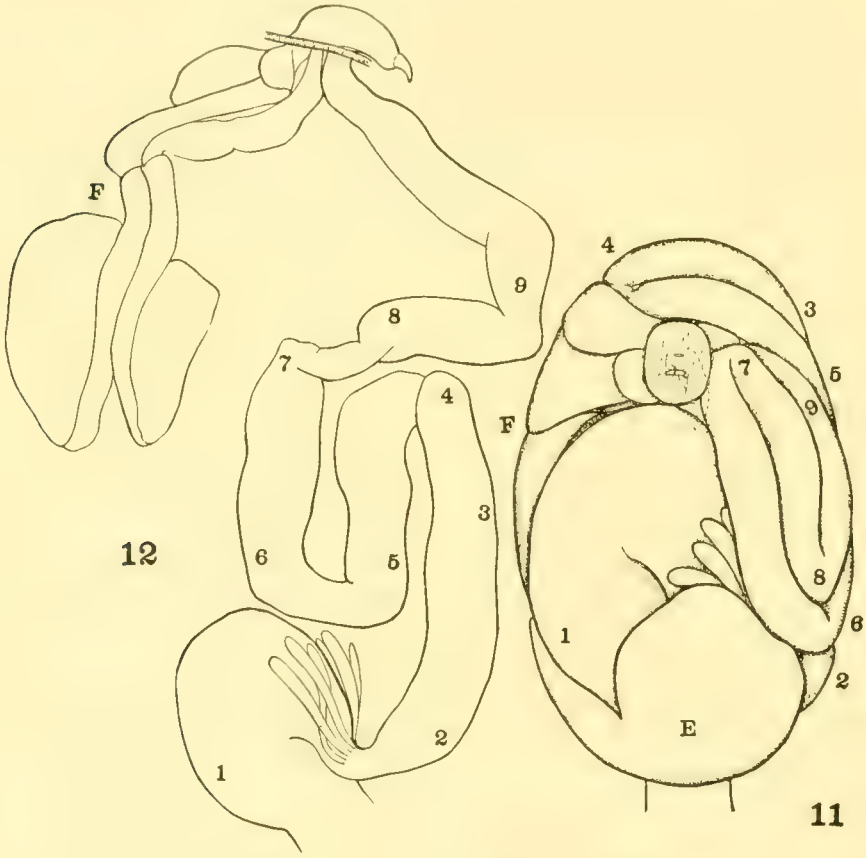
Figure 9 shows a specimen in which the body walls, and most of the head have been removed, leaving the internal organs from the gills back. The relatively small liver, and relatively large stomach and pyloric cæca are most noticeable, the stomach occupying a large portion of the abdominal cavity. The real proportions of the stomach are better shown in Figure 10, which is an outline of the alimentary canal, including the pharynx with its peculiar patches of teeth. The pertinence of such a large stomach, a comparatively short intestine, and the peculiar pharyngeal teeth pads, is evident upon examination of the food taken.

Food—Mainly Mollusca, Crustacea, and annulate worms, especially the first. Of Mollusca there were found principally limpets, and other small lamellibranchs, and various gasteropods; of Crustacea, many small crabs, and a few amphipods; of worms, chætopods. No traces of plant food were found. One specimen 82 mm. long contained among other things an abalone 15 mm. long, and a section of a chætopod 8 mm. wide.

Note on **Blennicottus recalvus** Greely
(Figures 11 and 12)

It is of interest to notice here, another small, tide-pool cottid, *Blennicottus recalvus,* which is of much the same appearance, and is sometimes found in the same pools with *Clinocottus analis* farther north. The accompanying figures and notes were made from specimens taken by the author at Pacific Grove, California, in April, 1911.

Blennicottus recalvus is especially interesting here because it appears to be almost or entirely herbivorous. The very different alimentary canal is evident at a glance (Figures 11 and 12), being in this species twice as long in proportion to the body length. The walls of the canal, especially the stomach, are very much thinner and more elastic. In location, however, the canal agrees with that of *Clinocottus analis,* in lying along the right side of the body cavity,



Figures 11 and 12. Blennicottus recalvus

Fig. 11, Ventral view of viscera entire. Fig. 12, Alimentary canal and urogenital organs removed. E, Liver. F, Urogenital organs, male.

the left side being occupied by the urogenital organs. The details of arrangement and form may be best seen from the figures (11 and 12). The latter figure is drawn to a scale one-third smaller than the former. In Figure 11, the vent is seen to be located some distance in front of the end of the cavity; a character not found in any other cottids examined. The food in the five or six specimens dissected was made up entirely of vegetable remains, principally foliose algæ, mixed with which were numerous grains of sand.

Family GOBIIDAE

Gillichthys mirabilis Cooper

Morris and Starks record this species as "taken in abundance in a slough which received some fresh water near Old Town" (San Diego Bay), and, "in Newport Bay it was found more widely distributed." In a small brackish slough in "Aliso Canyon" near Laguna large numbers up to two inches in length were found. The water in this slough was apparently derived mainly from the slight drainage down "Aliso Creek," but probably also received some salt water from the bay at the mouth of the canyon during the highest tides.

Typhlogobius californiensis Steindachner. Blind Goby.
(Plate III, P)

One specimen, about two and one-half inches long, taken in the sand under a stone above low tide mark. The water was a few inches deep over the stone when the fish was taken, but a lower tide would leave it dry. Whether the fish remains under stones in such cases was not determined, as no other specimen was found.

Family ECHENEIDIDAE

Echeneis remora Linnaeus. Remora.

One specimen brought in from deep water by fishermen at Newport.

Family MALACANTHIDAE

Caulolatilus princeps (Jenyns). Whitefish, Whiting.

One specimen, thirteen inches long, taken in deep water off Newport.

Family BATRACHOIDIDAE

Porichthys notatus Girard. Midshipman.

One specimen washed up on sand at Laguna Beach; another taken by fishermen at Newport. Apparently not rare.

Family GOBIESOCIDAE

Rimicola eigenmanni (Gilbert)

(Plate III, I, J)

This species was found to be fairly common in a little cove near Laguna, where it lived in a growth of *Phyllospadix* (eel grass), in shallow water. Jordan and Evermann in "Fishes of North and Middle America" record two species of this genus, *R. eigenmanni* and *R. muscarum*, the one greenish, the other brownish in color, and supposedly differing in fin rays. They have since been shown to be simply forms of one species (J. O. Snyder, Proc. U. S. Nat. Mus. XXXV; 183, Oct. 1908). Both forms were found, presumably clinging to *Phyllospadix*, the green form resembling the living plants, the brown the dead ones. Whether or not the two forms actually selected the plants of their own color upon which to attach themselves could not be ascertained. A careful search was made to find individuals so attached, but it was unsuccessful. They detached themselves as soon as they were taken out of the water, if they were ever attached, and no specimens were seen in the water. The only way they could be taken at all was by means of a small hand net swept through the eel grass. Fifteen or twenty specimens were secured in this way. When put into vessels of water with live and dead *Phyllospadix* they seemed to show no preference in regard to color, attaching themselves to either brown or green blades indiscriminately. In size the series ranged from one-half to one and one-half inches in total length. The following color notes were taken from fresh specimens: Green form: Upper parts translucent green, uniformly speckled with minute dark dots of brown; head with two transverse rows of spots which intersect before the eyes and extend forward on the sides of snout, and backward to near the base of pectorals. A brown band extends from snout, through eye, to opercle; a similar one extends along the side of body through base of pectorals, becoming obsolete on tail and opercle. Caudal rays speckled like body, a dark band of spots across tip; other fins white. Under parts before vent white, behind similar to dorsum. Some specimens have spots on head irregular, some have anterior and posterior lateral bars fused into one long one.

Brown form: Quite similar to the green form in markings, but ground color brownish, like dead leaves, instead of green. One specimen is covered with olive green mottlings on a brown background. Another has a row of large light spots on the posterior part of each side behind the pectorals. A wide range of variation is shown in even this small series of specimens. The two types of color, however, appear to be constant and equally common. After

death specimens change color in water, the green fading to white. All specimens examined have five dorsal and five anal rays.

Arbaciosa rhessodon (Rosa Smith)

(Plate III, M, N, O)

Quite common in the tide-pools throughout the range worked over. Nowhere found in large numbers, however.

Family BLENNIDAE

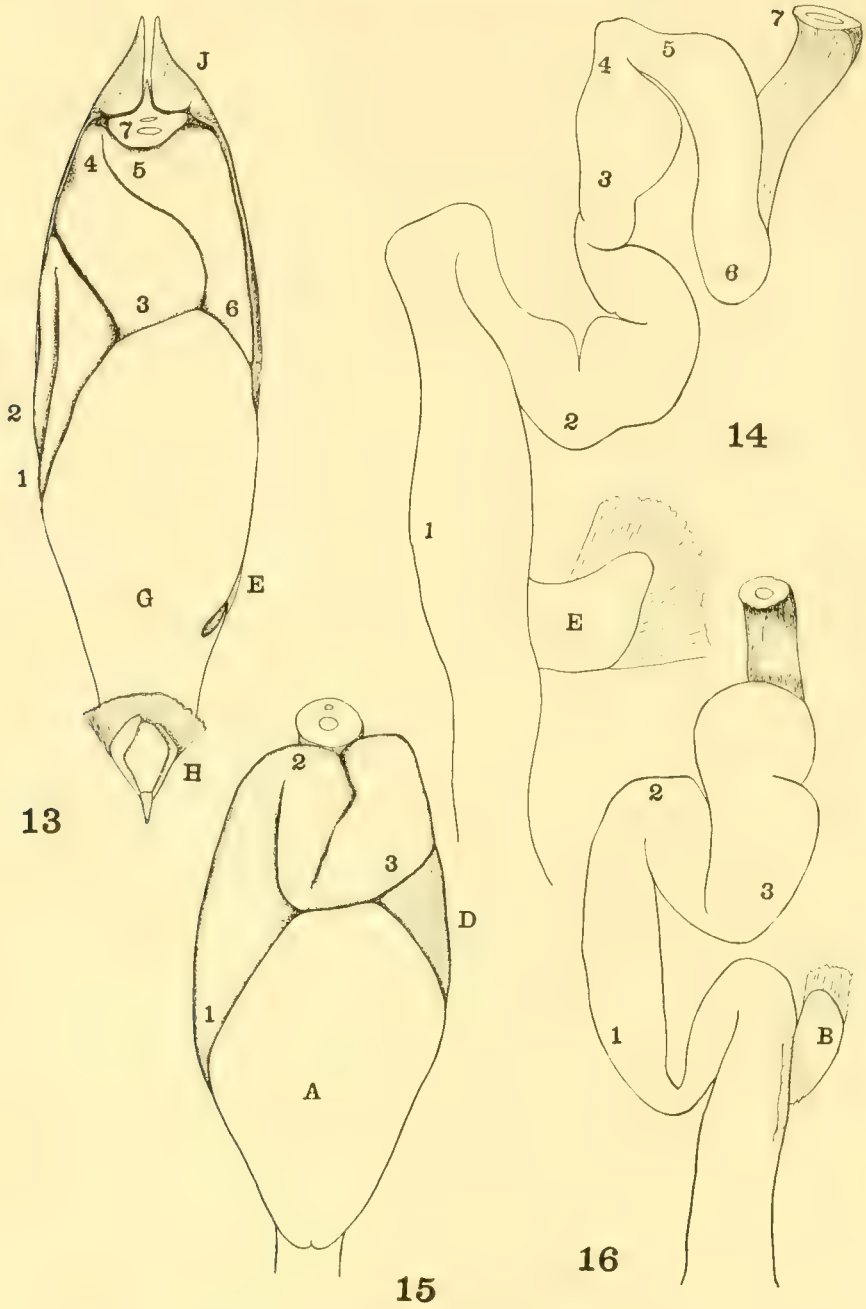
Heterostichus rostratus Girard. Kelp-Fish.

(Plate II, G, and Figures 13 and 14)

Very common in the kelp close to the rocky shores, and in the outlying beds. Taken commonly by rod fishermen, who dislike it because of its bait-stealing proclivities.

There are two color types in this species. The one a plain dull olive or drab, as shown in the photograph (Figure G), the other distinctly marked with longitudinal or transverse bands, much as is *Gibbonsia evides*. The latter form is described by Starks and Morris (Marine Fishes of Southern California, p. 232), as having "ground color light green; yellow on belly and under parts. Back and sides with three or four longitudinal dark green stripes, more or less broken up into spots, darker toward the edges and outlined with white. A similar stripe running from snout through eye, to upper edge of gill opening. * * * Dorsal and anal mottled with alternate dark green and translucent spots; tip of mandible dark." In the transversely banded form of this the colors are the same, but the longitudinal bands are obsolete, being broken into eight or nine sections forming irregular bars, which extend on the vertical fins forming dark blotches. At a glance this form might be confused with the similar form of *Gibbonsia evides* (Figure Z), but the forked caudal, pointed snout, etc., readily distinguish it.

Viscera—The abdominal cavity is long and compressed, conforming to the shape of the fish, as indicated by Figure 13. The liver, as shown, is very large, underlying the whole anterior half of the alimentary canal and associated organs. The gall bladder is closely attached, and conspicuous, showing in Figure 13 through the slit just in front of E. Posteriorly a large air bladder is present, closely adhering to the dorsal wall of the abdominal cavity and extending two-thirds of its length. Perhaps the most conspicuous feature, however, is the pair of gonads lying dorso-laterally, with posterior ear-shaped projections extending into a cavity behind the vent, as shown in the figure. The alimentary canal, which is shown diagrammatically in Figure 14, is moderately elongate, (four-fifths length of fish),



Figures 13 and 14. Heterostichus rostratus

Fig. 13, Ventral view of viscera entire. Fig. 14, Alimentary canal of same. G, Liver. E, Spleen, J. Gonads. H, Heart. Numbers refer to corresponding regions of the alimentary canal.

Figures 15 and 16. Gibbonsia elegans

Fig. 15. Ventral view of viscera. Fig. 16, Alimentary canal removed. A, Liver. B, Spleen. D, Oviduct full of ova. Numbers refer to corresponding regions of alimentary canal.

rather thin walled, and little differentiated into stomach and intestines. Other details may be seen from the figures.

Food—So far as observed the food consists principally of soft Crustacea, (amphipods and isopods). The evidence would indicate carnivorous habits, but not enough specimens were examined to show whether they are exclusively so.

A Study of GIBBONSIA

Specimens examined:	*elegans.*	*evides.*
Fort Bragg, California	3	
Monterey, California	160	65
Laguna Beach, California	130	27
San Diego, California	61	3
San Martin Is., Mexico	1	
	355	95

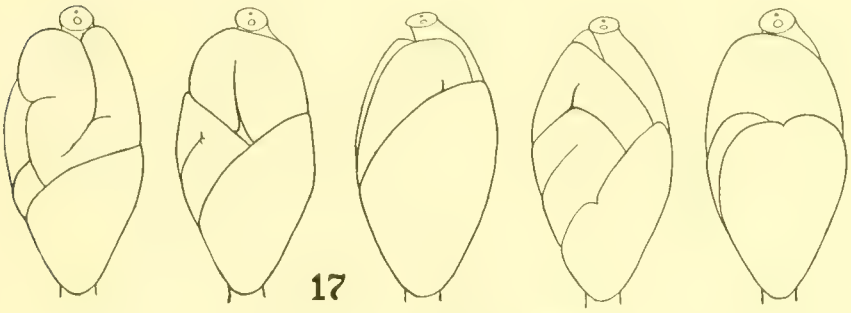


Figure 17. Gibbonsia elegans
Diagrams to show variation in form and location of visceral organs.

Measurements are as follows:

Length: Tip snout to base caudal.

Eye: Diameter.

Snout to dorsal: Tip snout to base first spine.

Eye to dorsal: Shortest distance between eye and first dorsal spine.

Head: Tip snout to inner edge of notch on upper, posterior part of opercle.

Scale counts: Three counts are used. One from anterior end of lateral line, along the lateral line until it curves down, then in a straight line to base of caudal; second from lateral line to base of dorsal just above axil of pectoral where the lateral line arch is highest; third above lateral line at the angle behind pectoral, the anterior end of straight portion.

Ocellated spots behind pectorals present; soft dorsal of 6-8 rays, very rarely 9; scales above lateral line (from lower angle) about 20-24; small, usually not over 100 mm. long; color rich, usually variegated. *elegans*

No ocellated spots; soft dorsal of 9-10 rays, rounded; scales above lateral line, (counted as above) 32-36; larger, usually 100-200 mm.; brilliant colors lacking. *evides*

Gibbonsia elegans (Cooper)

(Plate IV and Figures 15, 16, 17)

Length to base caudal 4.5 times depth at anus; head 5 in length; eye large, diameter almost or quite equal to distance from eye to dorsal, 2.7 in distance from snout to dorsal; scales, counted along anterior part of lateral line and thence on a level to base caudal, about 135; scales above lateral line at lower angle 20-24; scales above lateral line at middle of anterior, elevated portion 10-12; dorsal usually V-XXX, 7 or 8 in northern, and V-XXVIII, 7 or 8 in southern specimens, but ranging from V-XXVII to V-XXXI in spines and 7-9 in rays; anal II-26 to II-28 in northern, and II-23 to II-25 in southern specimens. (See charts).

Body rather strongly compressed and deep, tapering rapidly behind; caudal peduncle slender; head short, upper outline convex, distance from snout to dorsal equal to depth at front of dorsal; mouth small, terminal, oblique; maxillary scarcely reaching pupil; lower jaw slightly projecting; teeth on vomer, none on palatines. Dorsal with first three spines elongate, graduated; first usually about 2.5 in head, but varying from 1.5-3; fourth, fifth, and sometimes sixth spines from one-third to one-half first, and shorter than following, but quite variable; third and fourth nearly twice as far apart as fourth and fifth; remaining spines uniform, half to two-thirds length of first; soft dorsal short, high, abruptly truncate after third or fourth ray, first three or four rays (as the case may be) equal and close together, remainder abruptly shortened, and conspicuously farther apart; membrane connecting them usually translucent.

Body variously striped and barred, or mottled; always, so far as known, with one to seven ocellated spots along each side slightly above median line; first just above base of pectoral, remainder uniformly separated and extending to base of soft dorsal; first and last two most commonly found. Prevailing color variable, may be red, brown, olive, green, chocolate, or other rich shades. The typical color pattern is as follows: prevailing color chocolate brown, or dull red; head dark above, broken by line running back from eye, through opercle to base of pectoral, and by irregular lines above this; head below lighter; cheeks spotted with silvery, lower half of iris silvery;

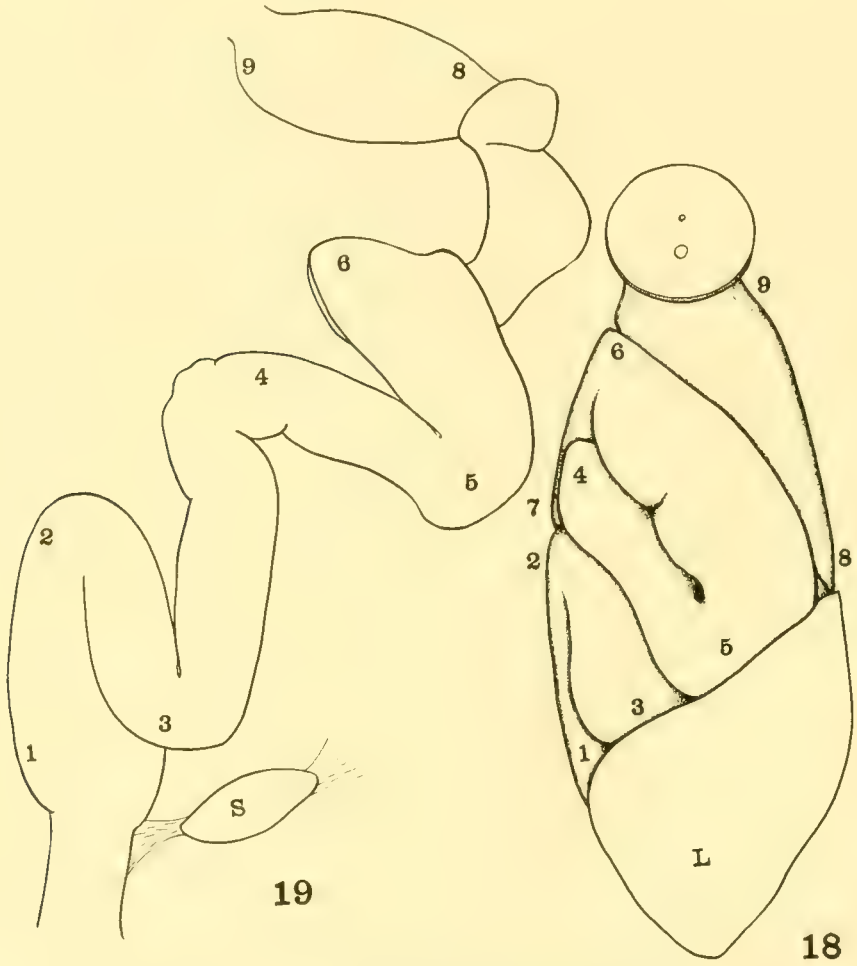
body transversely, irregularly barred by seven or eight cross bands, all of which usually extend on dorsal, and last four or five on anal; these are usually heavier at base of dorsal and anal, and in middle of side, having broken irregularly in a line running parallel to dorsal and about half way between it and lateral line, and broken along similar space above base of anal. Over the sides, breast, and often lower part of head are irregular spots and blotches of all sizes; these and the cross bars outlined with white. Pectorals and ventrals light red, dorsal and anal dark, corresponding to body color. Belly lighter, tinged with yellow; chin and throat pinkish white. First, and last two ocellated spots present, each black ringed with red and then again with white. Another form commonly found differs as follows: General appearance mottled and spotted, but without red; body above lateral line almost wholly dark, except for light edging of blotches; below conspicuously lighter, but irregularly spotted and speckled, and broken by five or six bars extending from above, between each two of which is usually a rounded spot. Top of head dark, with continuation of body markings below; lower half silvery spotted, and lighter, similar to lower part of body. Other specimens show almost every conceivable modification of pattern and color. Some specimens are plain dull green, or olive (Figure V), almost unmarked except for the ocellated spots; others are similarly plain, but reddish brown; still others have the red, brown or green almost obliterated by silvery spots and blotches, (especially younger specimens). Very young individuals are usually uniform dark red, with faint traces of the adult markings and a conspicuous broad silvery band extending in a median line backward from eye, becoming broken near tail. A great diversity of color and pattern is found in any series, and can only be appreciated by an examination of the specimens. Something of this diversity, however, may be seen from the accompanying cuts, which are taken from fresh specimens, and illustrate a few of the many color variations.

Gibbonsia evides (Jordan and Gilbert).

(Plate V and Figures 18 and 19)

Depth at anus 4.9 in length to base caudal; head 4.7-5 in length; eye smaller, almost 1.5 in distance from eye to dorsal, and 3.25 in distance from snout to dorsal; scales counted on level of anterior part of lateral line, about 185; scales above lateral line at posterior angle 30-36; scales above lateral line at middle of anterior, elevated portion 18-22. Dorsal usually V-XXX, 9 or 10 but ranging from V-XXIX to V-XXXII in spines and from 8 to 10 in soft rays, (very rarely 8); anal II, 26-II, 27, rarely II, 28. (See figures).

Body as in *G. elegans,* but more slender, tapering gradually behind; head usually more slender; caudal peduncle deeper. First three spines of dorsal not usually so high as in *G. elegans,* but quite variable; soft dorsal longer, outline rounded, not conspicuously truncate; rays usually all equidistant from each other; pellucid area small and not terminal. Shade and color pattern usually quite unlike that of *G. elegans,* neither the rich colors nor the ocellated spots being found. Usual color greenish or yellowish, "kelp color"; sides each with three or four dark longitudinal stripes, the upper running from snout through upper part of eye and along base of dorsal to caudal,



Figures 18 and 19. Gibbonsia evides

Fig. 18, Ventral view of viscera entire. Fig. 19, Alimentary canal removed. L, Liver. S, Spleen. Numbers refer to corresponding regions in the alimentary canal.

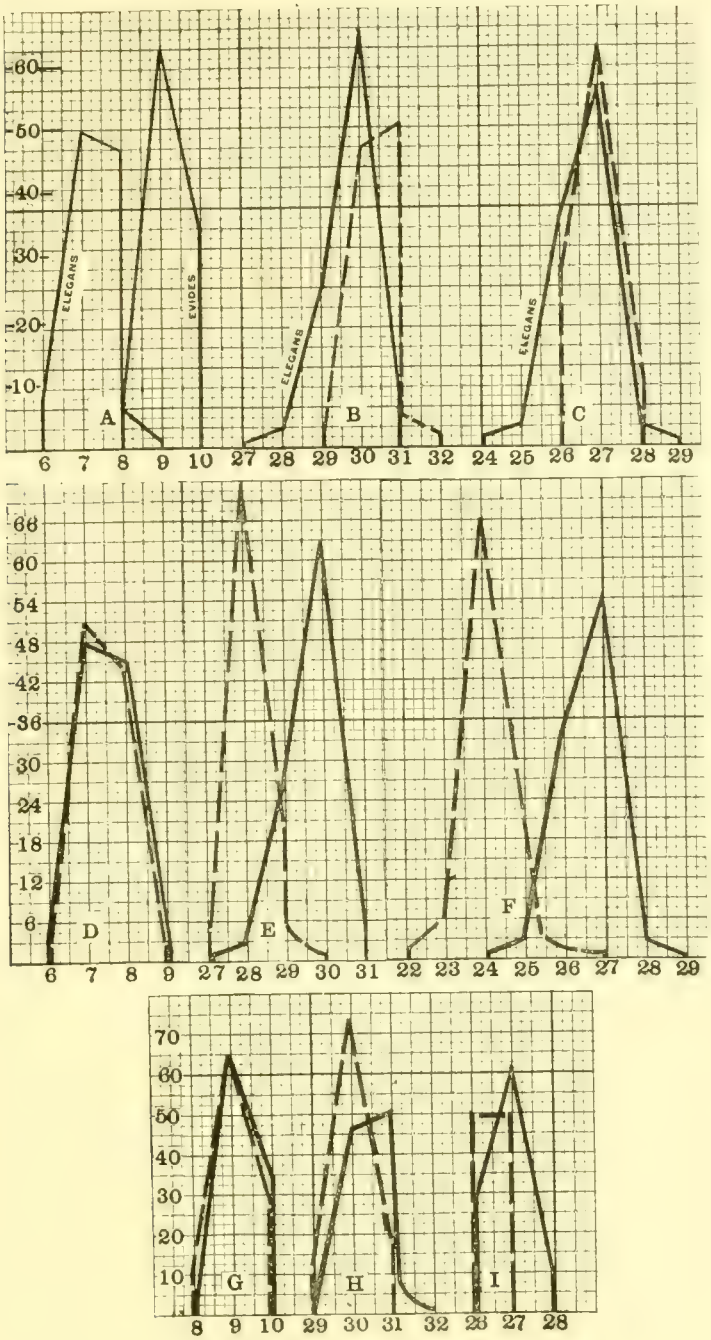


Diagram A. Variation of Gibbonsia

median sometimes appearing as two, extending from eye to tail; lower one extending from base of pectoral toward tail. The dark bands are separated by lighter, sometimes silvery ones, and are often broken into blotches by a tendency toward cross-banding; distinct cross bands, however, are lacking except in rare cases. Belly and throat often bright yellow. The detail of color pattern is variable, but the general form is quite constant, much more so than in the preceding species; and the fine, variegated, silvery or other bright colored mottlings are always lacking, although young specimens may have bright silvery bands.

Diagram A. Curves of Variation in Fin Rays of *Gibbonsia elegans* and *Gibbonsia evides.*

A, B, C.—Specimens collected at Monterey, California.

Continuous lines *Gibbonsia elegans,* (curves plotted from 160 specimens); broken lines *Gibbonsia evides,* (from 65 specimens).

A. Rays of soft dorsal.
B. Spines in spinous dorsal.
C. Rays in anal.

D, E, F. Variations in *G. elegans.**

Continuous lines Monterey specimens, (160); broken lines Laguna Beach and San Diego specimens, (190).

D. Rays in soft dorsal.
E. Spines in spinous dorsal.
F. Rays in anal.

G, H. I. Variation in *G. evides.*

Continuous lines Monterey specimens (65); broken lines Laguna Beach and San Diego specimens, (30).

G. Rays in soft dorsal.
H. Spines in spinous dorsal.
I. Rays in anal.

Numbers at the bottom from left to right indicate fin rays. Numbers at the side from bottom to top indicate percentage. The curves are plotted on a percentage basis. Not all are drawn to the same scale, however, as may be seen.

Example: In G. the continuous line shows that of the Monterey (northern) specimens, 3% have 8 rays, 63% have 9 rays and 34% have 10 rays. The broken line shows that of the Laguna and San Diego (southern) specimens, 10% have 8 rays, 63% have 9 rays and 27% have 10 rays.

Gibbonsia elegans may usually be distinguished from *G. evides* at a glance, by its rich colors, variegated markings, and the presence

*Specimens from Laguna Beach and San Diego are almost identical, i. e., show almost identical variation curves, so are here combined to represent the southern specimens.

of ocellated spots. Otherwise the two species differ in the number and size of scales, *G. elegans* having fewer, larger scales than *G. evides;* also in shape and in number of rays of the soft dorsal, in shape of caudal peduncle, in size of eye and its distance from dorsal, and in general shape of body. On the Southern California coast the two species may be readily separated by the difference in fin rays, *G. elegans* having a dorsal of V-XXVII to V-XXIX spines and 6-8 rays, and an anal of II-22 to II-25, while *G. evides* has a dorsal of V-XXVIII to V-XXXI spines, and 9-10 rays, and an anal of II-26 to II-28. Farther north, however, the species overlap, except in the rays of soft dorsal. In size both the average and full grown specimens of the two species differ greatly, *G. evides* being much the larger, averaging about 125 to 150 mm. in length, where *G. elegans* averages about 70 to 80 mm., and reaching a length of over 200 mm. while the largest specimens of *G. elegans* are less than 125 mm.

Formerly these two species have been separated by the fin counts alone, which resulted in many northern specimens of *G. elegans* being included under *G. evides.* Such a distinction, however, will not hold. I have examined all the material in the Stanford University collection, upon which nearly all reports on this species have been based, and find that northern specimens of both species having an increased number of fin rays have been called *G. evides.* Starks and Morris, (Marine Fishes of Southern California, p. 233), state that at Monterey Bay only one specimen of *G. elegans* was found among about a hundred of *G. evides.* An examination of 225 specimens from this locality, including the latter lot, shows both species present, and *G. elegans* represented by 160 specimens, to 65 of *G. evides.*

Both of these species are very common in the tide-pools about Laguna Beach, and probably continue so along the coast in favorable localities from San Diego to San Francisco or farther. Apparently *G. elegans* is always the more abundant of the two. This is certainly true on the southern coast, and judging from the material taken at Monterey it holds true in the north also. The species are commonly found associated in the same pools, living among the algæ, and other kinds of vegetation, where their singularly variegated markings render them inconspicuous.

Viscera: *G. elegans*—Internally, in the size, form and shape of the visceral organs, *Gibbonsia elegans* shows the same tendency toward wide variation that appears in external characters, but not in any way conformable to this. A typical specimen is shown in Figures 15 and 16, but from this type there are all sorts of variations in form and arrangement of organs, a series of which are represented diagramatically in Figure 17. The liver in some specimens is twice as large as in others; in some it is elongate, in others broad and short,

or intermediate. The alimentary canal is ordinarily as shown in Figure 16, being about three-fifths the length of the fish, but in some specimens it is much longer. It lies mainly in the right side of the abdominal cavity, never in the left. The stomach is only slightly differentiated from the remainder of the canal, and has no pyloric cæca.

The *food* of *Gibbonsia elegans* is both vegetable and animal, with perhaps a predominance of the latter. Many of the specimens contained small molluscs (especially limpets), crustaceans (crabs, amphipods, etc.), and minute worms, while a few contained large amounts of foliose red algæ, which are common in the pools.

Viscera: *Gibbonsia evides*—In the larger species, *G. evides,* the viscera is little different from that of *G. elegans,* except that the alimentary canal is normally longer, being about nine-tenths the length of the fish. Figures 18 and 19 indicate the principal features of importance. The stomach in Figure 19 is shown distended with food, which makes it appear quite different from that of *G. elegans,* a difference which is only apparent, however. The alimentary canal is very thin walled, and easily distended in both species.

The food habits of this species are apparently not appreciably different from those of *G. elegans.* In the specimens examined about the same range of food materials was found, i. e. small molluscs, crustaceans, worms and bits of algæ.

Neoclinus satiricus Girard

(Figures 20 and 21)

One specimen, nine inches long, taken alive in a baited trap off Newport Beach. It was very pugnacious while alive in the rowboat, and would snap viciously at anything put near it. It would turn round and round in the water, always keeping its eye on any object moving close to it. The writer, while observing the fish, incautiously got his fingers a little too near the fish's head, with the result that they were savagely snapped and the fish was thrown several feet away on the beach by the backward jerk of his hand. The specimen is slate blue all over, without any bars or spots.

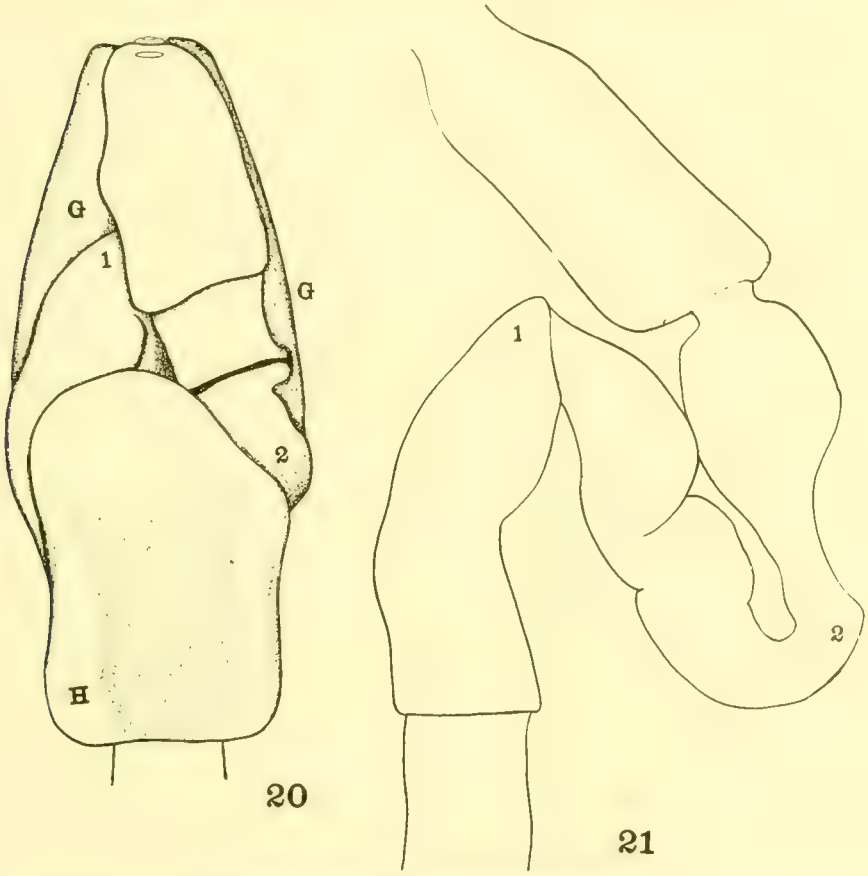
The accompanying notes and figures were taken from this specimen: Abdominal cavity placed far forward, extending in front of ventrals to between pectorals; very short; vent at posterior end. Liver very large, broad. Alimentary canal of large bore, short, (one-half length of fish), thick walled and muscular; stomach well differentiated from remainder; rectal portion thickened and tough, like a gizzard. No pyloric cæca. Figures XX and XXI show the gross characters of the viscera in their natural positions, and of the alimentary canal separated from the rest. From the latter figure the

differentiation into stomach, small intestine, and rectum may be plainly seen.

Food—The alimentary canal was empty except for one or two fish bones. This, and the fact that it was taken in a baited trap, would indicate that the species is carnivorous. A conclusion with which the visceral organs, teeth, etc., fully accord.

Auchenopterus integripinnis (Rosa Smith)
(Plate III, K, and Figures 22, 23)

Not uncommon in the tide-pools about Laguna Beach. Females with fully matured ova were taken in July. A richly colored, variegated species, of one to three inches in length. The accompanying figures and notes were made from fresh specimens taken in July.

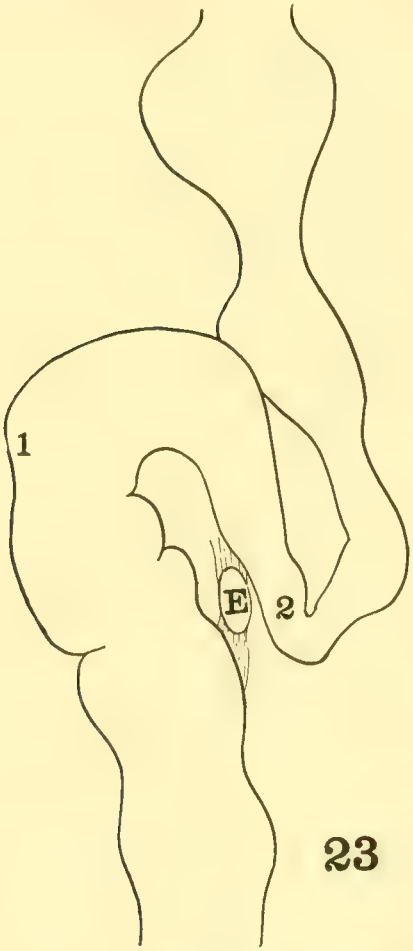


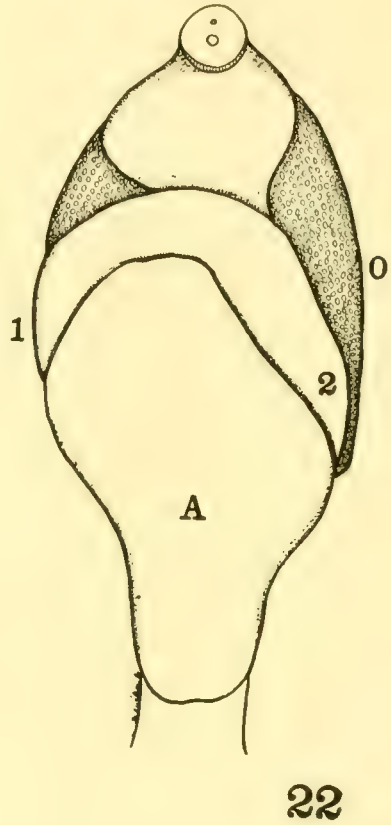
Figures 20 and 21. Neoclinus satiricus

Fig. 20, Ventral view of viscera, entire. Fig. 21, Alimentary canal removed. H, Liver. G, Gonads. Numbers refer to corresponding regions in the alimentary canal.

No. 1. Ground color ochraceous, lighter on throat and belly; sides with five fairly distinct transverse bands of brown extending on vertical fins; caudal peduncle with a similar bar; a dark narrow band across base of caudal, and a similar one across middle of pectoral. Caudal membrane yellow, rays spotted with rusty; anal light at base, darker apically; apical half of pectorals similar to caudal. Cheeks and mandibles speckled with dark brown. Ocellated black spot with yellow margin at base of dorsal behind twentieth soft ray.

Other specimens have pink where this had yellow, with ground color rosy. Some are very dark, with cross bars on sides indistinct. One specimen has pink between the cross bands on sides, and yellow





Figures 22 and 23. Auchenopterus integripinnis

Fig. 22, Ventral view of viscera, entire. Fig. 23, Alimentary canal removed. A, Liver. E, Spleen. O, Oviduct. Numbers refer to corresponding regions of alimentary canal.

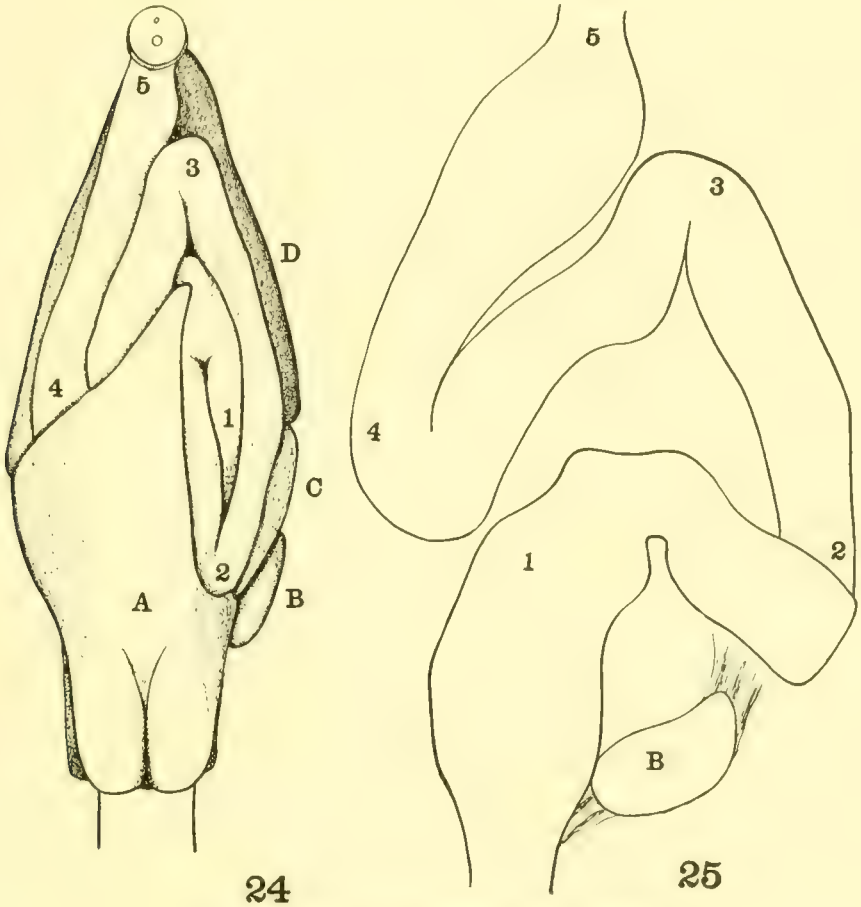
on fins as above. Another has neither yellow nor pink on body, but has a large livid purple spot on opercle and another at base of pectorals, and has belly and brancheostegals tinged with purple. The ocellated spot on all specimens begins behind the twentieth ray of soft dorsal.

Ten specimens have dorsal rays as follows:

III-28 (one specimen).
III-29 (four specimens).
III-30 (two specimens).
IV-28 (one specimen).

None has 27 soft rays as stated in Jordan and Evermann.

Four specimens dissected, show almost no variation in the form and location of the visceral organs. All are essentially as shown in



Figures 24 and 25. Hypsoblennius gilberti

Fig. 24, Ventral view of viscera, entire. Fig. 25, Alimentary canal removed. A, Liver. B, Spleen. C, Gall bladder. D, Oviduct. Numbers refer to corresponding regions of alimentary canal.

Figures 22 and 23. The abdominal cavity is quite short, and depressed rather than compressed, except anteriorly, where it narrows decidedly, the liver extending well forward along the œsophagus. The spleen is very small, the liver large. No pyloric cæca are present.

Food—The specimens dissected contained only small crustaceans (amphipods, etc.), no traces of plant food being found.

Hyposoblennius gilberti (Jordan)

(Plate II, F, and Figures 24 and 25)

One specimen taken in a tide-pool near Laguna Beach. This species is reported by Starks and Morris (Marine Fishes of Southern California, p. 238), as abundant in the tide-pools near Point Loma and at San Pedro. Our observations show a decided contrast to this in the region of Laguna Beach, however, as only one specimen was obtained during the summer's collecting. The following notes and figures are taken from this specimen, a female 27 mm. long:

Abdominal cavity greatly compressed, over twice as high as broad in front; no pyloric cæca; liver greatly compressed, nearly as high as long, triangular in lateral view; its right side not developed apically, but stopping in a straight line back from tip, as shown in Figure 24. The gall bladder is not enveloped by the liver, but lies on the right side as indicated, being connected with the liver by a long neck. The alimentary canal (Figure 25) is long, being seven-eighths of the body length, and not distinctly differentiated into definite regions. The inner lining of the stomach is densely covered with relatively long papillæ, looking like minute tentacles.

Food—Only traces of food were found. These were evidently plant remains, but so disintegrated as to make further identification impossible.

Hypsoblennius gentilis (Girard).

(Plate III, E, G, and Figures 26 and 27)

One specimen taken in a tide-pool near Laguna Beach, and about twenty-five specimens at Long Beach. The latter were found among green algæ in some small pools at the base of a number of old piles. They were all livid green when taken, but soon faded to the normal white color with gray markings. The accompanying figures and notes are from the Laguna specimen, a female 37 mm. long. This individual contained mature ova when collected in July.

Visceral organs and abdominal cavity much as in *H. gilberti.* The long gall bladder, peculiarly shaped liver, and the alimentary canal do not differ essentially from the latter, as may be seen from Figures 26 and 27. Figure 26 gives a somewhat distorted view because of

the swollen oviducts, which give a broadened appearance to the whole.

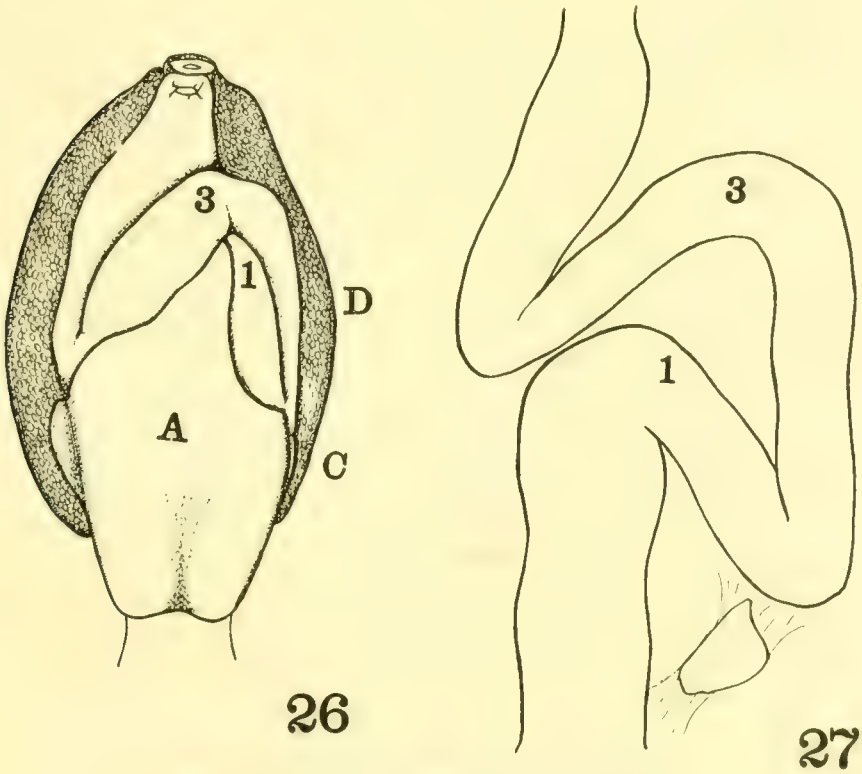
Food—Only decomposed vegetable matter was found in the intestine.

Xererpes fucorum (Jordan and Gilbert)

(Plate II, D, and Figures 28 and 29)

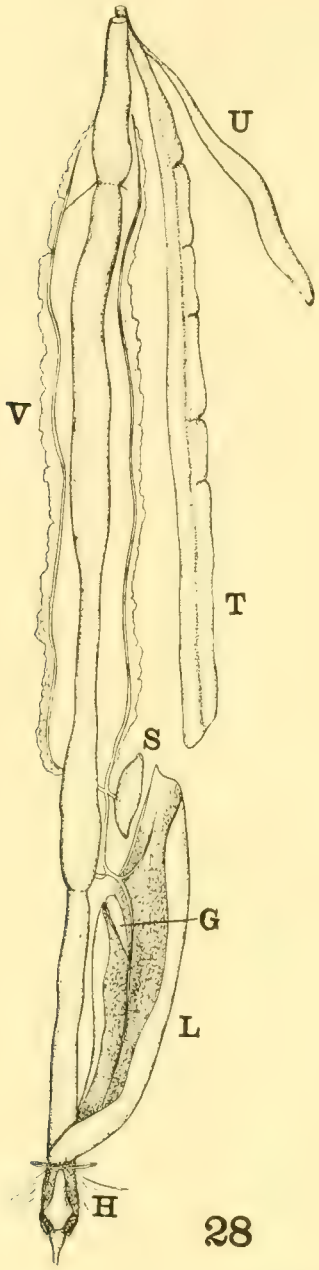
Several specimens taken at Point Firmin near San Pedro. None found around Laguna Beach although conditions almost identical with those of Point Firmin are found here. All of our specimens were taken at low tide from among the masses of eel-grass (*Phyllospadix*) on the rocks above low water. About the roots of the grass and the irregularities of the rocks the fish can move with amazing ease, which, together with the slender, slippery body, makes it a difficult object to capture.

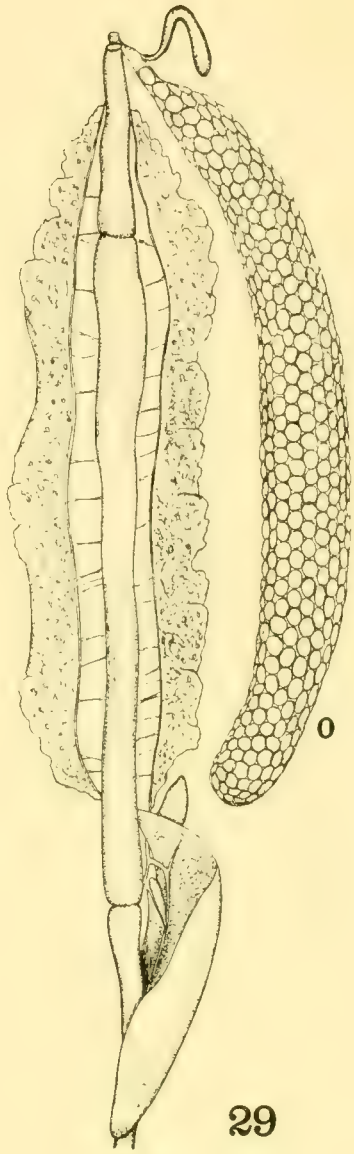
One specimen was found coiled around a mass of eggs placed in a small depression in the rock, and well concealed by the matted grass



Figures 26 and 27. Hypsoblennius gentilis

Fig. 26, Ventral view of viscera, entire. Fig. 27, Alimentary canal removed. A, Liver. C, Gall bladder. D, Oviduct. Numbers refer to corresponding regions in alimentary canal.



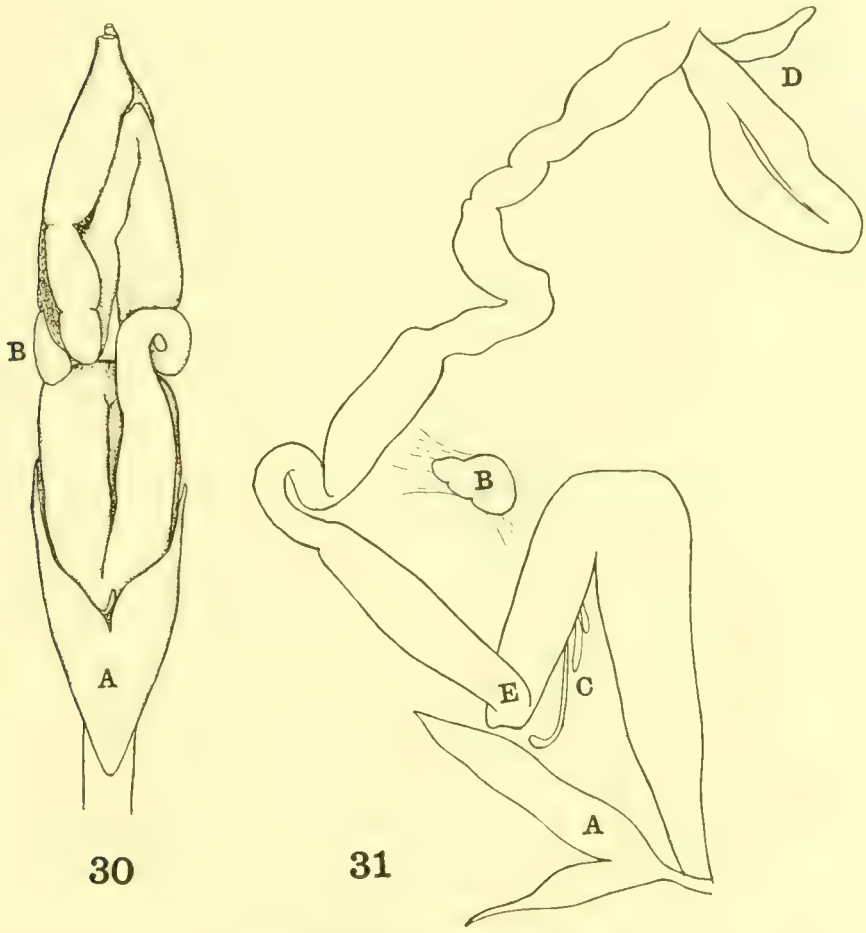


Figures 28 and 29. Xererpes fucorum

No. 28, Ventral view of viscera, of male; separated to show the individual organs. No. 29, Similar view of female organs. G, Gall bladder. H, Heart. L, Liver. S, Spleen. T, Testis. V, Fat. O, Oviduct.

above. The figure shows a photograph of the egg mass with the fish around it, (not in situ).

Visceral anatomy: The abdominal cavity is long, slender and compressed, corresponding to the general shape of the fish. The alimentary canal is peculiar in being perfectly straight from mouth to vent, a condition not found in any other blennies examined. Three divisions, fore, mid and hind-gut are made evident by constrictions as shown in the figures, but no differentiated stomach, and no cæca are found. The gonads of each sex are apparently single, as shown. Lying along the alimentary canal are two characteristic, elongate bodies (v) which are apparent in all of our specimens, and which appear to be definite organs, but a histological examination shows



Figures 30 and 31. Xiphidion rupestre

Fig. 30, Ventral view of viscera entire. Fig. 31, Same, with organs separated. A, Liver. B, Spleen. C, Pyloric caeca. D, Urogenital organs. E, Pyloris.

them to be only fat bodies, united by connective tissue threads to the intestine. Other characters of the viscera may be seen from the figures.

Note on *Xiphidion rupestre* (Figures 30 and 31), from specimens taken at Monterey, California:

This species is interesting to note here because of its great similarity in external, and dissimilarity in internal form to *Xererpes fucorum*. The visceral anatomy in these two species is evidently not determined entirely by external form and habits. The two fishes are found side by side in the tide-pools, among identical surroundings, and so far as our observations extend are of similar food habits. They are not especially nearly related species, but are superficially very much alike.

The alimentary canal of *Xiphidion rupestre* has no resemblance to that of *Xererpes fucorum*, being long and coiled, more like that of the *Heterostichus* group of blennies, and has pyloric cæca. The contrast in general characters is best shown by the figures (30 and 31).

Family PLEURONECTIDAE

Hippoglossoides stomata Eigenmann and Eigenmann

One specimen obtained from Newport Beach fishermen who took it in bottom nets near Newport. This species has seldom been taken except in deep water, and is nowhere common so far as known, although it has been reported from several California ports.

Paralichthys californicus (Ayres)

Very common at Newport, as well as other Southern California fishing stations.

Pleuronichthys ritteri Starks and Morris

P. ritteri, Starks and Morris. Marine Fishes of Southern California 1907, p. 243.

Commonly taken by the fishermen using bottom nets near Newport.

Hypsopsetta guttulata (Girard)

This species is also common on the sandy bottom near Newport.

EXPLANATION OF PLATES

Plate I

A, *Girella nigricans.*
B, *Embiotoca jacksoni.*
C, *Sebastodes rastrelliger.*

Plate II

D, *Xerepes fucorum,* coiled around egg mass.
E, *Scorpaena guttata,* young.
F, *Hypsoblennius gilberti.*
G, *Heterostichus rostratus.*
H, *Lamna cornubica.*

Plate III

I, *Rimicola eigenmanni,* dark form.
J, *Rimicola eigenmanni,* light form.
K, *Auchenopterus integripinnis.*
L, *Hypsoblennius gentilis,* dorsal view.
M, *Arbaciosa rhessodon,* light form, dorsal view.
N, *Arbaciosa rhessodon,* light form, ventral.
O, *Arbaciosa rhessodon,* dark form, dorsal.
P, *Typhlogobius californiensis.*
Q, *Hypsoblennius gentilis.*

Plate IV. *Gibbonsia elegans*

S, Very young.
T, U. W, Progressive ages of the usual variegated form.
V, Olive green, almost unmarked form.
M, Chocolate colored, slightly marked form.
X and Y, Odd forms.

Plate V. *Gibbonsia evides*

Z, Typical form, transverse markings emphasized. (Dorsal fin not extended).
AA, Typical form with longitudinal marking emphasized.
BB, Dorsal view.
CC, Very young.
DD, Somewhat older.
EE, Odd form.

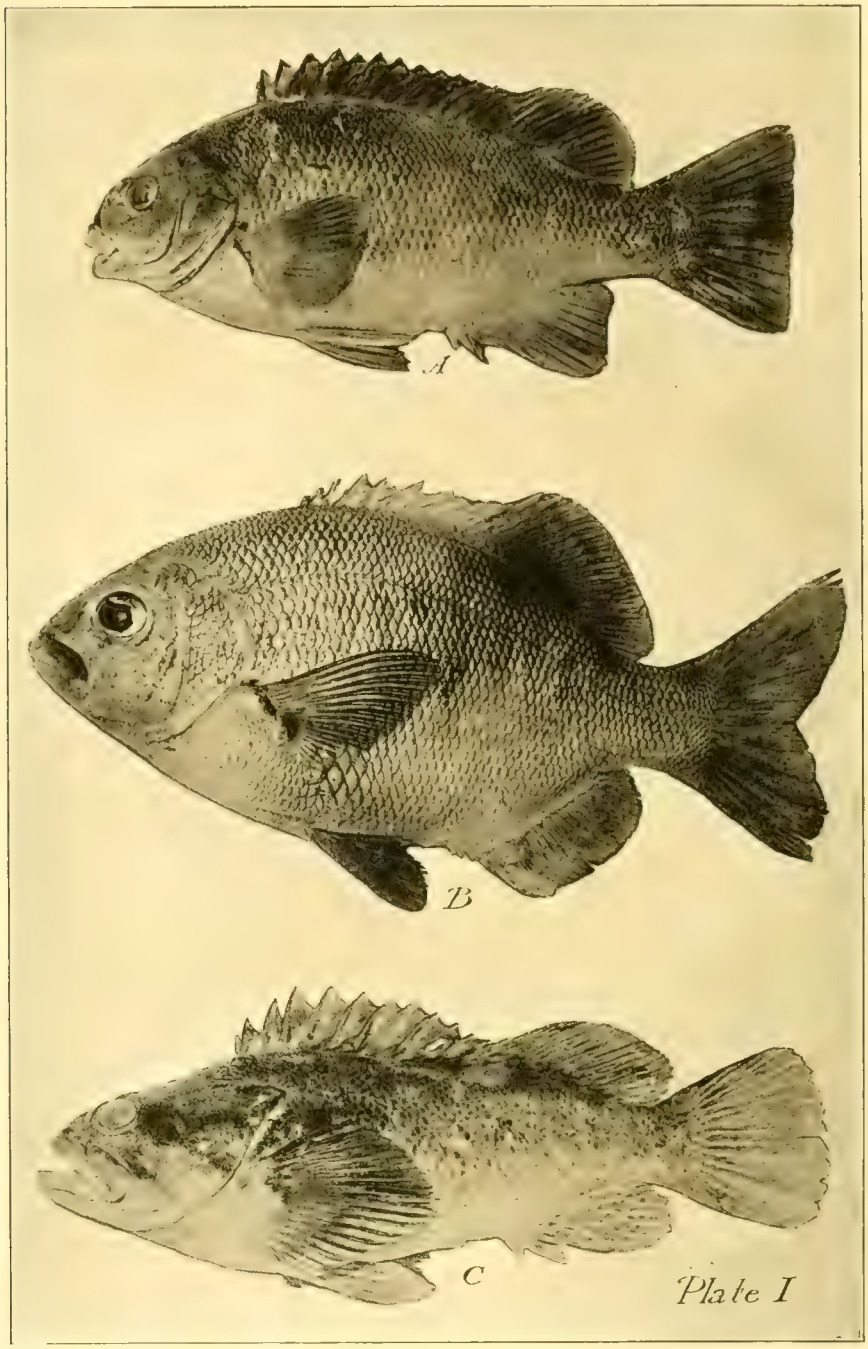


Plate I
A, Girella nigricans. B, Embiotoca jacksoni. C, Sebastodes rastrelliger.

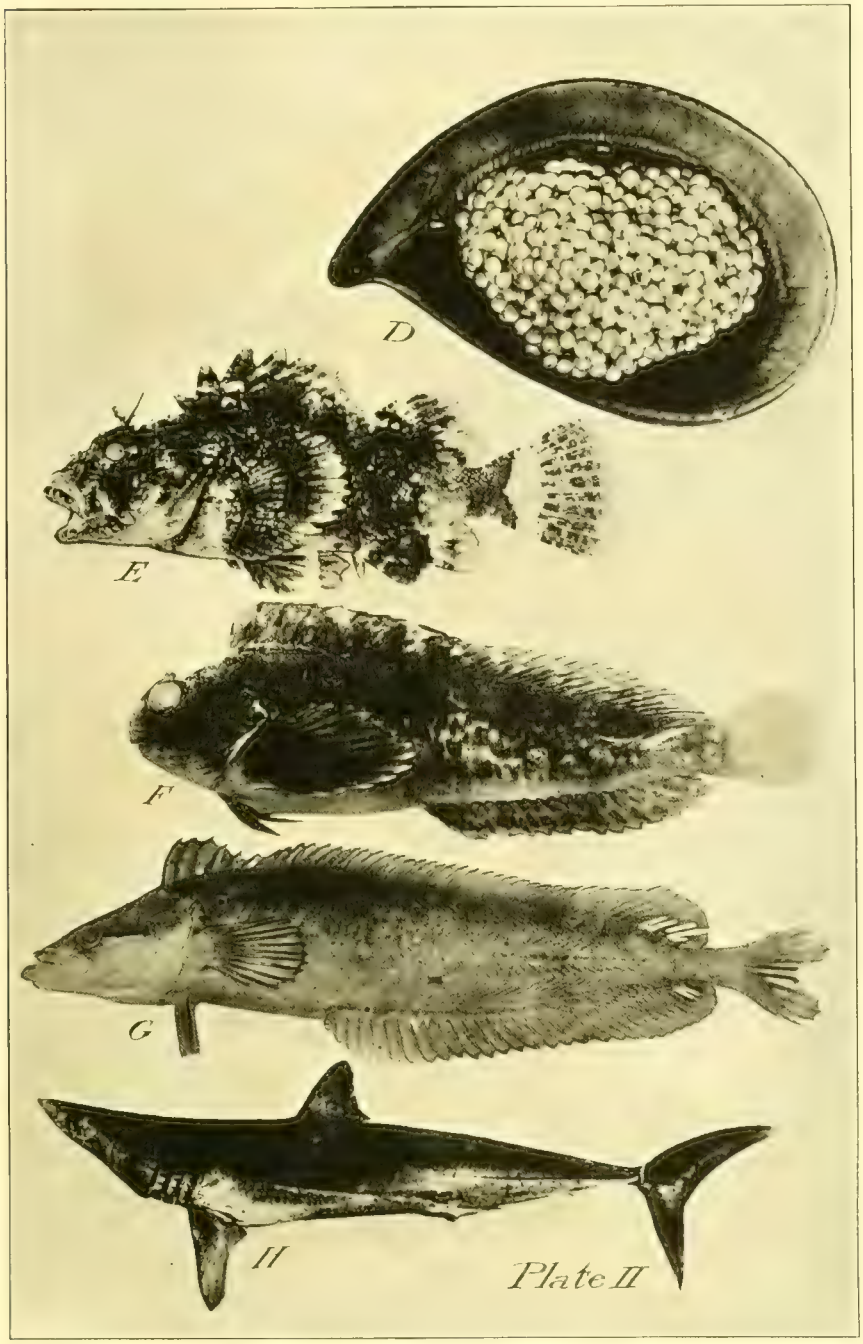


Plate II

D, Xererpes fucorum and eggs. E, Scorpaena guttata, young. F, Hypsoblennius gilberti. G, Heterostichus rostratus. H, Lamna cornubica.

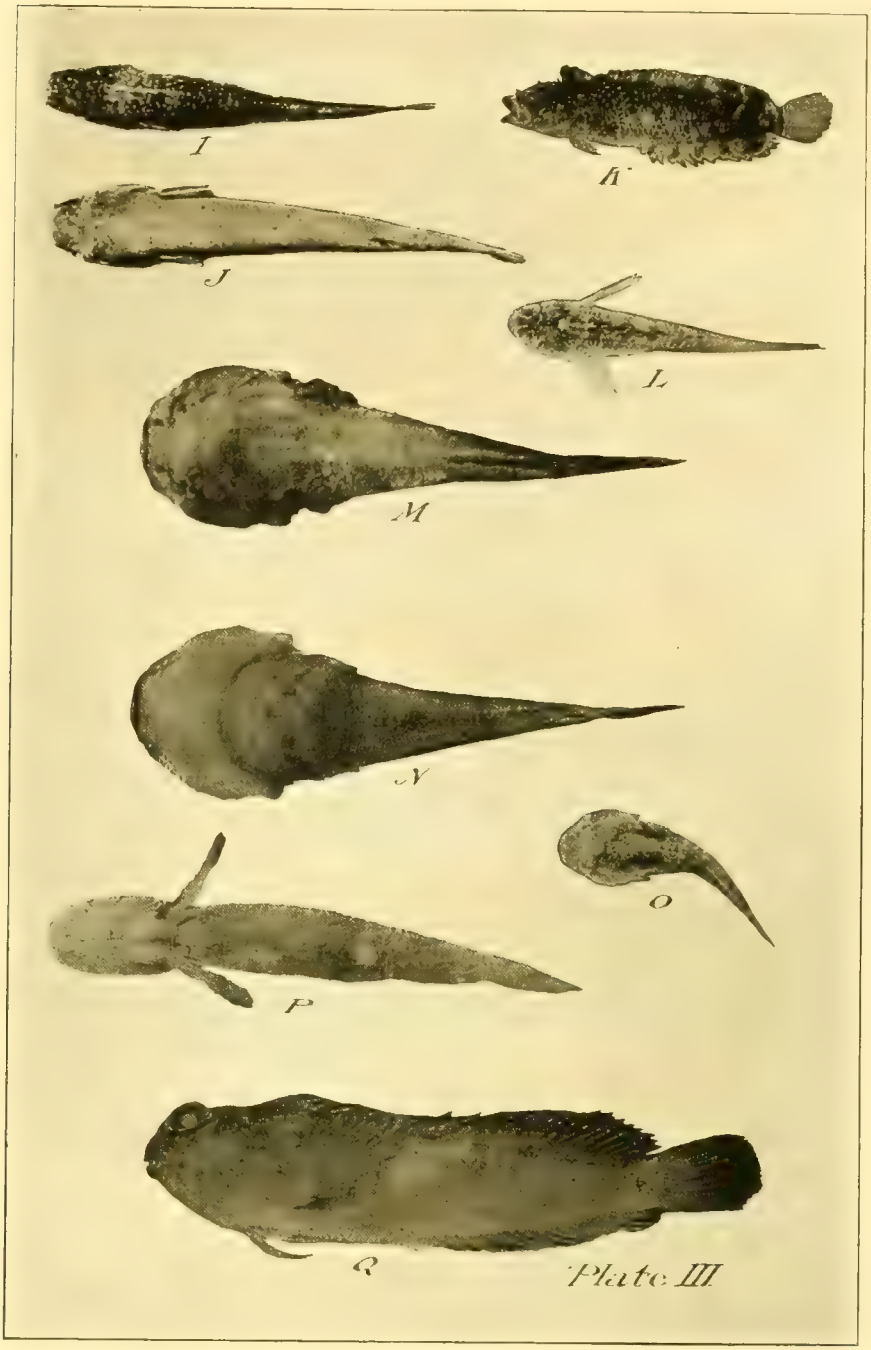


Plate III

I, Rimicola eigenmanni, dark form. J, R. eigenmanni, light form. K, Auchenopterus integripinnis. L, Hypsoblennius gentilis. M, N, O, Arbaciosa rhessodon. P, Typhlogobius californiensis. Q, Hypsoblennius gentilis.

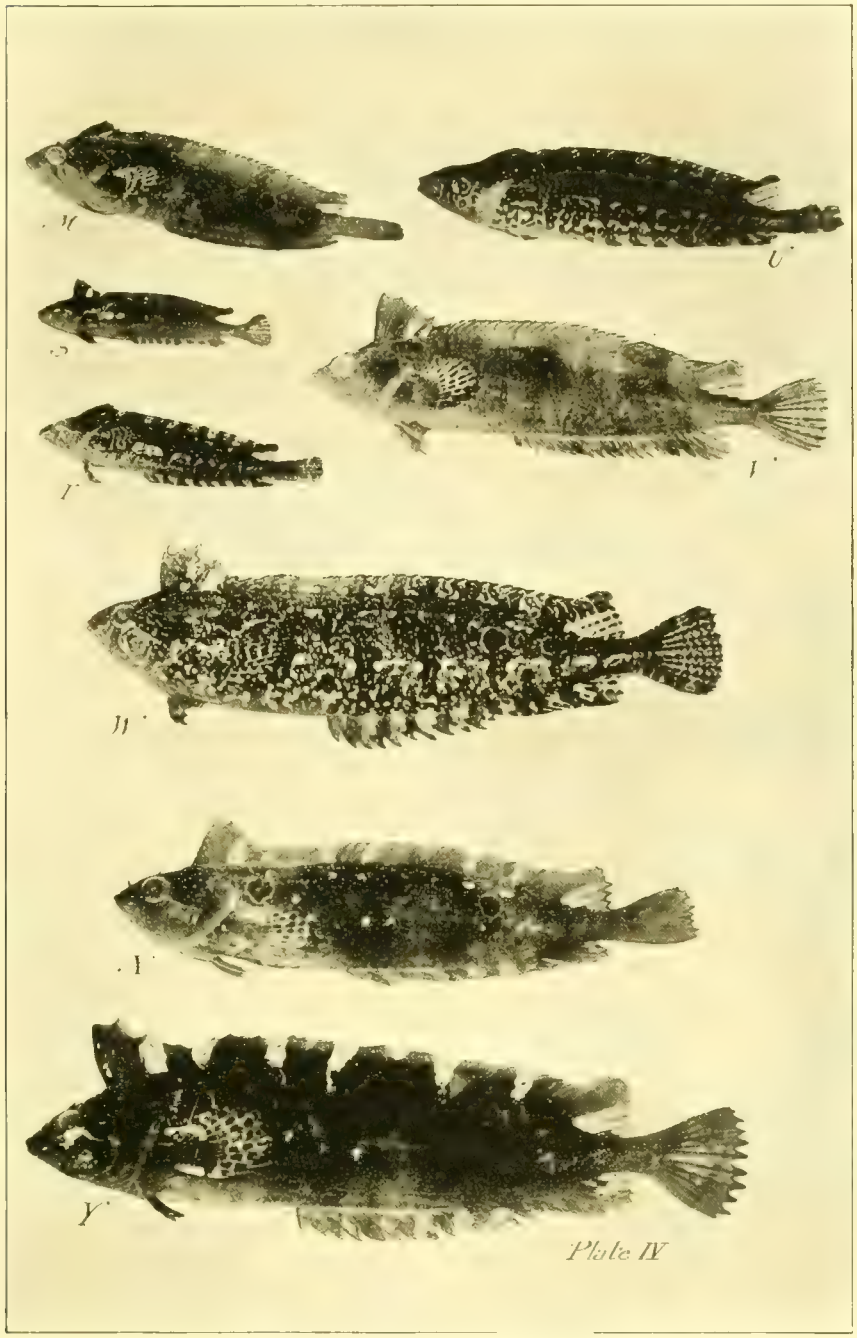


Plate IV. Gibbonsia elegans

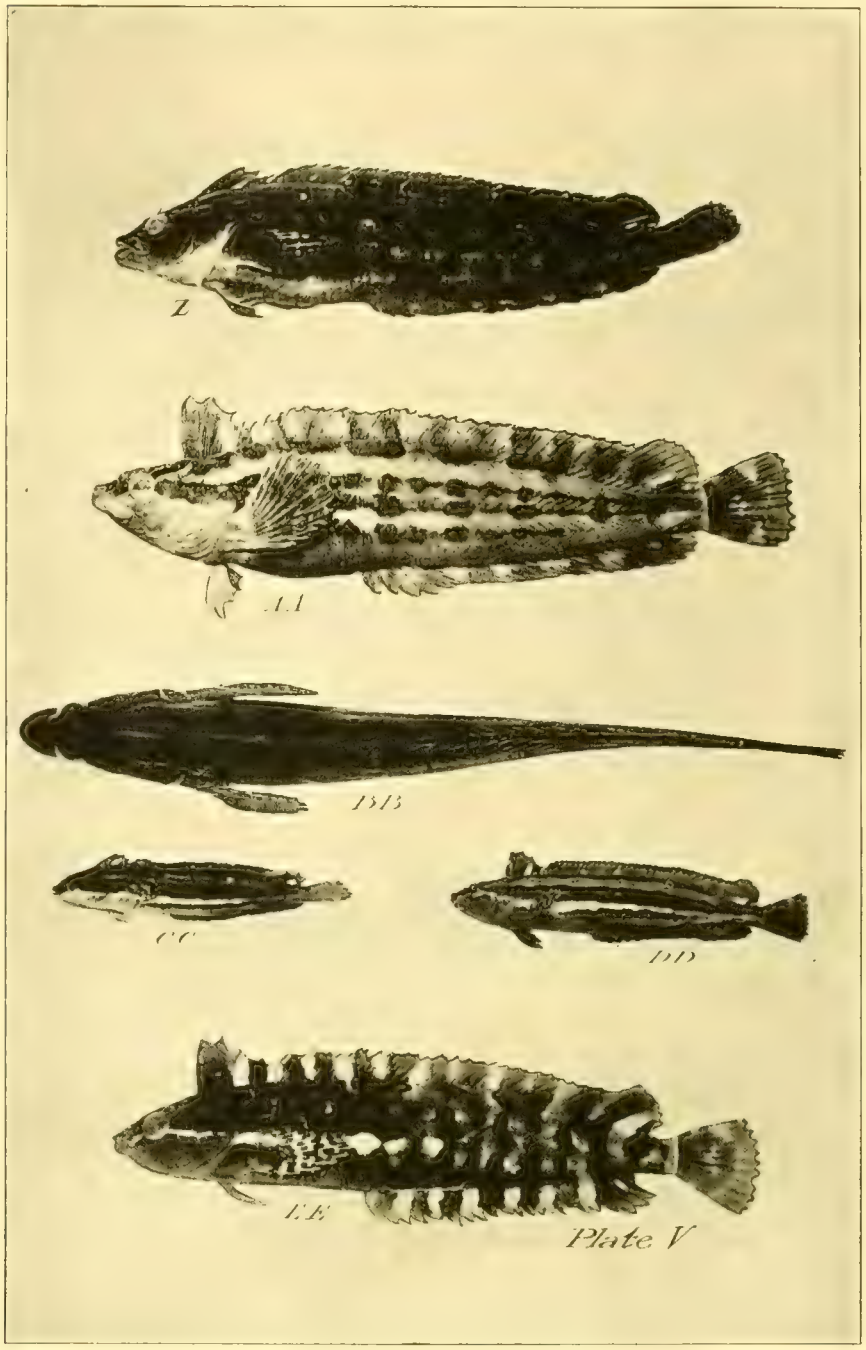


Plate V. Gibbonsia evides

REPTILES AND BATRACHIANS OF LAGUNA BEACH

JULIUS HURTER, SR.*
ACADEMY OF SCIENCES, ST. LOUIS

AMPHIBIA

Bufo columbiensis Baird and Girard

This large toad is quite common at Laguna.

Hyla regilla Baird

A number of specimens of this tree frog were taken one night after dark about the water tap behind the laboratory.

REPTILIA

Uta stansburiana Baird and Girard

Common on the cliffs along the coast.

Cnemidophorus stejnegeri VanDenburgh

Occasional along the hills.

Phrynosoma blainvilli Gray

In the dry mountains back of Arch Beach.

Eumeces skiltonianus Baird and Girard

One specimen taken.

Diadophis amabilis Baird and Girard

One specimen of this small snake taken near the laboratory.

Thamnophis hammondi Kennicott

This water snake was taken in the slough at Aliso Creek.

Rhinocheilus lecontei Baird and Girard

One specimen taken just as it was entering a squirrel burrow.

Crotalus spp.

Rattlesnakes of perhaps several species—certainly several marked color forms, are to be found in the hills about Laguna, as is indicated by numbers of fine skins in the possession of people living at Laguna. Good specimens of all these forms for study are great desiderata.

Clemmys marmorata Baird and Girard

This turtle was common in the brackish water slough at Aliso Creek, and eight good specimens were taken there.

*Mr. Hurter spent a couple of days at the laboratory and used them most industriously, making in these two days a good beginning for a study of the amphibians and reptiles of the region. Especially interesting to us was the lizard, Uta, living practically within reach of the salt spray, and the turtle living in brackish water.—Ed.

SOME OF THE MOLLUSCA OF LAGUNA BEACH

MABEL GUERNSEY

Wishing to study the gross anatomy of the soft parts of some of the common mollusks of our Coast, and spending some time at Laguna in the pursuit of this object, I improved the opportunity to bring together all such species as came in my way to serve as the beginning of a faunal list of the local mollusks of the tidal zone. A set of most of the shells collected was sent to Dr.Dall, who very kindly gave us the determinations. Some of my anatomical work is not at all complete, but I am hoping to continue it another season.

GASTEROPODA

AMPHINEURA

Ischnochiton clathratus Roe

Ischnochiton magdalensis Mds.

(Figure 32)

Mopalia hindsii Gray

Mopalia muscosa Gld.

Nuttallina scabra Roe

All of the above five chitons are found clinging to rocks between tides. The second species is by far the most common, while the last is quite rare.

PROSOBRANCHIATA

Acmaea scabra Roe

(Figure 33)

Common in tide-pools.

Acmaea persona Esch.

Common on rocks covered only by the highest tides.

Acmaea spectrum Roe

Distribution the same as *Acmaea persona* but much rarer.

Acmaea asmi Midd.

Found on other shells, usually of other limpets in tide-pools, and fairly common.

Lottia gigantea Gray

(Figure 34)

Found in a few channels where there is constant and violent wave action, and fairly numerous where found.

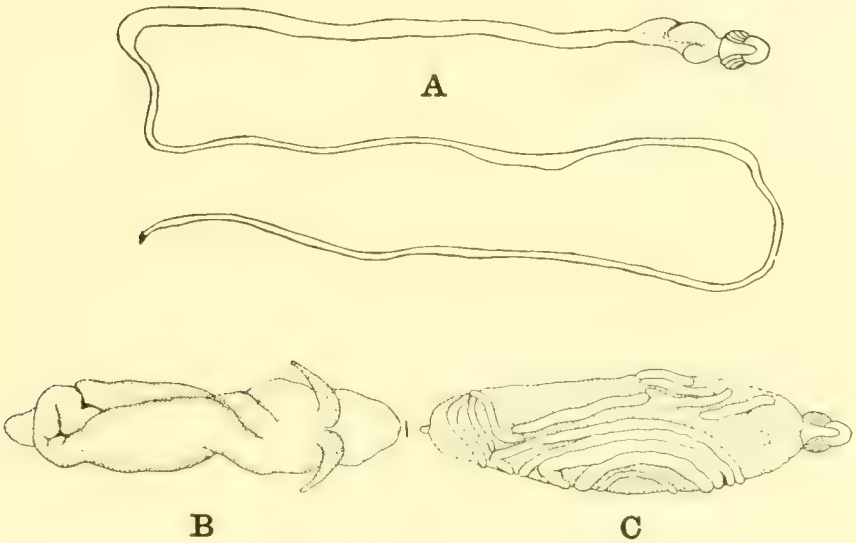


Figure 32. Ischnochiton magdalencusis
A, Alimentary canal. B, Reproductive organs. C, Alimentary canal and liver.

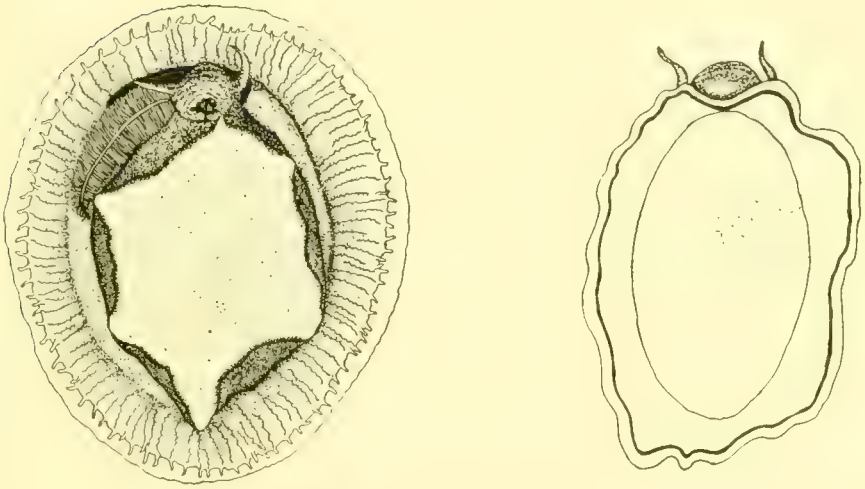


Figure 33. Acmaea scabea

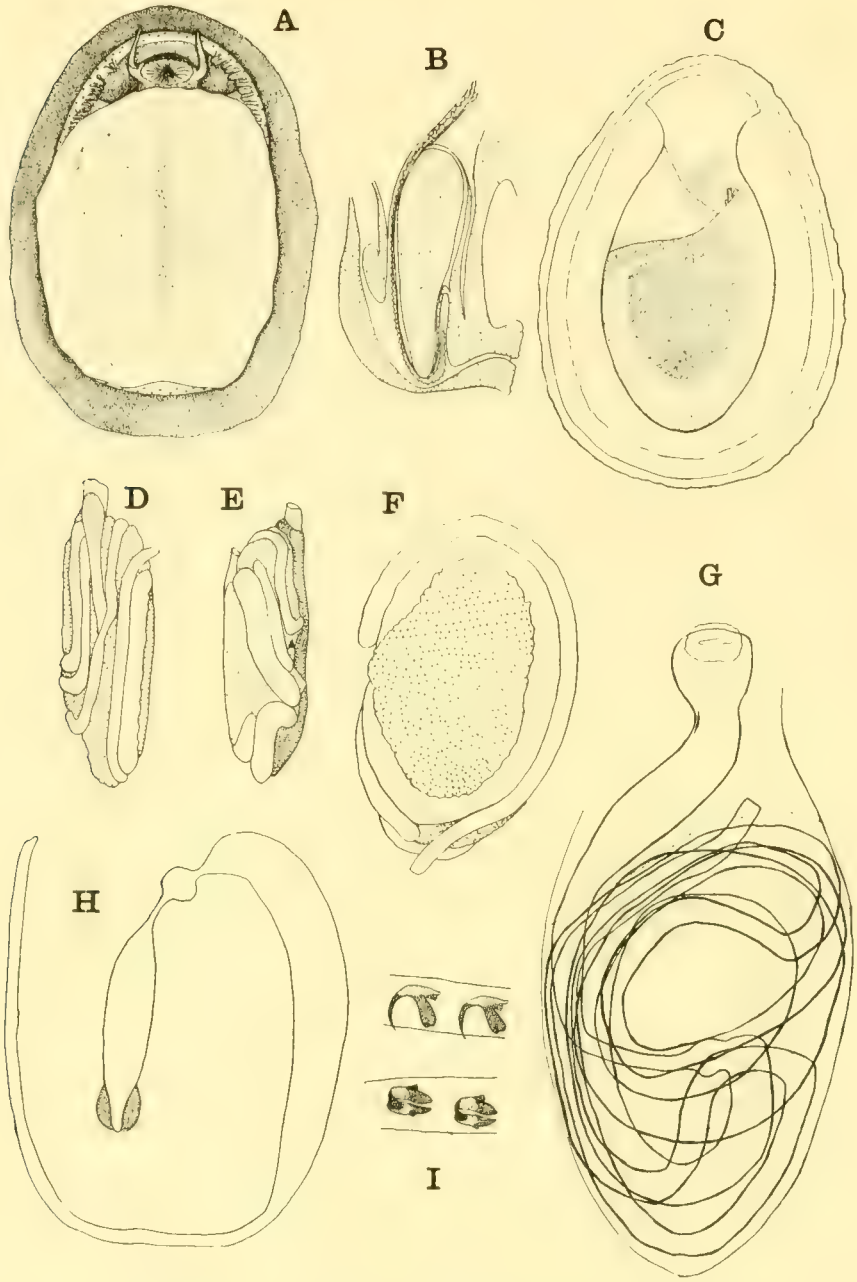


Figure 34. Lottia gigantea

A, Ventral view. B, Longitudinal section pharynx. C, Dorsal view after removing shell. D, Alimentary canal in liver (left side). E, Alimentary canal in liver (right side). F, Alimentary canal in liver (upper side). G, H, Alimentary canal. I, Radula.

Fissuridea volcano Roe

Shells common to the beach in certain localities. Living animals sometimes found in the lower tide-pools.

Lucapina crenulata Sby.

(Figure 35)

A fine living specimen found at very low tide. Evidently living mostly below low tide.

Haliotis spp.

Young specimens of several species are frequent in the lower tide-pools. Large specimens could only be found below low tide. Abalones have evidently been very abundant at Laguna Beach, but wholesale gathering is depleting them very rapidly. One raid by Japanese fishermen who worked with diving suits, resulted in a very large catch. These fishermen were arrested and fined a nominal amount and were then allowed to depart with their entire catch—a pure travesty. It seems probable that by protection, and breeding, a fisheries asset of great value might be built up on this coast.

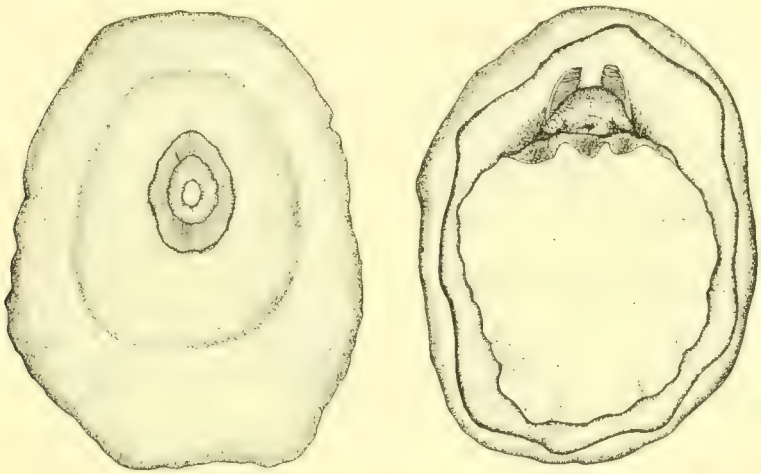


Figure 35. Lucapina crenulata. Dorsal and ventral views

Tegula gallina Fbs.
Tegula fuscescens Phil.
Tegula aureotincta Fbs.
Norrisia norrissii Sby.
Pomaulax undosus Wood

(Figure 36)

The above five species are common on the rocks between tides, and extend commonly into the upper limits of the fucus zone.

Epiphragmophora arrosa Gld.

A few specimens found on the cliffs at Arch Beach.

Opalia insculpta Cpr.

Scala hindsii Cpr.

Only empty shells of these two species were taken, and these were inhabited by hermit crabs.

Littorina planaxis Phil.

The commonest shell of the beach, found in great numbers adhering to the rocks from those only wet by spray at high tide down to rocks uncovered only at low tide.

Littorina scutulata Gld.

Occurring with *L. planaxis,* but far less common.

Figure 36. Pomaulax undosus

Cypraea spadicea Gray

Rare among the rocks between tides.

Murex gemma Sby.

Among the rocks between tides, not common, but the most common of the Muricidæ.

Purpura nuttallii Con.

Not common.

Ocinebra gracillima Stearns

Acanthina spirata Blv.

Of the above two species, only shells inhabited by hermit crabs were found.

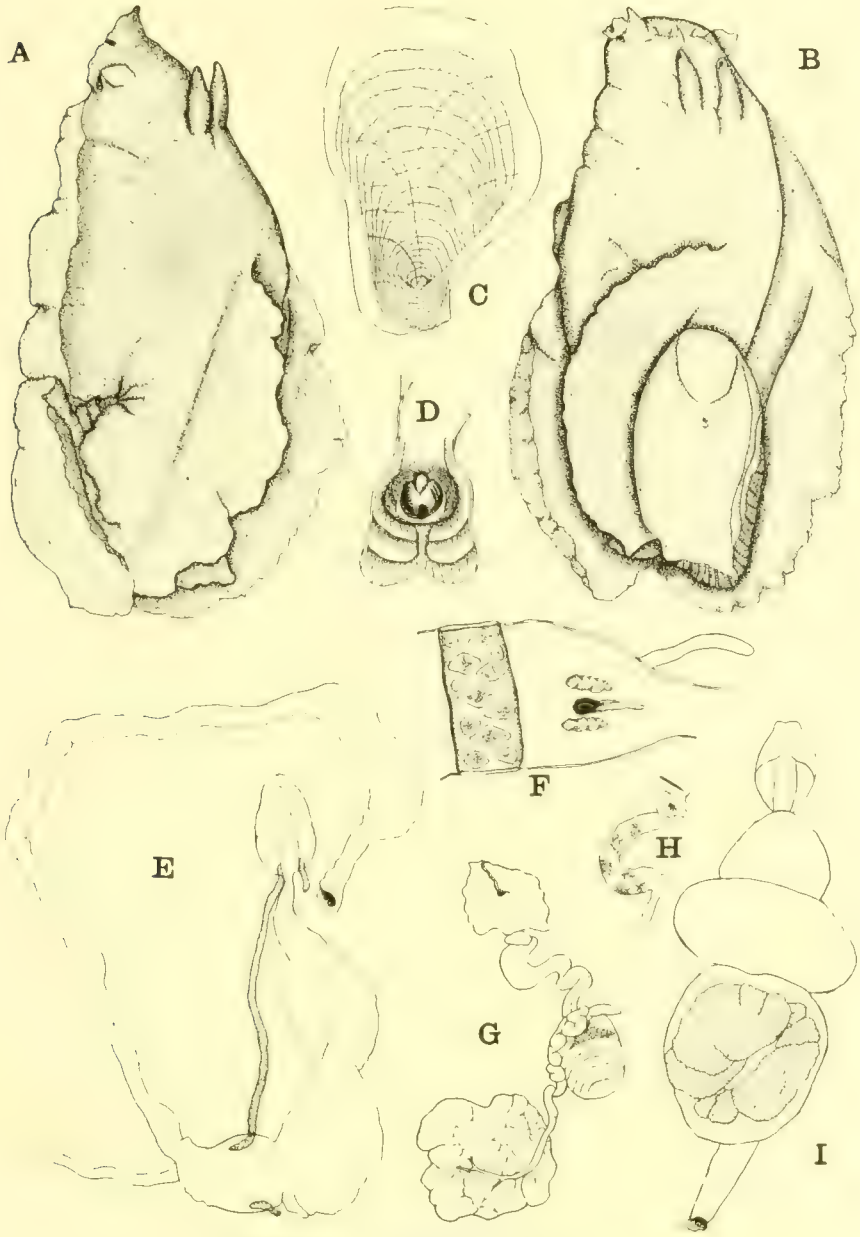


Figure 37. Aplysia californica

A, Side view. B, Dorsal view. C, Shell. D, Pharynx (opened). E, Alimentary canal. F, Stomach (opened). G, H, Reproductive organs. I, Alimentary canal and liver.

Thais ostrina Gld.

While dead shells are fairly common between tides, living specimens appear to be rare here.

Astyris hindsii Roe

Fairly common on sea-weeds between tides.

Amphissa versicolor Dall.

Empty shells of this only, were encountered.

Macron lividus A. Ads.

Common attached to fucus.

Volvarina varia Sby.

Between tides, but not common.

Olivella pedroana Conr.

A few dead shells found.

Conus californicus Con.

Common, attached to fucus.

OPISTHOBRANCHIATA

TECTIBRANCHIATA

Aplysia californica Cooper

(Figure 37)

These enormous purplish sea-slugs were occasionally encountered in the lower tide-pools. A good many specimens were dissected.

NUDIBRANCHIATA

Numerous species of remarkably beautiful nudibranchiate mollusks are to be found at Laguna Beach, and they are among the most attractive objects of the tide-pools, never failing to call forth the most enthusiastic exclamations from both students and visitors. "Exquisite" is the only word that adequately described them. I determined the species so far as I could from MacFarland's writings, but a large part of the species seem to be underscribed. In the works of Bergh and other writers on this group, our west coast species seem never to have been treated.

Chromodoris porterae Cockerell

(Figure 39 B)

Color prussian blue, the dorsum of a deeper shade than the sides. Mantle narrowly white edged. On the dorsum is a median line of light blue running from between the rhinophores to the branchiæ. On each side, half way between this line and the mantle edge, a broad

orange yellow band runs from the rhinophores to just beyond the branchiæ. In front of the rhinophores is an orange spot. Both rhinophores and tentacles are dark blue. A narrow light blue line runs down the middle of the tail. Length when in ordinary posture about 12 mm.

Chromodoris sp.

(Figure 39 C, D)

Color prussian blue, the mantle and foot bordered with light blue. Body covered with numerous orange spots. Length 5.5 cm. The largest nudibranch seen at Laguna.

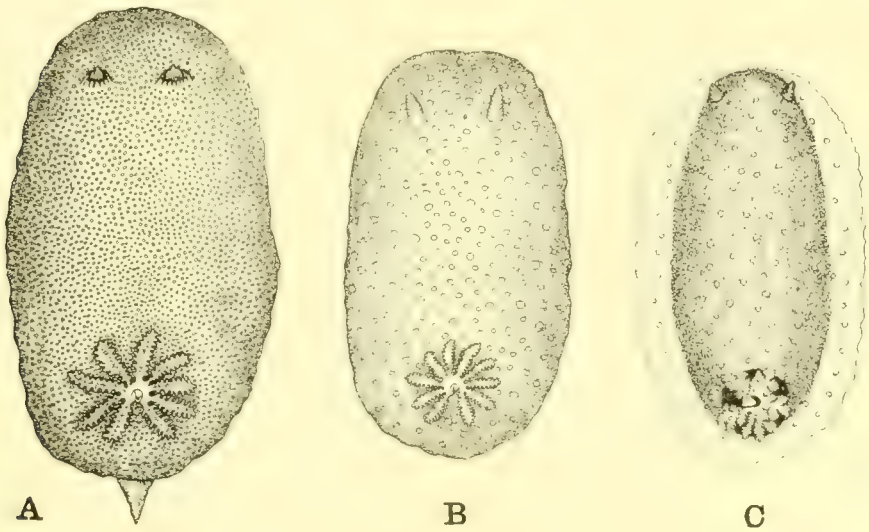


Figure 38

A, Rostanga pulchra (McFarland). B, Doriopsis fulva (McFarland). C, Doris sp.

Ancula pacifica MacFarland

(Figure 39 G)

Color translucent whitish. Gills and tentacles tipped with reddish orange. Back striped with orange. Papillæ around branchiæ tipped with pale yellow. Length 1 cm. Differs somewhat from *Ancula pacifica* as described by MacFarland in having eight instead of six processes around the branchiæ, but this is a variable character.

Aegires albopunctatus MacFarland

(Figure 39 F)

Color opaque white, spotted with dark brown. Length 12 mm. Two specimens taken.

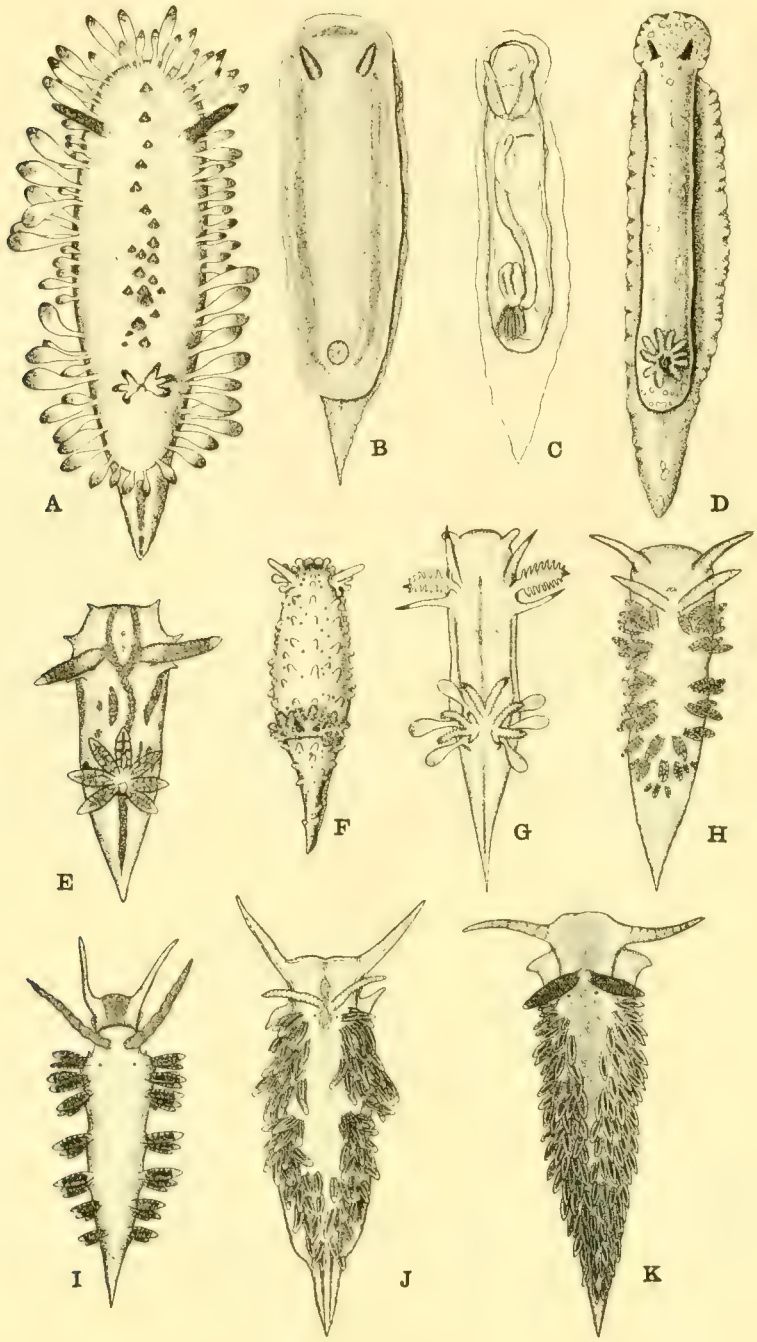


Figure 39

A, Laila cockerelli. B, Chromodoris porterae. C, Chromodoris sp. (mantel removed). D, Chromodoris sp. E, Genus? F, Aegires albopunctatus. G, Ancula pacifica. H, Cuthonia sp. I, Hervia sp. J, Hermissenda opalescens. K, Spurilla sp.

Laila cockerelli MacFarland

(Figure 39A)

Color translucent whitish. Branchiæ and clavate papillæ tipped with orange red. Rhinophores orange red with white bases. Numerous small orange red tubercles on the dorsum. Orange red marking also occur on the tail. The one specimen taken differed from MacFarland's description in having two instead of five branchial plumes, but this is of little moment since the branchiæ are constantly subject to injury.

Genus and Species?

(Figure 39 E)

Color white, with two black stripes from mouth to rhinophores, where they unite and pass as one to the branchiæ. Sides irregularly marked with black stripes and spots. Tentacles yellow. Rhinophores black, tipped with yellow. Bordering the black stripes are various spots and stripes of yellow. Many of the yellow spots occur on small tubercles. The branchiæ are black, tipped with yellow.

Rhinophores foliate and retractile into small sheaths. Branchiæ seven, and also foliate and retractile. Six short tentacle-like processes on the head, which are joined by a thin prolongation of the mantle edge, this being practically all of the mantle that is evident. Head large and truncated. Length about 7 mm.

Doriopsis fulva MacFarland

(Figure 38 B)

Color lemon yellow. Mantle thickly covered with small white-tipped tubercles. Rhinophores brownish. Branchiæ a paler yellow than dorsum. Front edge of foot deeply bilobed. No notch on upper lip. Rhinophores and branchiæ retractile into small smooth edged sheaths. Tentacles rudimentary, attached to lateral folds on the sides of the mouth. Length 9 mm. Frequent under stones between tides. Doubtless the determination of this would not be sure without a comparison of the internal anatomy.

Rostanga pulchra MacFarland

(Figure 38 A)

Color orange red, the foot pinkish. Rhinophores darker than mantle. Anterior margin of foot bilobed. Upper lip notched. Tentacles small. Rhinophores very short and completely retractile. Mantle covered with short spiculate papillæ. Length 5 mm. Found under stones, thus differing in habit from the species as described by MacFarland for he records it from a red sponge.

Doris sp.

(Figure 38 C)

Mantle brown, bordered with yellow, and covered with small white tubercles more thickly in the center than on the edges. Foot yellow, branchiæ light yellow. The branchiæ and rhinophores are retractile into smooth bordered sheaths. Body deep, with the dorsum highly arched. Tentacles rudimentary. Length 27 mm. Common under stones during July and August but rare in September.

Cuthonia sp.

(Figure 39 H)

Color translucent whitish. Cerata translucent with a dark green core. A dark green spot in front of the rhinophores. Length 5 mm.

Cutting edge of mandible strongly denticulate. Radula consisting of a single row of plates. There are usually nine teeth on a plate, the central one not prominent, as short or shorter than the prominent laterals.

Hervia sp.?

(Figure 39 I)

Color translucent whitish. Rhinophores orange, and with an orange spot in front of them. Cerata with greenish-black cores, and tipped with orange. Animal very slender, the body highest in the region of the rhinophores. Rhinophores and tentacles slender and non-retractile. Length 7 mm.

Cutting edge of mandible not toothed, strongly striated. Radula consisting of a single row of plates. Usually eleven teeth on a plate, the central not prominent, the laterals long and slender.

Hermissenda opalescens (Cooper).

(Figure 39 J)

Color translucent whitish, with light brown stripes on tentacles and tail. Orange markings occur on the head. Cerata translucent, with brown cores and orange markings. Animal very slender. Cerata numerous and very easily detached. Anterior margin of foot prolonged into two tentacle-like processes. Lips bilobed, the upper narrow, the lower large. Common during the early part of the summer in tide-pools.

Cutting edge of mandible with about thirty strong denticles. Radula consisting of a single series of angularly arched plates. The central tooth is large and finely denticulated on the lower edge; the laterals are small, three to four on a side.

Spurilla sp.

(Figure 39 K)

Color white. Back and top of head orange with a finely granulated appearance. Cerata near head orange with brown cores, those farther back becoming browner. Tentacles white. Rhinophores foliate, and red, with white tips. Animal slender, the foot large, anterior margin slightly prolonged into tentacle-like processes. Rhinophores and tentacles slightly contractile. Mouth large, under lip bilobed, upper smooth. Cerata in constant motion and very easily detached. Common in September. Length 15 mm.

Cutting edge of mandible not toothed, strongly striated. Radula consisting of a single series of low-arched, pectinate plates, notched in the center.

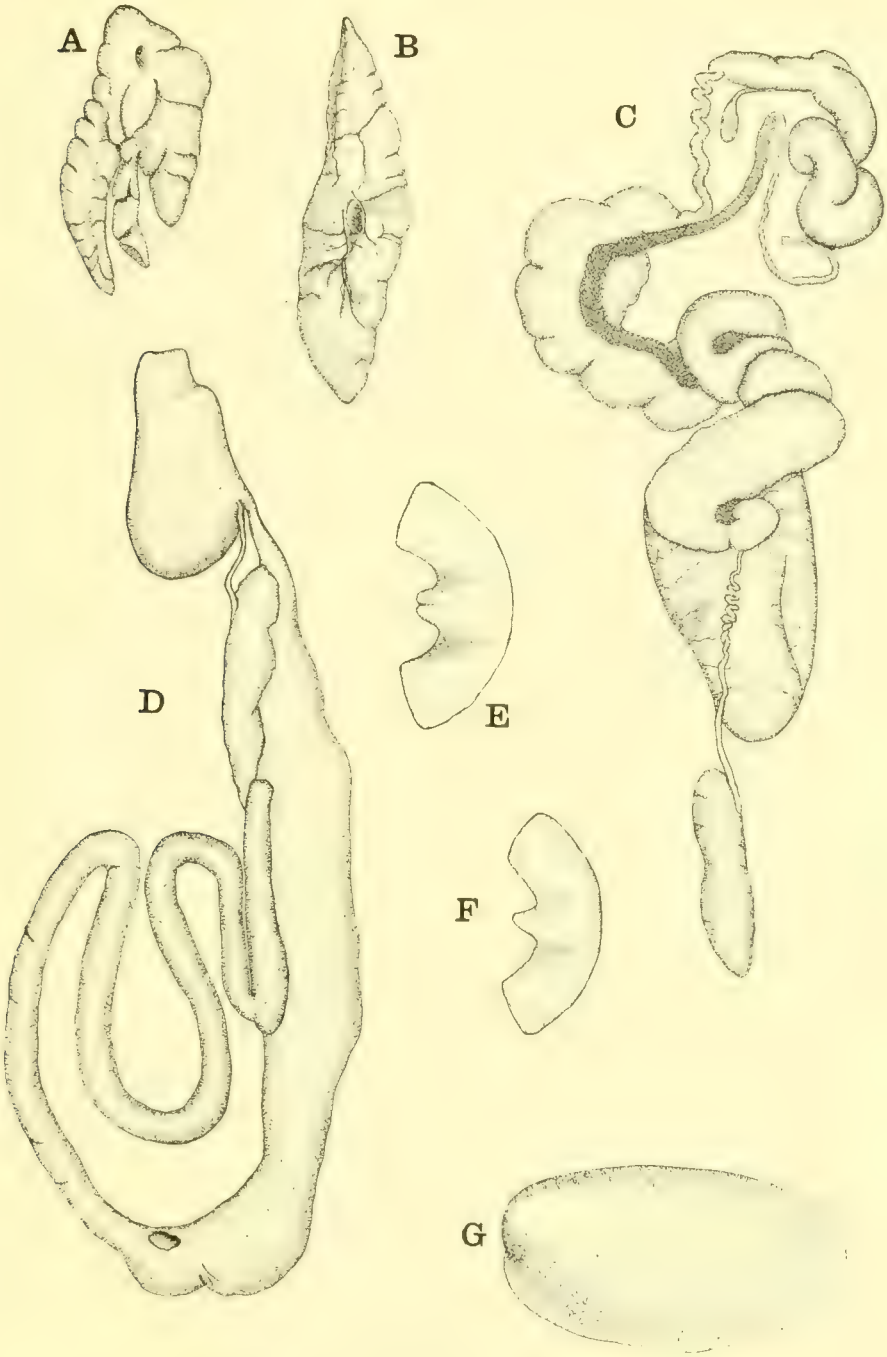


Figure 40. Limax maximus

A, Left lobe of liver. B, Right lobe of liver. C, Reproductive organs. D, Alimentary canal. E, Abnormal jaw. F, Normal jaw. G, Shell.

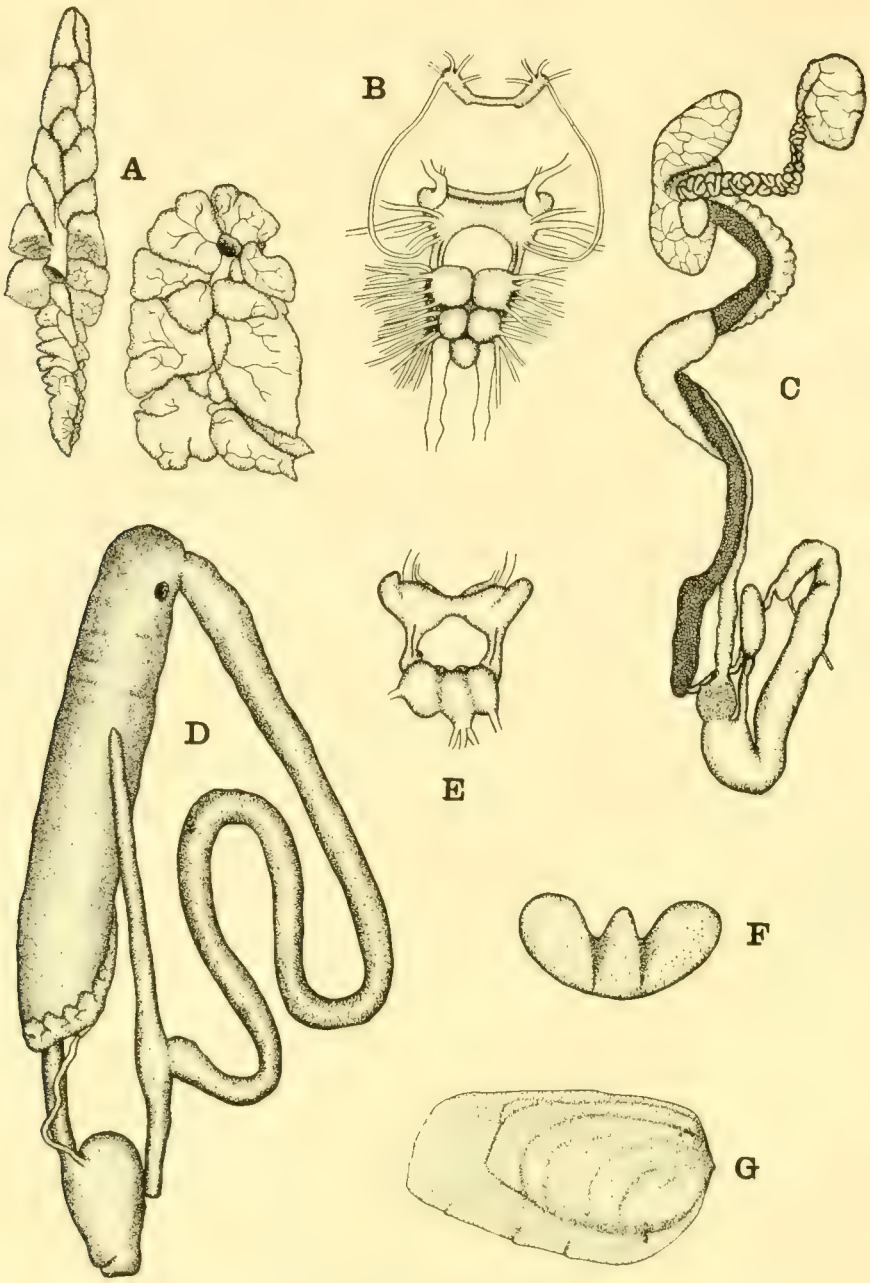


Figure 41. Limax flavus

A, Liver. B, Nervous system (ventral view). C, Reproductive system. D, Alimentary canal. E, Nervous system (dorsal view). F, Jaw. G, Shell.

PULMONATA

Two species of *Limax* are common both at Laguna Beach and Claremont. They have been provisionally determined by Mr. S. S. Berry, as *Limax maximus* Linn. and *Limax flavus* Linn. They differ in color, both being of a yellowish-gray, but *Limax maximus* is spotted and streaked with black, while *Limax flavus* has no black spots. There are also some anatomical differences. *Limax maximus* is, when fully grown, about two inches long; *Limax flavus* is somewhat smaller.

Figure 42. Circulation of Limax flavus

Limax maximus L.
(Figure 40)

Limax flavus L.
(Figures 41 and 42)

PELECYPODA

FILIBRANCHIATA

Mytilus californianus Conr.
(Figure 43)

The species is gregarious, forming extensive mussel-beds on flat rocks exposed to the surf. There are several large colonies of them at Laguna, notably the one at Mussel Point, which furnishes to the villagers endless supplies for food and for bait.

Mytilus bifurcatus Conr.

More generally distributed along this coast than *M. californianus*. Sometimes very numerous on rocks uncovered at low tide.

Septifer bifurcatus Roe

Distribution same as *Mytilus bifurcatus* but rarer.

PSEUDOLAMELLIBRANCHIATA

Ostrea lurida Cpr.

Found in lower tide pools and on rocks uncovered but a short time at low tide. Not at all common.

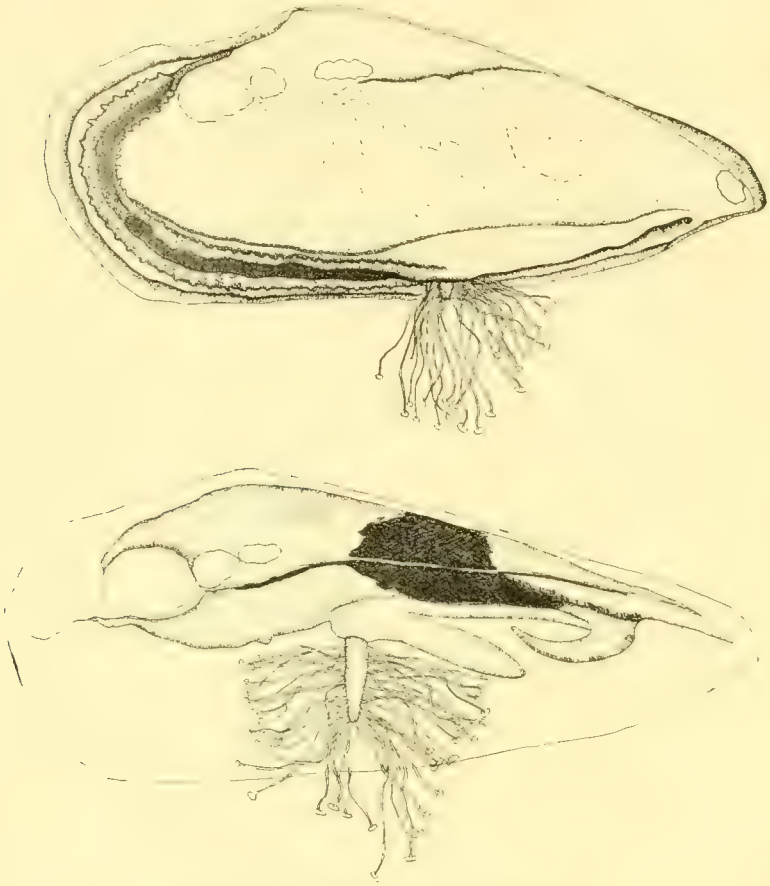


Figure 43. Mytilus californianus

EULAMELLIBRANCHIATA

Phacoides californicus Conr.
Semele rupium Sby.
Tivela stultorium Mawe
Chama pellucida Sby.

The above four shells are found washed up on the beach, the last two quite common.

ON A CEPHALOPOD NEW TO CALIFORNIA WITH A NOTE ON ANOTHER SPECIES

S. S. BERRY

The two species of cephalopod mollusks (one squid and one octopus) which are the subject of the following notes were obtained by Mr. C. W. Metz during the 1911 session of the Pomona College Marine Laboratory at Laguna, Orange County, California. Although so few of this class of animals were taken, one of the two specimens submitted to me represents a species new not only to California, but apparently to the entire western coast of North America as well. I am indebted to the gentleman named for the opportunity to examine and report upon the material.

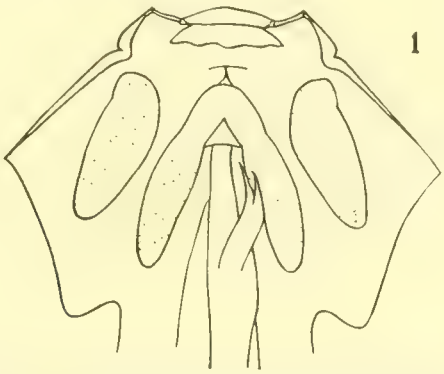


Figure 44. Funnel of Onychoteuthis banksii

Laid open along the medio-ventral line to show the funnel organ (semi-diagrammatic).

Onychoteuthis banksii (Leach 1817) Ferussac

1817 *Loligo banksii* Leach, Zool. Miscell., vol. 3, p. 141.

1826 *Onychoteuthis banksii* Ferussac, in D'Orbigny, Ann. Sci. Nat. (1), vol. 7, p. 151.

1879 *Onychoteuthis banksii* Tryon, Man. Conch. (1), vol. 1, p. 168, pl. 73, figs 291-294.

1908 *Onychoteuthis banksii* Pfeffer, Nord. Plankton, IV, Ceph., p. 65, figs. 71-77.

A single female specimen of this widespread oceanic species was obtained from J. H. Souder, who captured it in a seine off the entrance to Newport Bay, S. S. B. No. 295. In a report written some

months ago and now in press, the writer expressed the opinion that *O. banksii* would very likely be found to occur in the waters of our region, but so prompt a confirmation of the statement was scarcely to have been expected.

From all other West American species excepting only the gigantic *Moroteuthis* of Alaska, *O. banksii* is readily distinguishable by the double series of powerful hooks on the tentacle clubs as shown in the accompanying photograph (Figure 45). The curious "fixing apparatus" at the base of the club (Figure 46) furnishes another conspicuous character. This structure comprises a compact, rounded

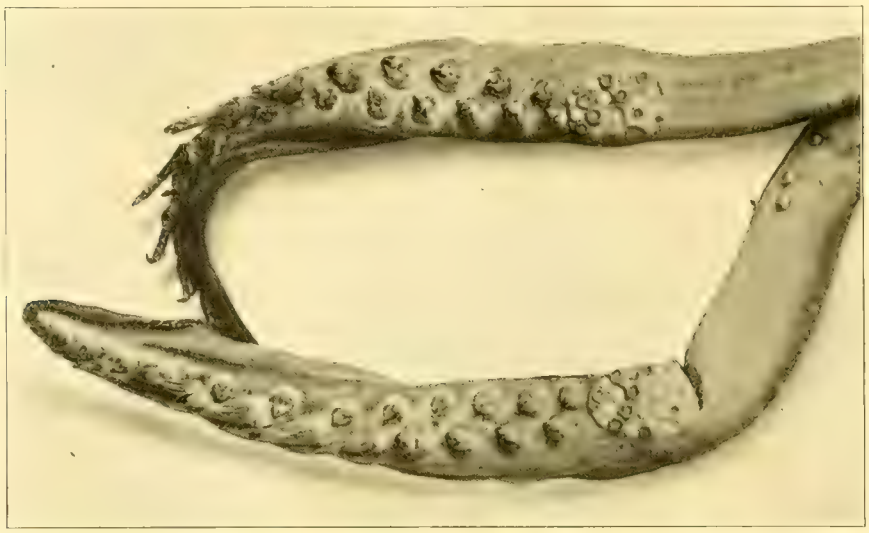


Figure 45
Showing hooked tentacle clubs of Onychoteuthis banksii.

group of suckers and pad-like organs so arranged that the suckers on one tentacle fit perfectly over the pads of its mate, securing a most powerful adhesion at a point where such support very greatly increases the prehensile power of the tentacles. The immense rhomboid fins are also characteristic.

So far as I have been able to determine from the literature the present individual is by far the largest specimen of the species which has happened to be placed on record. D'Orbigny* gives the total length of *O. banksii* as 310 mm., mantle length 130 mm.; of the identical *O. angulata*† as 400 mm.; mantle 130 mm. Tryon gives the

*Moll, viv. et. foss., 1845, p. 387.
†Voy, Amer. Merid., Moll., p 43, 1845.

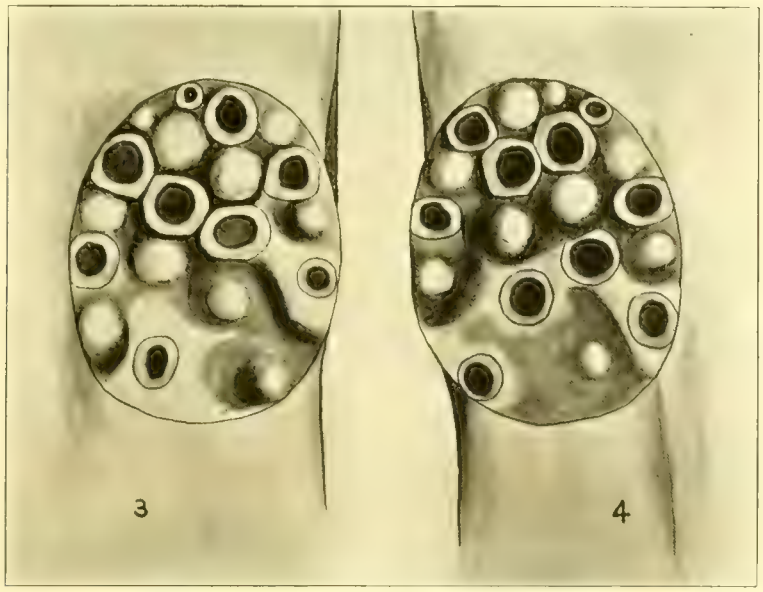


Figure 46
Fixing apparatus of right and left tentacle clubs of Onychoteuthis banksii.

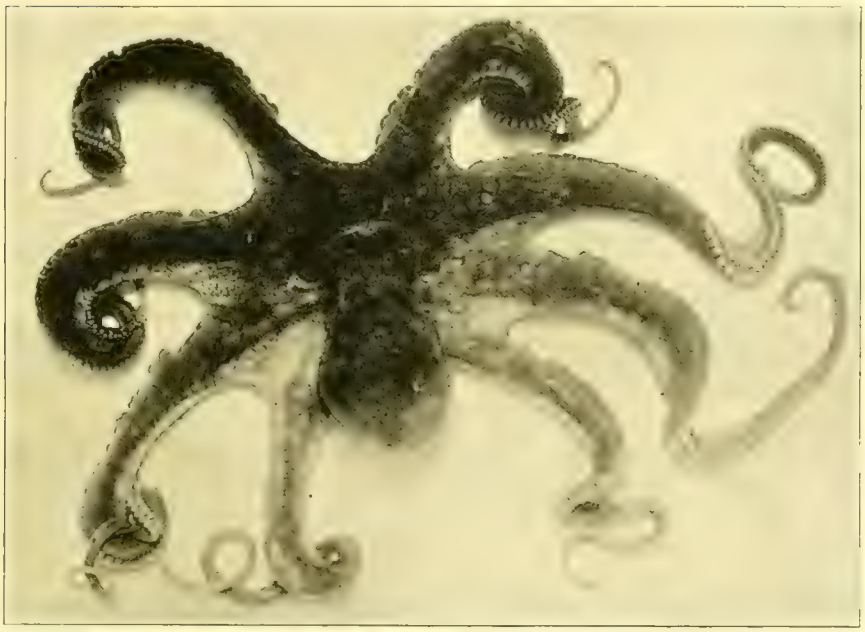


Figure 47. Polypus bimaculatus

ordinary length of the body as six inches (i. e., about 150 mm.). Joubin* records a specimen having a total length of 195 mm., mantle 110 mm. The body of our specimen is considerably over twice as long as the largest here cited. Its more important dimensions are therefore appended below:

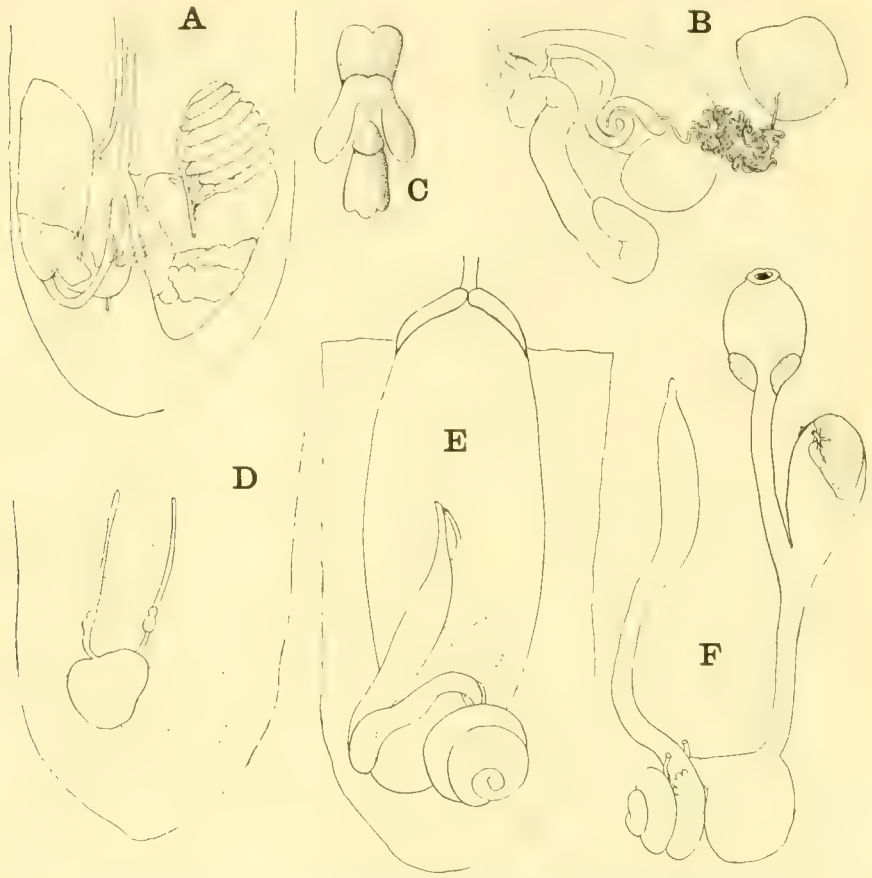


Figure 48. Anatomical details of Polypus bimaculatus

A, Circulatory system (right kidney removed). B, Male reproductive organs. C, Jaw. D, Female reproductive organs. E, Alimentary canal and liver. F, Alimentary canal. From dissections by Miss Guernsey.

Length to tail 680 mm.; length, exclusive of arms, 353 mm.; length, exclusive of tentacles, 488 mm.; length of mantle (dorsal) 313 mm.; width of mantle 80 mm.; length of fins, total, 183 mm.; length of fins along plane of attachment 164 mm.; width across fins, 215 mm.; length of head 40 mm.; width of head 49 mm.; length of dorsal arm 101 mm.; length of second arm 120 mm.; length of third arm 116 mm.;

*Ceph. "Princ.-Alice," 1900, p. 63.

length of ventral arm 135 mm.; length of tentacle 327 mm.; length of tentacle club 73 mm.

Polypus bimaculatus (Verrill 1883)

(Figures 47 and 48)

A specimen of this species (S. S. B. No. 324) was taken by Mr. Metz in one of the lower tide-pools at Laguna, and numerous other specimens by other members of the laboratory. It is the common shore "octopus" of Southern California and has been previously reported from White's Point, San Pedro and San Diego. The large, eye-like, lateral markings near the base of each arm of the third pair constitute its most conspicuous specific character. In the present specimen the usual bluish ring* surrounding the central spot is obscured or absent.

A microscopic examination of a portion of the integument in the neighborhood of these markings shows that the outer ring of the oculation owes its pale color chiefly to a diminution in the number of chromatophores over this area.† Similarly the dark center is due to a great and sudden increase in their frequency. The exact number is somewhat variable, but a given space in the dark center appears to contain fully twice as many as an equal area in the paler border.

Even when expanded, all the chromatophores are excessively small. In the present material the dimensions of one of these organs is .09 x .16 mm. expanded, and .04 x .06 mm. in diameter contracted. Their detailed structure is correspondingly difficult to make out.

The illustrations accompanying this paper were prepared by Mr. John Howard Paine of Stanford University, Mr. Metz and Miss Mabel Guernsey.

*Berry, Univ. Calif. Publ. Zool., vol. 18, p. 302, 1911.

†Whether the pigment within the chromatophores themselves is likewise differentiated either in color or quantity, cannot of course be determined without examining fresh material.

SOME ECHINODERMS COLLECTED AT LAGUNA

C. F. BAKER

Starfish, serpent stars, sea-urchins, and sea cucumbers are very much in evidence between tides at Laguna, some species occurring in enormous numbers. As yet, no special effort has been made to collect the species thoroughly. Of most of those taken a set was determined by Prof. Walter K. Fisher of Stanford University, and he very kindly furnished the notes incorporated below under quotation marks.

HOLOTHUROIDEA

Synapta inhoerens O. F. Mull

These beautiful pale-colored little holothurians are frequent in the sand under stones in tide-pools. Some of their movements are extraordinarily worm-like. The peculiar character of the dermal anchors and plates in this species are very distinctive.

Stichopus californicus (Stimpson)

The large brown sea cucumber is a common object in the tide-pools. Some grow to eight and ten inches in length and even more. We examined large numbers of them for commensals but did not happen to encounter any.

ASTEROIDEA

Linckia columbiae Gray

The smooth red starfish is common in the tide-pools. Its capacity for arm motion is very limited compared to other starfishes here, and through frequent mutilations it is rarely normally armed. Prof. Fisher says of it: "This curious little starfish is a member of the Panamic fauna, the type having been taken on the west coast of Colombia. It has been recorded previously from California at La Jolla, San Clemente Island, Santa Catalina Island and San Pedro. Miss S. P. Monks carried on some interesting studies on the variability and autonomy of this species. It is able to sever its arms, and not only to regenerate new arms, but also to regenerate new disks on the severed rays. The number of rays varies from one to nine, but there are usually five. There may also be more than one madreporic body, and as many as four anal apertures. Very rarely there are two mouths."

Coscinasterias sertulifera (Xantus)

The "soft starfish" is very common in the tide-pools. It is one of the most unpleasant starfishes to handle, due to its extraordinary sliminess. Its soft body gives a very wide range of possibilities in movement. Of this species Prof. Fisher remarks: "This is the species (under the name *Asterias ferreri*) upon which Prof. H. S. Jennings carried on a number of experiments at La Jolla. It is a member of the southern fauna, the type locality being Cape San Lucas. The true *Coscinasterias ferreri* belongs to the northern fauna and is not found along shore."

Pisaster capitatus (Stimpson)

Not common in the tidal pools, but evidently much more numerous just at and below low tide mark. Prof. Fisher says of it: "This species grows to a large size and is characterized by the heavy, well spaced tubercles of the back. It was formerly included in the genus Asterias."

OPHIUROIDEA

Ophioderma panamensis Lutken

Apparently the largest serpent star at Laguna, and abundant in the lower tide-pools. Its smoothish body and commonly bright and varied shades of brown and yellow make it a very conspicuous species. Prof. Fisher remarks of it: "This is a common littoral serpent star from Panama to Catalina. It has a finely granulated disk and four genital openings on each interbrachial space."

Ophioplocus esmarki Lyman

As this species occurred to us at Laguna, it was smaller than the foregoing, and usually unicolored, instead of variegated. Prof. Fisher records this as occurring from San Diego to Monterey.

Ophionereis annulata LeConte

With a heavy vestiture and comparatively small, this serpent star occurs in great numbers under stones in tide-pools, sometimes dozens under a single stone. Prof. Fisher says: "This is a common form from Central America to Southern California. It has long, cross banded arms, short arm spines, and a disk covered with fine overlapping scales."

Ophiothrix spiculata LeConte

We found this species only in kelp holdfasts from three to six fathoms, and common in large sponge masses. It is common in these places and is doubtless common also under other conditions. Prof.

Fisher says of it: "This is one of the most beautiful of echinoderms, being characterized by many long thorny spines which are delicate and glassy. It ranges from Monterey Bay to Central America."

ECHINOIDEA

Strongylocentrotus franciscanus Agassiz

This is the large, commonly blackish purple, long spined sea urchin, usually found singly in the lower tide-pools. As Prof. Fisher remarks, it is commonly bright purple or even reddish purple. It is far less common than the following.

Strongylocentrotus purpuratus (Stimpson)

The bluish-purple gregarious sea urchin occurs in large colonies in some of the lower tide-pools. One such pool at Mussel Point contains a remarkable display of these urchins. Many of them are seated in deep, cylindrical bores in the rock from which it is frequently impossible to extricate them. They apparently do not favor pools that are beyond the reach of low tide spray.

Dendraster excentricus (Eschscholtz)

"The common sand dollar of the curio store. It was formerly included in the genus Echinarachnius" (Fisher). The shells of this species are occasional on the beach at Laguna.

STUDIES IN PYCNOGONIDA, I

HARRY V. M. HALL

In all our collecting but twenty-two pycnogonids were taken, twenty of which belong to the same species and one of the others to a different species of the same genus. The commonest had a spread of legs of about three-fourths of an inch, while the other species was about three times as large. The latter were so nearly the color of the fucus on which they lived and so covered with debris that it is possible that they may be much more numerous than the number taken would indicate. In working out this report I am indebted to Dr. Leon J. Cole for many kind suggestions and much valuable assistance. I have described the species found as follows:

Anoplodactylus californicus n. sp.

(Figure 49)

Body rather short, lateral processes about as long as their own diameter, radiate, with bases contiguous. First two intersegmental lines barely visible. Proboscis cylindrical with rounded end, almost as long as the length of the body. Diameter of the proboscis one-half its length. Eyes not apparent, but a large conical eye tubercle (bent to the right in the cut as is also the abdomen) arises from the anterior edge of the body which projects over nearly the first half of the proboscis. The abdomen is much the same shape as the last joint of a man's middle finger and, like the eye tubercle is deeply and closely pitted. The rest of the body is pitted but less deeply. Chelifores large with well developed chelæ and stout shaft, the whole reaching about half their length in front of the proboscis. (In my specimen the chelæ are extended straight in front but there seems to be no reason why they might not be bent in front of the proboscis.) A few short spines on the chelæ; basal joints grown together and apparently supporting the eye tubercle. Palpi and ovigerous legs very rudimentary and wholly within the body (see plate for details). The legs are rather long but stout, sparsely set with short spines. First coxa shorter than its diameter, second coxa over twice the length of the first and enlarged at its distal end, third coxa one and one-half times the length of the first. Femur longer than the combined length of the coxæ. Tibial joints each about three-fourths the length of the femur. All joints of the legs stout. Tarsus about one-half the length of tibial joints; claw two-thirds the length of tarsus

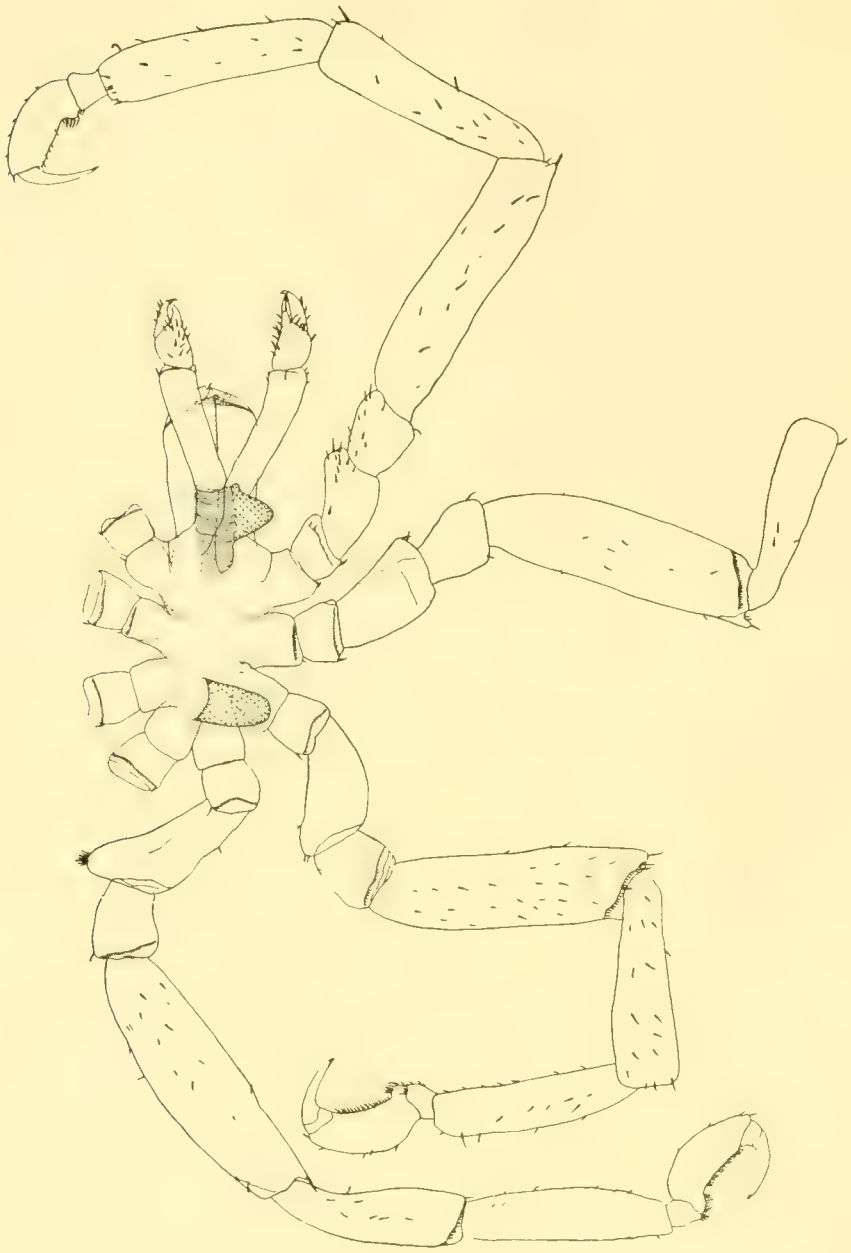


Figure 49. Anoplodactylus californicus

and folding down to rows of fine hairs. Auxiliary claws very small. Genital openings not apparent. Color straw. Measurements in mm. Proboscis 1.424; body (from anterior edge to insertion of abdomen) 1.5; leg (approximately) 8; diameter of lateral (leg-bearing) processes .428.

This specimen was swept from fucus at low tide and was put in a bottle with a small nudibranch mollusk which we caught about the same time. About half an hour later we discovered this pycnogonid greedily feeding on the nudibranch. This is of special interest as very little is known of the feeding habits of these interesting creatures.

This species bears a superficial resemblance to *Pallenopsis*, however it differs from that genus in the following respects, i. e.: The abdomen is neither long nor slender, there are no eyes apparent, and the ovigerous legs, instead of being ten-jointed and present in both sexes, are in my specimen reduced to the merest rudiments and are within the body wall so that externally they do not show. On the other hand it is not a typical *Anoplodactylus*, the body being more compact than is usual in that genus, though not nearly so compact as that of *A. anarthrus* (Loman).

Ammothella bi-unguiculata var. **californica** n. var.

(Figure 50)

Body distinctly segmented, leg-bearing processes moderately separated and moderately developed. Their length is about one-half their diameter. Intersegmental lines all distinct. Proboscis slim, spindle shaped; in length two and one-half times the diameter, and four-thirds the length of the body; ending in front with a rounded obtuse angle as seen from above. Four eyes in pairs on a very low eye tubercle; well pigmented. Abdomen small, cylindrical, less than one-fourth the length of the body, with bluntly rounded tip. Anus in notch at the tip. Chelifores short, one-sixth the length of the proboscis, three-jointed; chelæ undeveloped; first joint very short, shaft not quite as long as terminal joint which is nearly spherical. Diameter of chelifores slightly less than that of the palpi. Palpi nine-jointed; as long as the proboscis. First joint short and thicker than the others. Second joint four times as long as the third; fourth joint almost as long as the second; fifth and sixth joints about the same length as the third. Terminal joints decrease in order. Very few hairs on the palpus except on the terminal joint. Ovigerous legs slightly longer and with slightly greater diameter than the palpi. The ten joints named in the order of their lengths (except the first which is short and much thicker than the rest) are, 4, 2, 5, 6, 3, 7, 8, 9, 10. The terminal joints are spirally rolled and on the tip of the

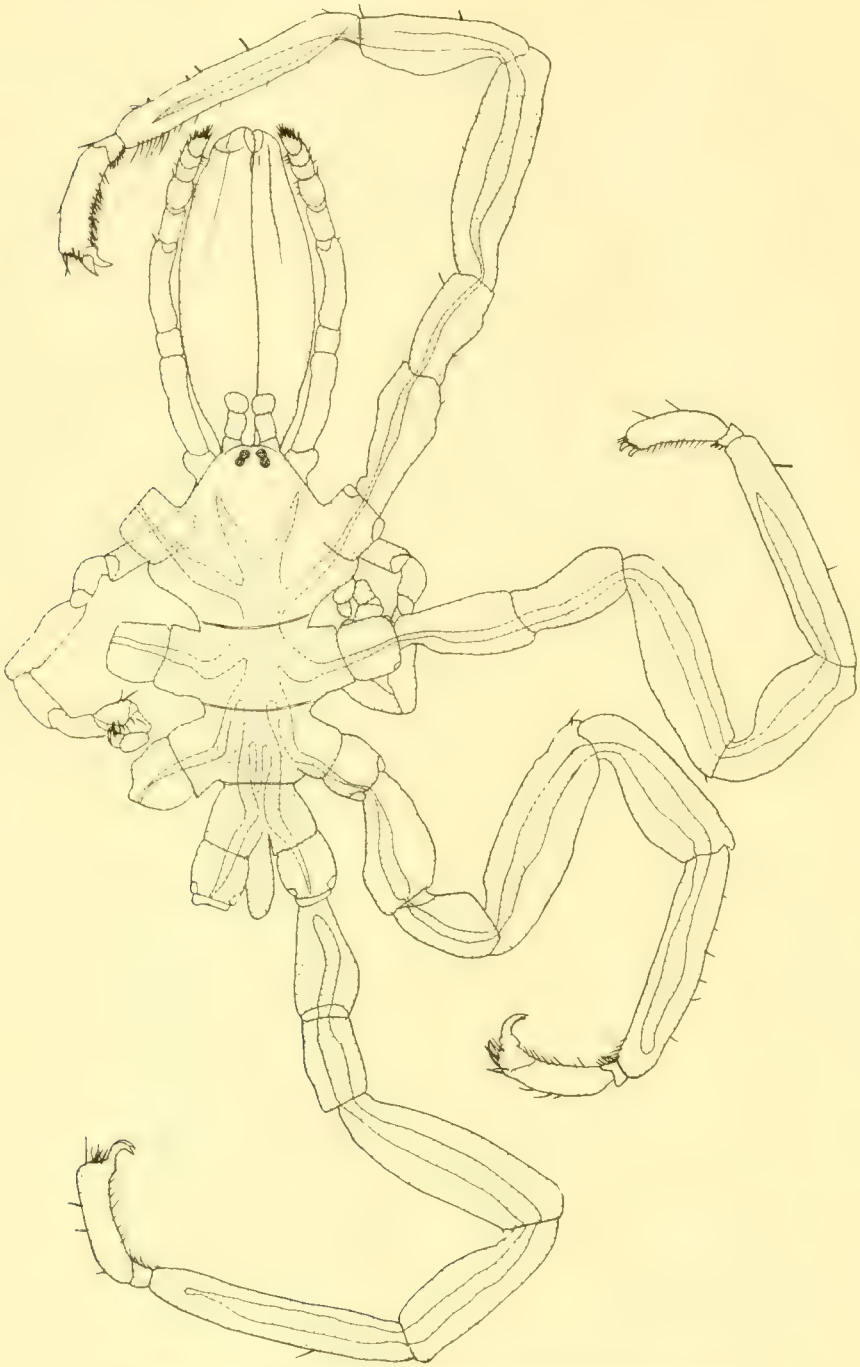


Figure 50. Ammothella bi-unguiculata var. californica

last are three stiffly plumose hairs. A similar hair is placed on each side of the eighth joint. Legs rather long but stout, no tibial processes, very few hairs except in double row on tarsus. First coxa as long as its own diameter; second twice as long; third coxa one and one-half times the length of the first. Femur about as long as the combined length of the second and third coxæ. Second tibial joint about the same length as femur; first tibial joint slightly shorter. Tarsus is less than one-half as long as second tibial joint. Tarsus has a double row of fine hairs down the "sole" and a few slightly longer hairs on the end. Terminal claw is lacking, while the auxiliary claws are unusually developed. Color light brown; the food was slightly darker making it easy to trace the branches of the stomach into the legs as shown in cut. Measurements in mm. Body 1.3; proboscis 1.05; abdomen .36; leg 4.2; diameter of leg-bearing processes .214.

About twenty specimens of this species were found under stones at low tide, well down toward low water mark. The males bore on their ovigerous legs bunches of dark colored eggs.

As pointed out to me by Dr. Cole, this species agrees closely with *A. bi-unguiculata* (Dohrn). As he says, "if we make the proper allowance for his specimen being an immature one" this specimen "agrees in detail with Dohrn's description." But to say that I had found in California the mature form of Dohrn's Naples species (described, as it was from an immature specimen), would be too much of a guess without comparing mature forms from both localities. This difference of location, the fact of Dohrn's specimen being immature, and the desire not to duplicate names, have led me to describe mine as a *variety* of *A. bi-unguiculata.*

Ammothella spinosissima n. sp.

(Figure 51)

Body with leg-bearing processes almost circular in outline. These processes are grown together for nearly their whole length, and at their distal ends are situated large tufts of spines. No intersegmental lines, but on the back, between the second pair of legs, is a longitudinal row of three large upright spine-covered, finger-like processes. (Bent to the side in the cut as are also the eye tubercle and the abdomen). Proboscis shorter than the apparent length of the body, but if compared with the length of the body from the anterior margin to the base of the abdomen the reverse is true. This is owing to the abdomen being inserted between the last pair of leg-bearing processes which are the only two that are separated. The proboscis is bluntly rounded in front with a notch at the tip; its diameter is about half its length. Four eyes, not conspicuously pig-

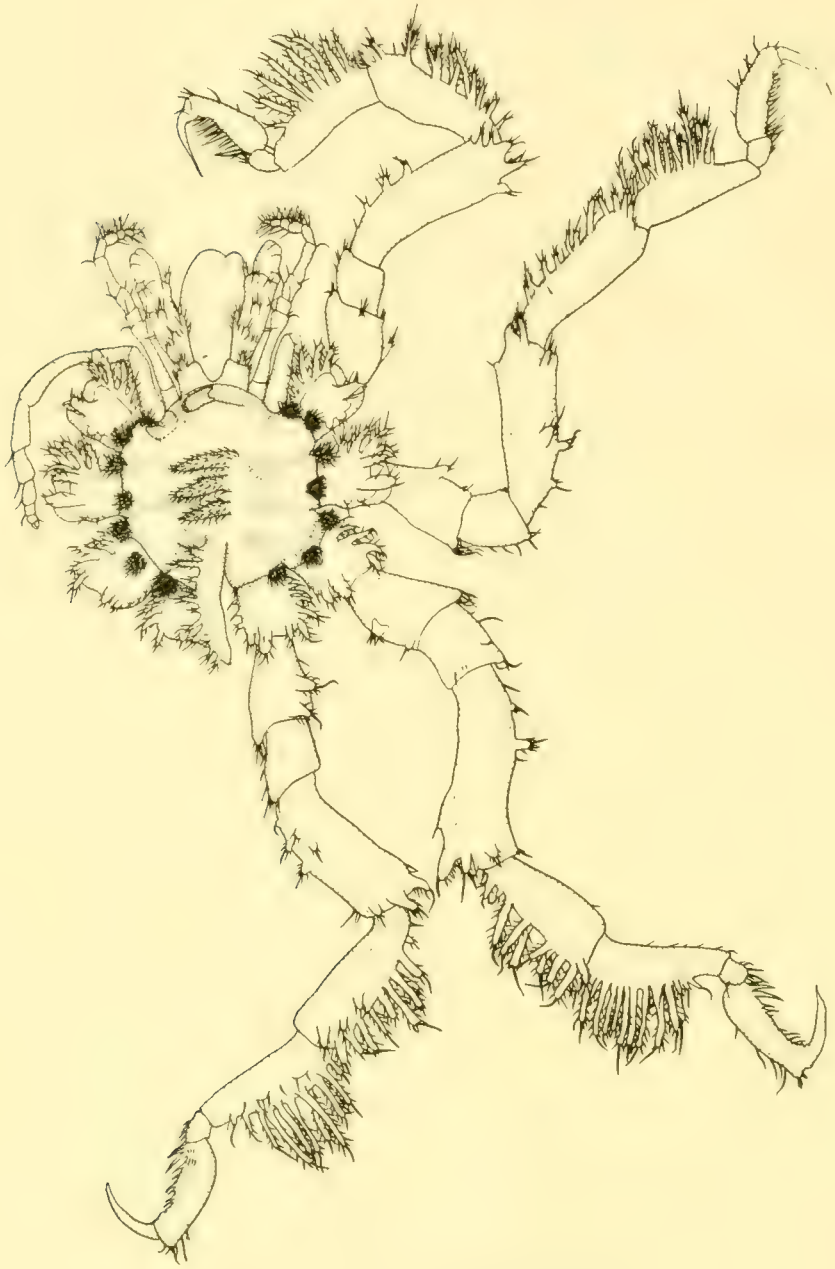


Figure 51. Ammothella spinosissima

mented, situated at the top of a relatively small eye-tubercle, the length of which is about twice its diameter. The abdomen is about three-fourths the length of the body, (the latter measured from the anterior margin to the base of the abdomen). Along the top of the abdomen is a row of finger-like, multi-spine-bearing processes similar to those on the legs to which I will refer shortly, but much smaller than the three large ones previously mentioned as on the back. The diameter of the abdomen is about one-fifth its length. The chelifores are stout and slightly surpass the proboscis in length; they are rudimentary in having the chelæ undeveloped. The shaft is set with quite a few multi-spine bearing processes. The basal segment is about the same size as the terminal segment, but the shaft is one and one-half times as long as their combined lengths. The palpi are nine-jointed, surpassing the end of the proboscis by one-third their length. The first joint is shorter and broader than the rest; the second is the longest, being almost one-third the whole length of the palpus; third joint very short; fourth joint not quite as long as second. A ridge across the fourth joint makes it appear like two joints as viewed from above. The terminal joints diminish in order. The first six joints have very few hairs, while the terminal joints are thickly set with hairs about as long as the diameter of the fourth joint. The second joint is thickened at the ends but the other joints are not noticeably so thickened. The average diameter of the palpus is about one-half that of the chelifores. The ovigerous legs are nine-jointed; their diameter about half way between those of palpus and chelifores. The joints in order of length (except the first, which is short and broad), 4, 2, 5, 3, 6, 7, 8, 9. Legs are rather short and powerful with numerous, multi-spine-bearing, finger-like processes, especially on the coxa and two tibial joints. On the two tibial joints these processes are arranged in a double row down the back of the joint. The first and third coxal joint are sub-equal in length, the second one and one-half times as long. The femur is as long as the combined length of all three coxæ; the tibial joints two-thirds as long as the femur and but slightly longer than the tarsus. The claw is over three-quarters the length of tarsus, folding down between two rows of stout spines on tarsus. No auxiliary claws. Genital openings not apparent. Color light straw. Measurements in mm.: Proboscis 1.424; body 1.2; abdomen 1.1; leg 6.35; diameter of lateral processes .5.

This single specimen was swept from fucus in July and when taken, was so covered with litter which was imbedded among the spines, that no idea of the real aspect of the creature could be obtained until after boiling in KOH. This litter rendered it very hard to find among bits of fucus even when we knew it was there and its

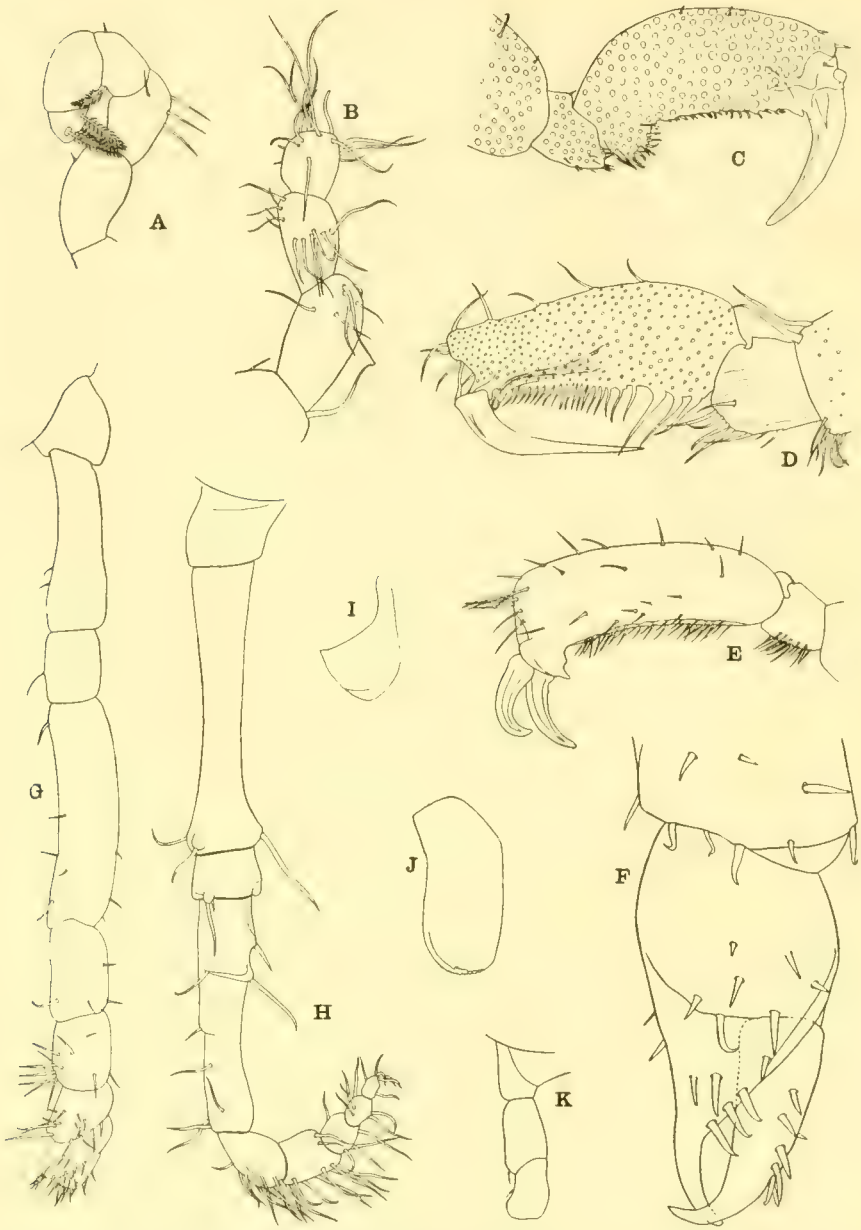


Figure 52. A, Ammothella bi-unguiculata californica, terminal joints of ovigerous leg. B, Ammothella spinosissima, terminal joints of ovigerous leg. C, Anoplodactylus californicus, tarsus. D, Ammothella spinosissima, tarsus. E, Ammothella bi-unguiculata californica, tarsus. F, Anoplodactylus californicus, chelifore-terminal joints. G, Ammothella bi-unguiculata californica, palpus. H, Ammothella spinosissima, palpus. I, Anoplodactuylus californicus, palpus. J, Anoplodactylus californicus, ovigerous leg. K, Ammothella bi-unguiculata, chelifore.

discovery in the towings was almost accidental. We spent much time looking for others but with no success. The spine-bearing processes with which this species is covered serve to distinguish it from all other species of the genus.

In placing these last two species in Ammothella, I have followed Cole, who raised the sub-genus Ammothella (Ammothea—part), of Verrill, to generic rank because of the trunk being "usually proportionately broader and distinctly segmented, the chelifori three-jointed, and the palpi nine-jointed." I hope that this brief explanation will show why they are not Ammothea proper, and avoid confusion. The multi-spine bearing processes on *A. spinosissima* may remind one of those on a Nymphopsis figured by Loman, Plate XIII of Siboga-Expeditie XL, but the arrangement of these processes, as well as generic characters, show that there can be no possible connection.

NOTES ON THE CRUSTACEA OF LAGUNA BEACH

C. F. BAKER

From the character of the coast at Laguna one would expect a rich representation of the crabs, shrimps, prawns, and their allies, and the richness of the crustacean fauna is most forcibly impressed upon one by a little collecting. We took a great number of specimens and species of crustaceans during this first summer, of which but a very small proportion have as yet been worked up, especially among the Entomostraca. A few of these latter I have examined in some detail in cases where they happened to be conspicuous or to occur in great numbers of individuals. Miss Stout has done a considerable amount of work on the Amphipoda of this locality, and Miss Stafford on the Isopoda. They both accumulated a great wealth of material, indicating a littoral fauna of great richness in these groups.

The crabs, but few of which I have determined, are extraordinarily abundant. The tide-pools swarm with them, a stone turned over frequently revealing a half dozen species at one time. One small crab, apparently quite rare, was of peculiar interest because it seemed to be always covered with a dense forest of small simple sponges, perhaps indicating a symbiotic relationship.

A number of species of parasitic copepods (three from one shark) and isopods were taken, but these are as yet undetermined.

MALACOSTRACA

Order DECAPODA

Epialtus productus Randall

The young of the kelp crab are very common in the tide-pools clinging to fucus and other brown algæ, but mature specimens are only to be found in the kelp beds.

Loxorhynchus grandis Stimp.

Large carapace shells of this deeper water crab are commonly washed up on the beach.

Cycloxanthops novemdentatus Lock.

Frequent under stones between tides.

Lophopanopaeus leucomanus (Lock.)

(Figure 53)

Occasional under stones between tides. Examination of the appendages of the head of this species, in comparison with those of

Xanthias taylori reveals some interesting resemblances and differences. The mandibles and maxillipeds are strikingly similar. The antennules, however, are very unlike and present some salient characters. The outer flagellum in this species is three-jointed while in *X. taylori* it appears to be seven-jointed. The large tuft of bristles opposite the outer flagellum is as long as the inner in this species, while in *X. taylori* it is only half as long.

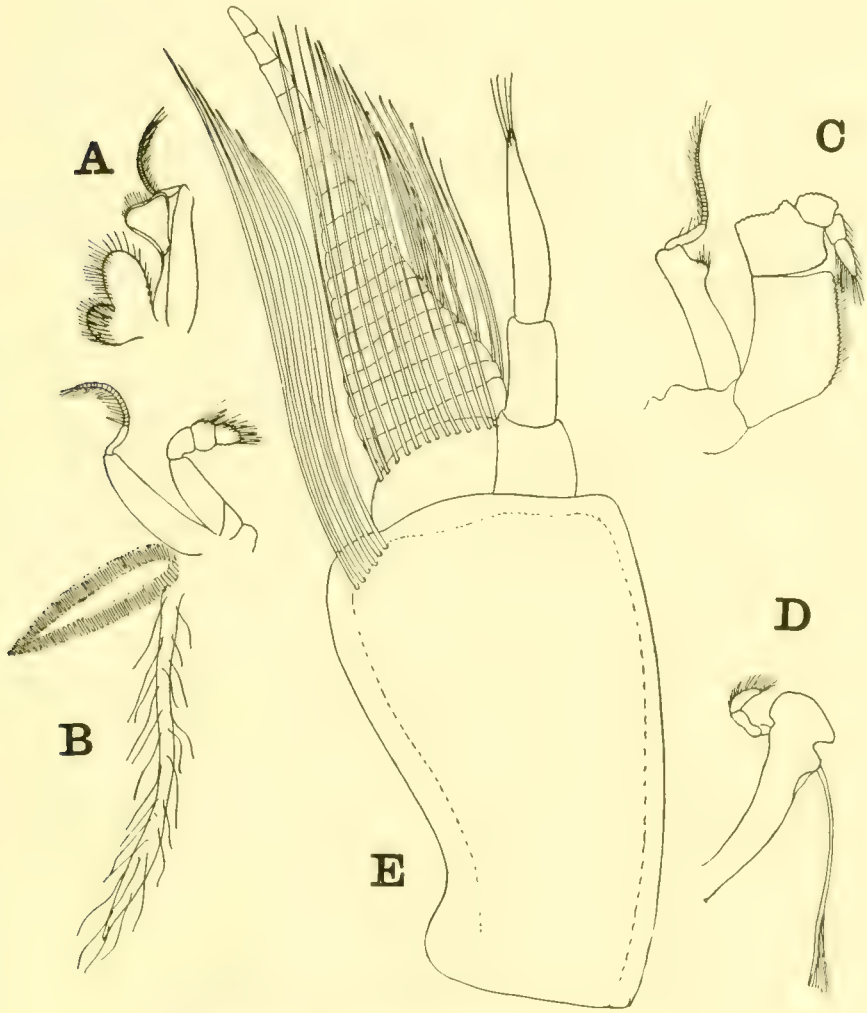


Figure 53. Lophopanopaeus leucomanus

A, First maxilliped. B, Second maxilliped. C, Third maxilliped. D, mandible. E, antennule.

Xanthias taylori Stimp.

(Figure 54)

Abundant under stones between tides and also in kelp holdfasts from deeper water.

Pachygrapsus crassipes Randall

This is the very abundant shore crab which is so common scuttling over the stones of the higher beach. It sometimes contains a large parasitic isopod in its branchial cavities.

Randallia ornata (Randall)

Occasional specimens from kelp holdfasts in deeper water.

Eremita analoga (Stimp.)

Exceedingly abundant, burrowing in sand between tides, and much used for bait.

Blepharipoda occidentalis Randall

This large species—one of the most remarkable crustaceans on the coast—is occasional on the sandy shores just below low tide. The boys locate them with their feet while in bathing and dive for them.

Lepidopa myops Stimp.

Occasional in the sand between tides, associated with *Eremita.*

Petrolisthes cinctipes (Randall)

The "flat crab" is common under stones between tides.

Pachycheles rudis Stimp.

Abundant under stones between tides. This little crab with swollen tuberculated chelipeds is also common in kelp holdfasts.

Callianassa longimana Stimp.

Burrowing in the sand underneath stones in the tide-pools. Not common. This loosely built, ghostly looking animal reminds one strongly of certain cave-dwelling animals.

Panulirus interruptus (Randall)

Very common in the deeper waters off shore. This seems to be headquarters for this splendid lobster. We frequently saw large specimens just below low tide, and encountered young specimens frequently in the tide-pools.

Crangon vulgaris L.

Some specimens which cannot be distinguished from the current descriptions of this species, were taken in a bed of *Phyllospadix* just below low tide.

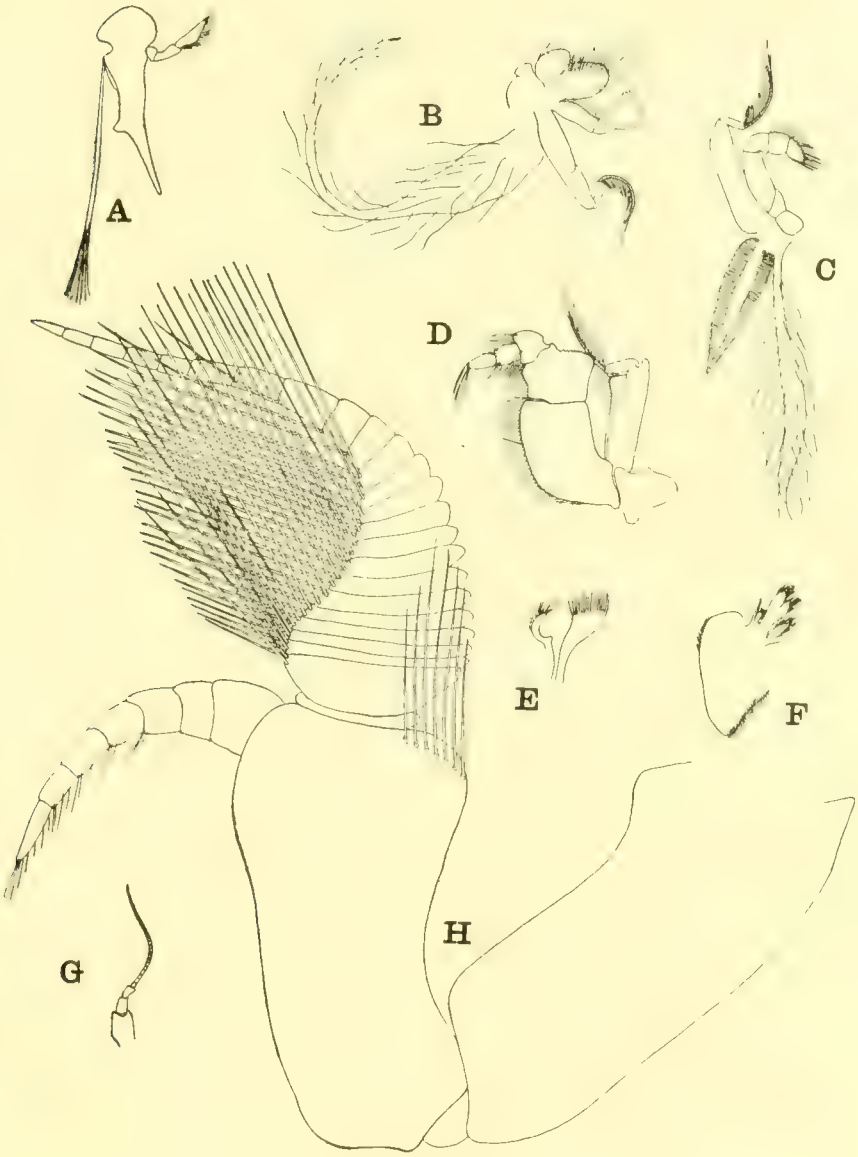


Figure 54. Xanthias taylori

A, mandible. B, First maxilliped. C, Second maxilliped. D, Third maxilliped. E, First maxilla. F, Second maxilla. G, Antennia. H, Antennule.

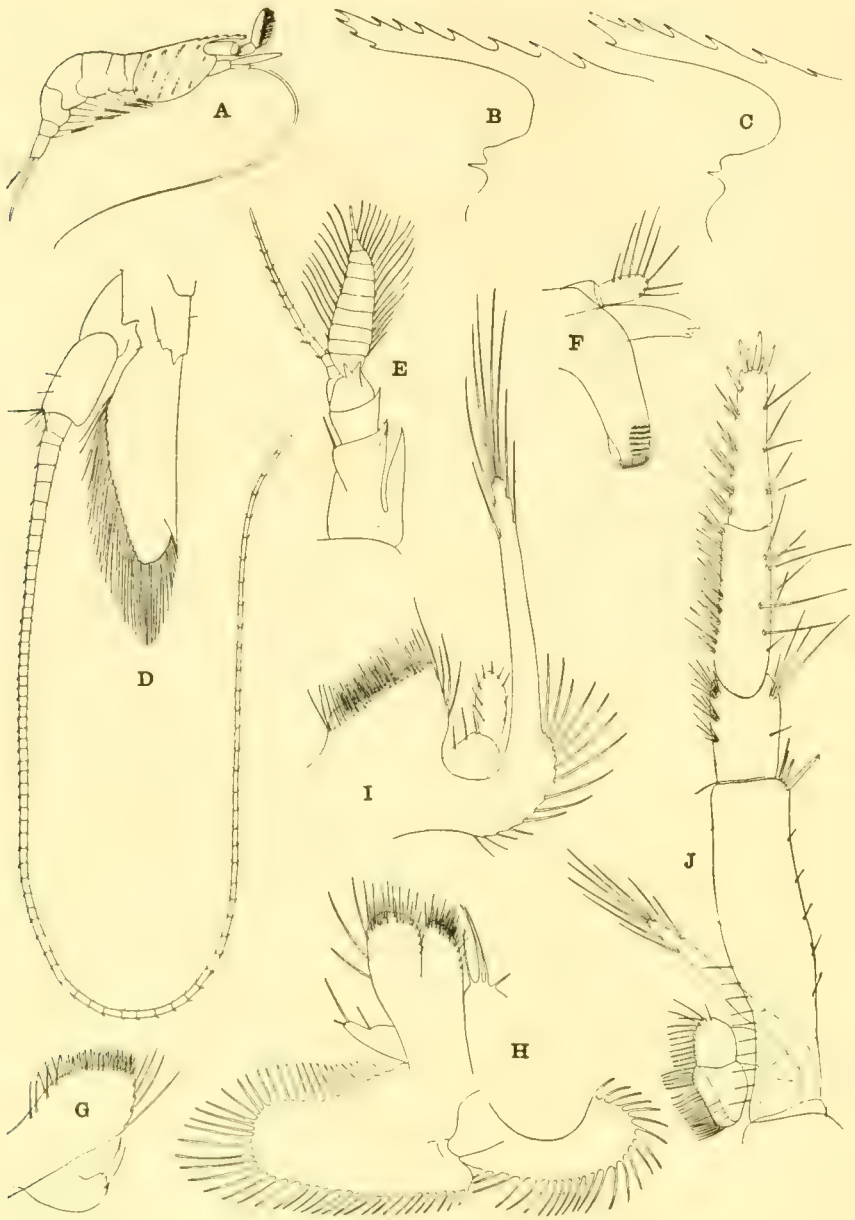


Figure 55. Heptacarpus pictus

A, Habit sketch, showing common attitude of body and antennules. B, C, Variation in toothing of rostrum. D, Antenna. E, Antennule. F, Mandible. G, First maxilla. H, Second maxilla. I, Third maxilla. J, Maxilliped.

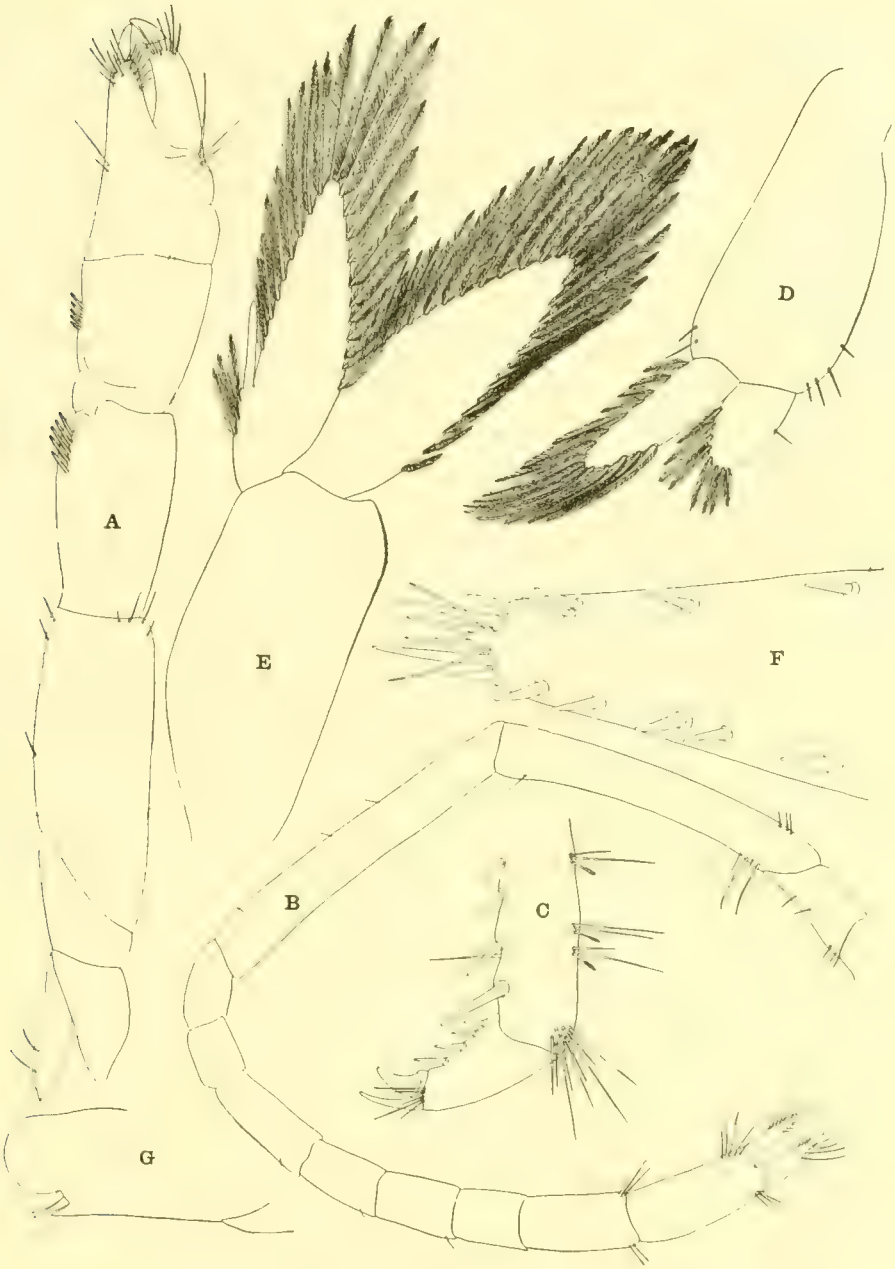


Figure 56. Heptacarpus pictus

A, First peraeopods. B, Second peraeopods. C, Third peraeopods. D, First pleopods. E, Second pleopods. F, Apical two-thirds of telson. G, Exopodite of uropod, showing teeth.

Crangon nigromaculatus Sm.

Under stones in sandy bottomed tide-pools. The color is translucent white, peppered with black dots, a larger dot on either side of the fifth and sixth pleon segments. When this species is exposed by the turning over of a stone, it settles immediately into the surface of the sand, and is then almost indistinguishable.

Hippolysmata californica St.

This extraordinarily brilliant Hippolytid with its red stripes is certainly one of the finest things to be found in the tide-pools. We frequently pointed to it as one of the most beautiful marine animals to be found at Laguna.

Alphaeus clamator Lock.

Common in sponge masses and kelp holdfasts.

Betaeus longidactylus Lock.

A very beautiful olive green species, abundant in tide-pools.

Heptacarpus pictus (Stimp.)

(Figures 55 and 56)

This small and very beautiful Hippolytid is abundant in the tide-pools and also outside in the kelp beds. Its greenish semi-transparency, with oblique reddish marks on the pereion, make it wholly inconspicuous—almost invisible—in alga-filled tide-pools. The tow-net, however, quickly reveals it as a very abundant species.

Order TANAIDACEA

A number of species of these minute tube-dwellers were encountered among the algæ lining tide-pools, and also in kelp holdfasts. They will be worked up later.

Order CUMACEA

Pseudocuma lagunae n. sp.

(Figure 57)

We were greatly interested to encounter in one of the lower tide-pools a minute *Pseudocuma*. It appears to represent an undescribed form.

Female. Length 1.5 mm. Carapace a little less than one-fifth the total length and nearly as deep as long. Pseudorostrum short, truncate, and not at all elevated. Back of the large eyes is a deep vertical plica standing nearly at right angles to the dorsum and reaching lower border of carapace, giving a remarkable appearance of a separated head. Sides of carapace with three curved ridges. Entire cephalothoracic region about as long as remainder of body. Telson equalling basal joint of uropods, and narrowing at the tip to a subacute point. Appendages as illustrated in the figure.

Order MYSIDACEA

Mysis costata Holmes

This species occurs in inconceivable myriads in the kelp beds just off shore, where Mr. Guernsey took it with the tow net.

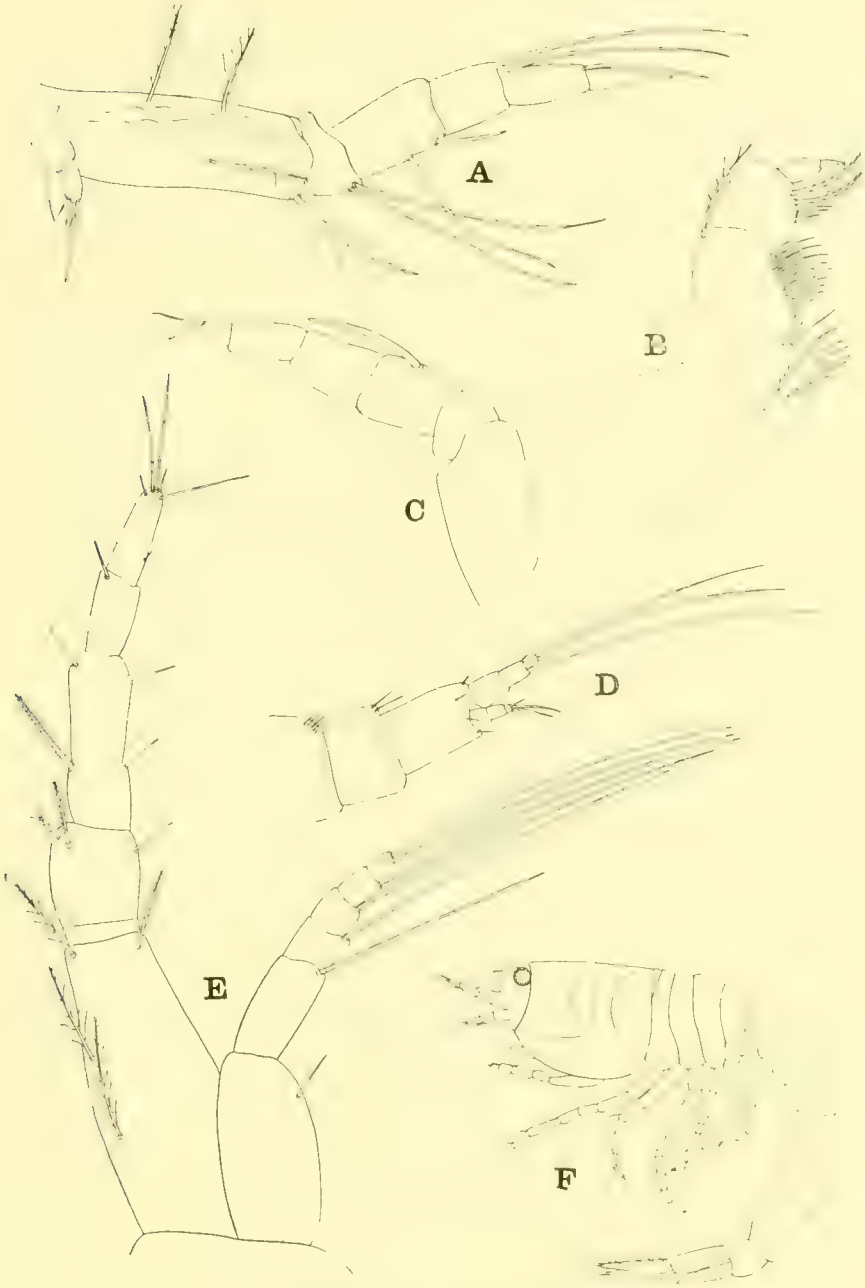


Figure 57. Pseudocuma lagunae
A, Third leg, with rudimentary exopodite. B, Third maxilliped. C, Fifth leg. D, Superior antenna. E, First leg. F, Habit sketch of female.

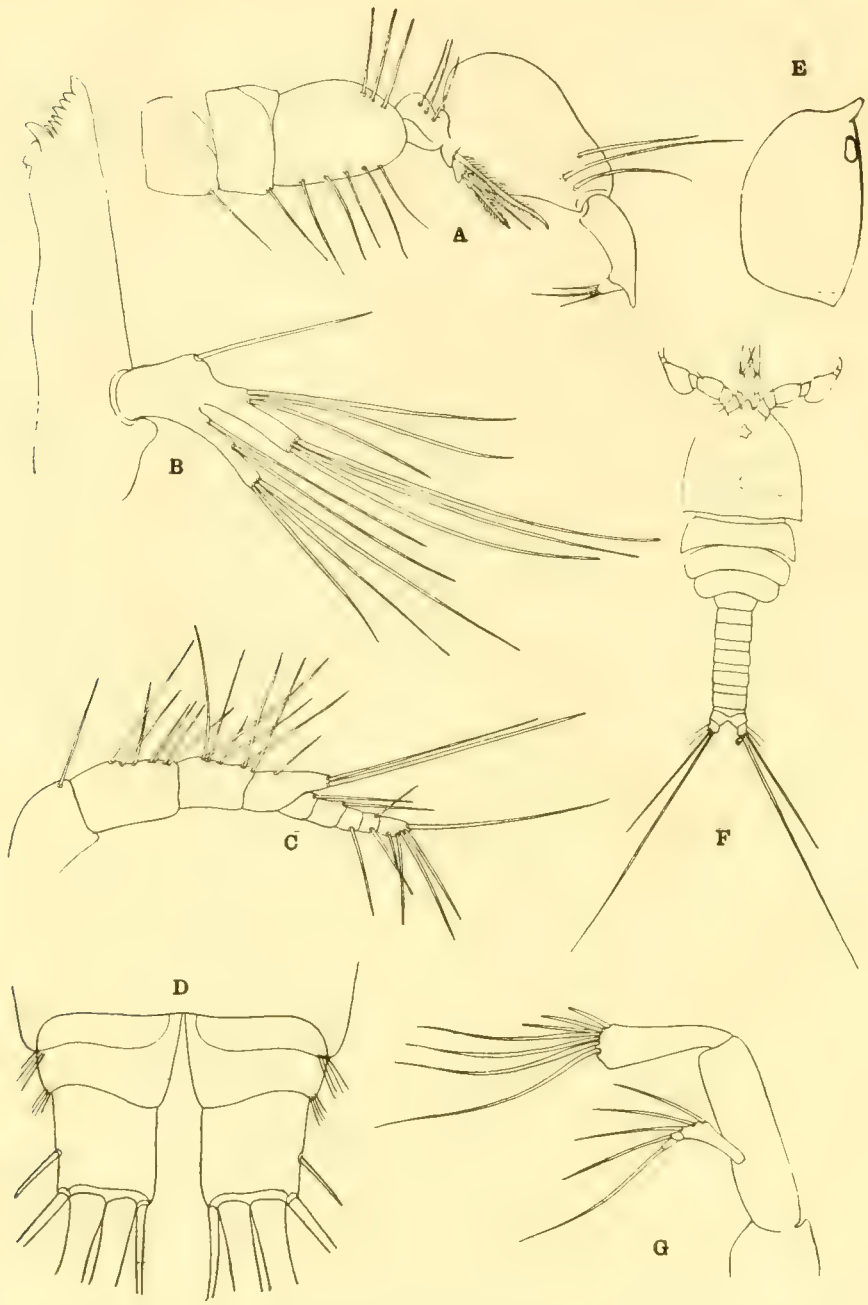


Figure 58. Tisbe californica

A, Antenna of male. B, Mandible, sutures in palp not distinct. C, antenna of female. D, Base of furca. E, Side view of carapace. F, Adult male. G, Antennule.

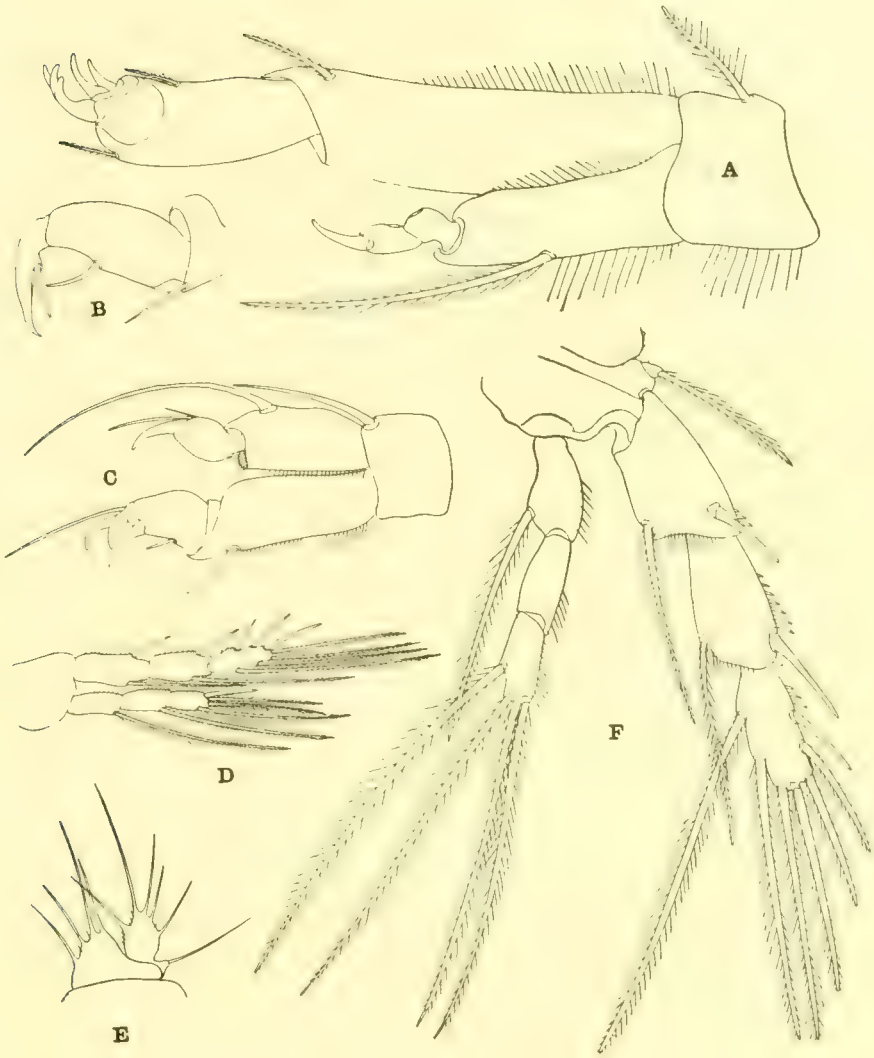


Figure 59. Tisbe californica

A, First leg of male. C, First leg of female. D, Penultimate leg. E, Last leg of female. F, Antepenultimate leg.

Subclass CIRRIPEDIA

Numbers of species of barnacles occur at Laguna and the beginnings of a study of them was made which will be continued later.

Subclass COPEPODA

Tisbe californica n. sp.

(Figures 58 and 59)

During a few weeks in July, some of the high tide-pools remained for days without change of water, and each day became very warm at noontime. Enormous numbers of an apparently red Copepod appeared in these pools. This species appears to me to be a *Tisbe* close to *Tisbe furcata* but differing as follows: The terminal flagellum of the female antenna appears to be five-jointed, the produced angle of the last joint of the basal portion being extended beyond the first joint of flagellum. The setæ of the mandibular palpi are numerous and longer than the palpi. The longest caudal setæ are much longer than abdomen. Other details are shown in the figures.

Diaptomus stagnalis Forbes

(Figure 60)

Harry Hall used the tow-net industriously in the two small ponds in the canyon above Laguna, with rich results. Among other things he took specimens of a colossal *Diaptomus,* which fit the descriptions of *stagnalis* very closely and which correspond with remarkable closeness to the figures of Herrick's *Diaptomus giganteus,* which is considered synonymous with *stagnalis.* The color in eastern specimens appears to be variable. Here it has a semi-transparent body, pale bluish ventrally as are also the feet, and with the antennæ pale yellowish to colorless. DeGuerne and Richard complain that this species was never properly illustrated, so I have tried to prepare a plate for it.

Subclass OSTRACODA

Cyprinotus californicus n. sp.

(Figure 61)

This minute species (length .5 to .8 mm.) was taken by Mr. Hall in considerable numbers in the freshwater ponds with *Diaptomus stagnalis.* Color pale translucent greenish. The shell is thickly covered, especially distally in all directions from the hinge, with minute papillæ bearing fine hairs, which are longer towards the margins. Right valve armed anteriorly with small dark marginal teeth. The four weakly plumose natatory setæ of the second antennæ exceed the longest terminal claws by one-half the length of the

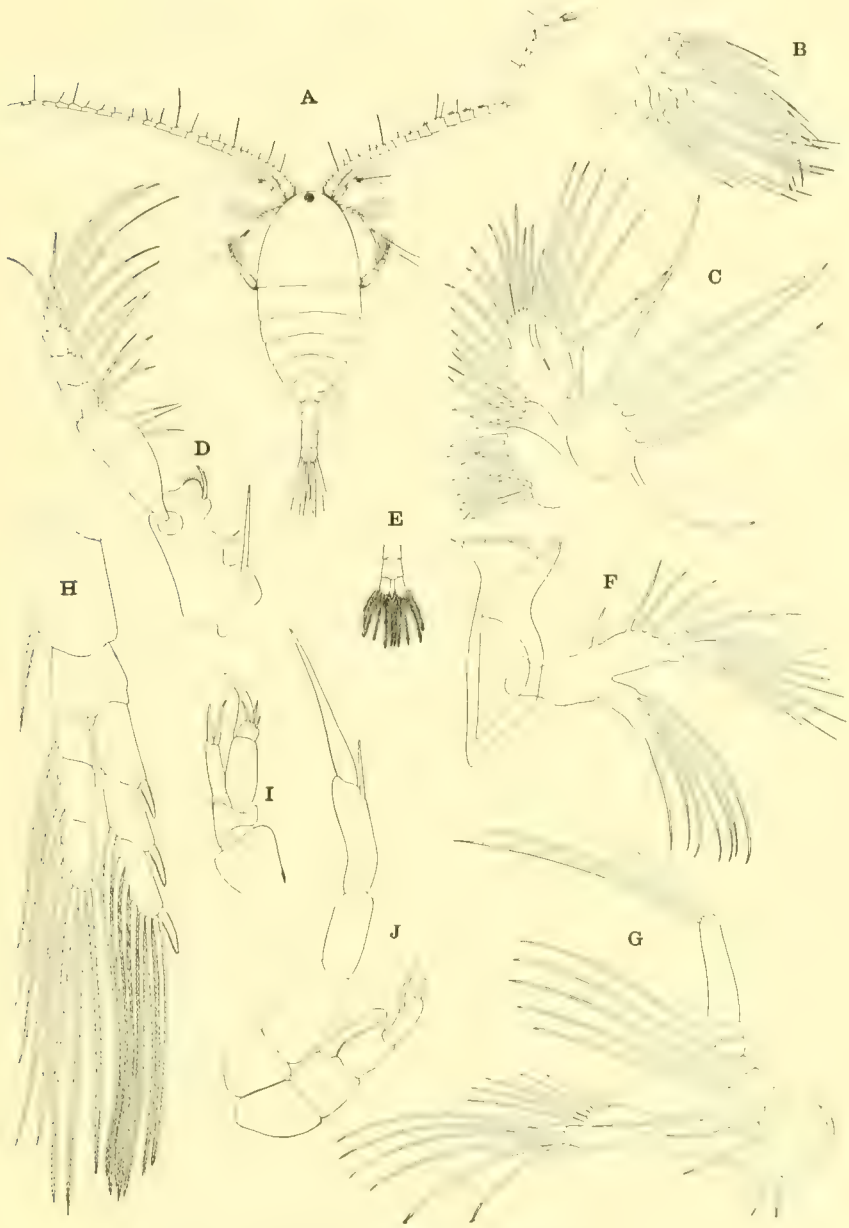


Figure 60. Diaptomus stagnalis

A, Habit sketch. B, First maxilla. C, Second maxilla. D, Maxilliped. E, End of abdomen. F, Mandible. G, Antennule. H, Antepenultimate leg of male. I, Last leg of female. J, Last leg of male.

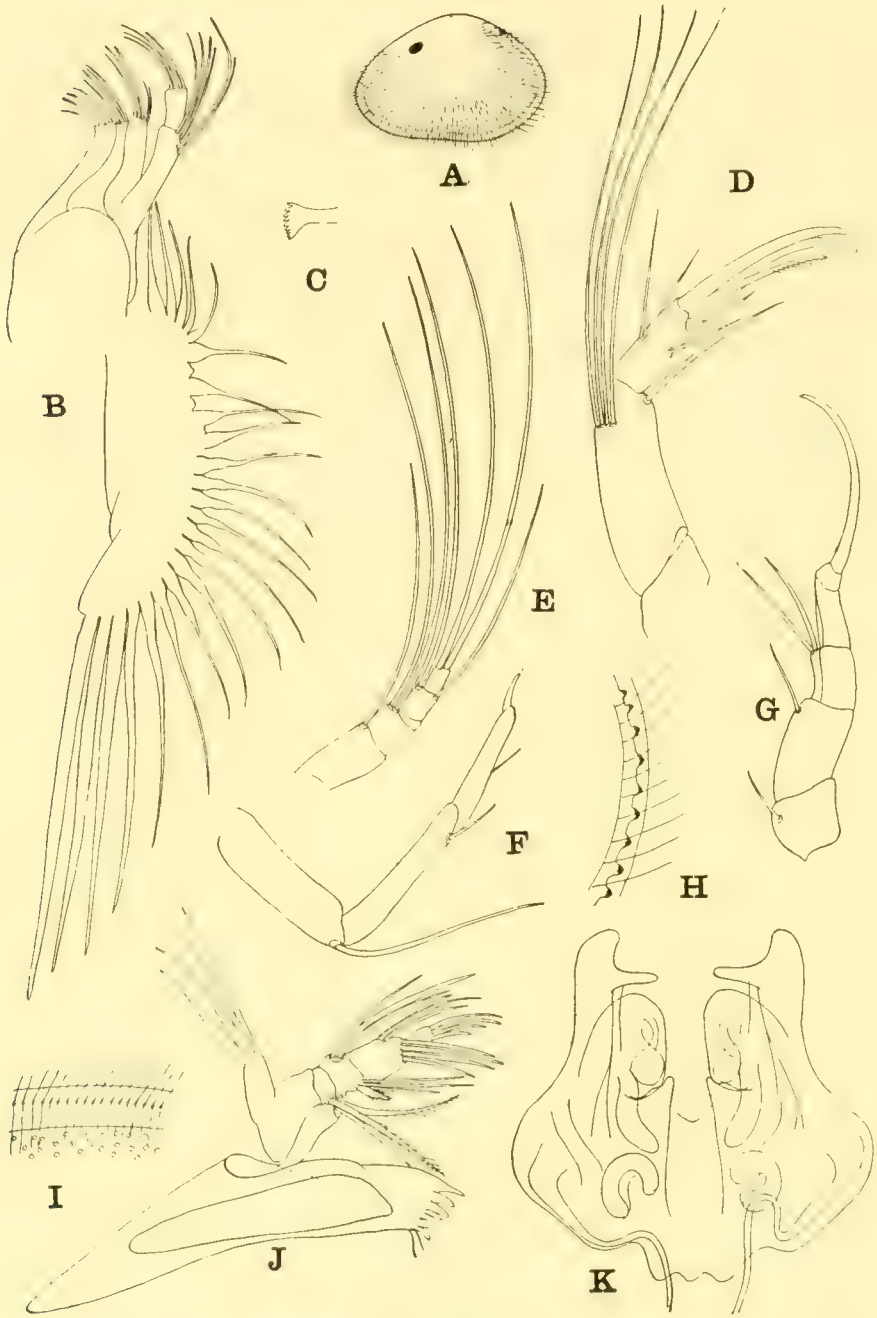


Figure 61. Cyprinotus californicus

A, Habit sketch. B, Maxilla. C, Upper lip. D, Second antenna. E, First antenna. F, Second leg. G, First leg. H, Anterior border of right valve. I, Shell structure on outer margin. J, Mandible. K, Anal armature.

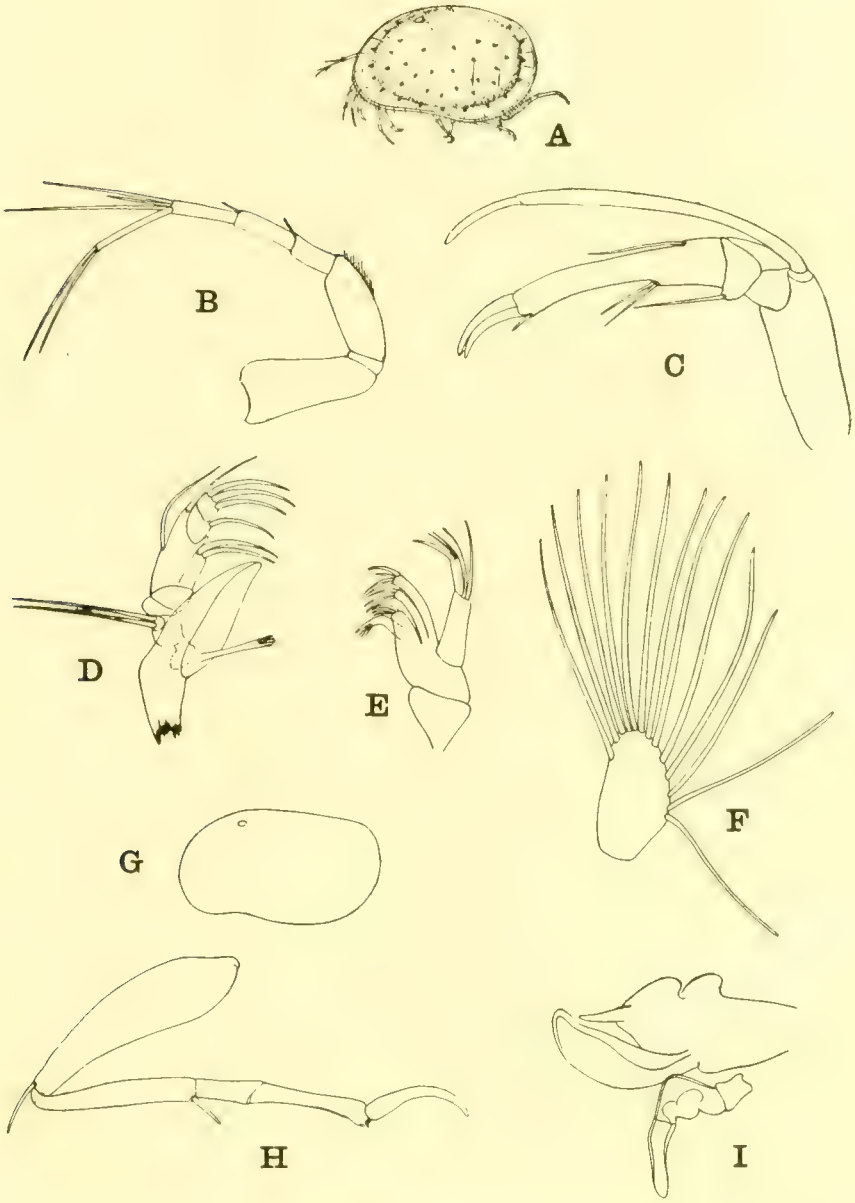


Figure 62. Xestoleberis transversalis

A, Adult, habit sketch. B, First antenna. C, Second antenna. D, Mandible with palpus turned backward. E, Maxilla. F, Branchial plate of maxilla. G, Sexual variation in shell outline. H, Second leg. I, Anal armature.

claws (which are not of equal length). The second legs with a cylindrical third joint armed with a short claw, and a small, weak, scarcely longer, recurved seta, which is not shown in the drawing. First legs with the long curved claw nearly as long as the three preceding joints. Branchial plate of mandibular palp with four stout setæ, the branchial plate of first maxillæ with about twenty-three. Other characters may be gathered from the figures. Nearest in general appearance, perhaps, to *Cypris pellucida.*

Xestoleberis transversalis n. sp.

(Figure 62)

A small (.5 to .65 mm.), very pale greenish or brownish, white banded podocopous ostracod is very abundant in tide-pools at Laguna Beach. The characters of anal armature, mandibular palp, second antennæ, and shell structure seem to distinguish it from anything previously described. The shell is very slightly hairy except along distal margin. The disc of the shell is armed with numbers of distinct tubercles, and with a transverse white band at or slightly posterior to middle. First antennæ six-jointed, the penultimate and antepenultimate joints of equal length, longer than third but shorter than the much slenderer last joint; last joint with two spines, penultimate with a tuft of spines at apical angle. Second antennæ with fourth joint not distinctly separated, the outer branch with terminal claw as long as claw of inner branch. The tuft of spines on outer margin of third joint of inner branch nearer base than apex. Mandibles at masticatory margin narrower than at insertion of palpus; palpus with respiratory plate distinctly separated to the base and with two slightly plumose spines, the terminal portion of palpus distinctly two-jointed; two large spines at base of palpus. Second leg with basal joint longer than second, the fourth nearly twice the length of third.

Both this species and the next are placed in *Xestoleberis,* though a new genus might easily be erected for each of them as Esterly has done for *Paracytheroma pedrensis.* These appear, however, to present only specific differences.

Xestoleberis flavescens n. sp.

(Figure 63)

Another podocopous ostracod occurs with *X. transversalis,* but is a slightly larger, and rarer, species. In shell structure, anal armature, and other details it is entirely distinct. The shell is entirely covered with small rounded bosses of peculiar structure, and it is cream colored and translucent throughout. The legs are distinctly yellowish. First antennæ four-jointed, penultimate joint far shorter

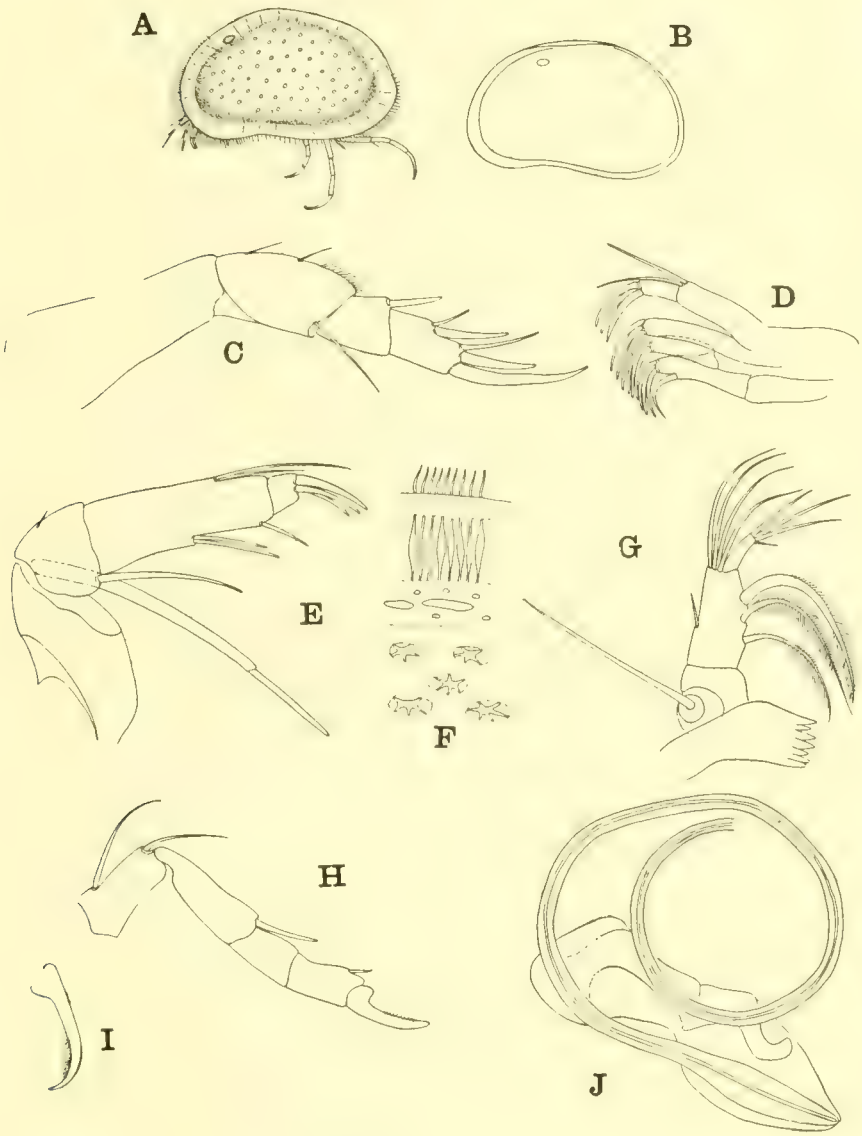


Figure 63. Xestoleberis flavescens

A, Adult, habit sketch. B, Sexual variation in outline. C, First antenna. D, Maxilla. E, Second antenna. F, Margin of shell, edge above. G, Mandibbe H, Second leg. I, Dactyle of last leg. J, Anal armature.

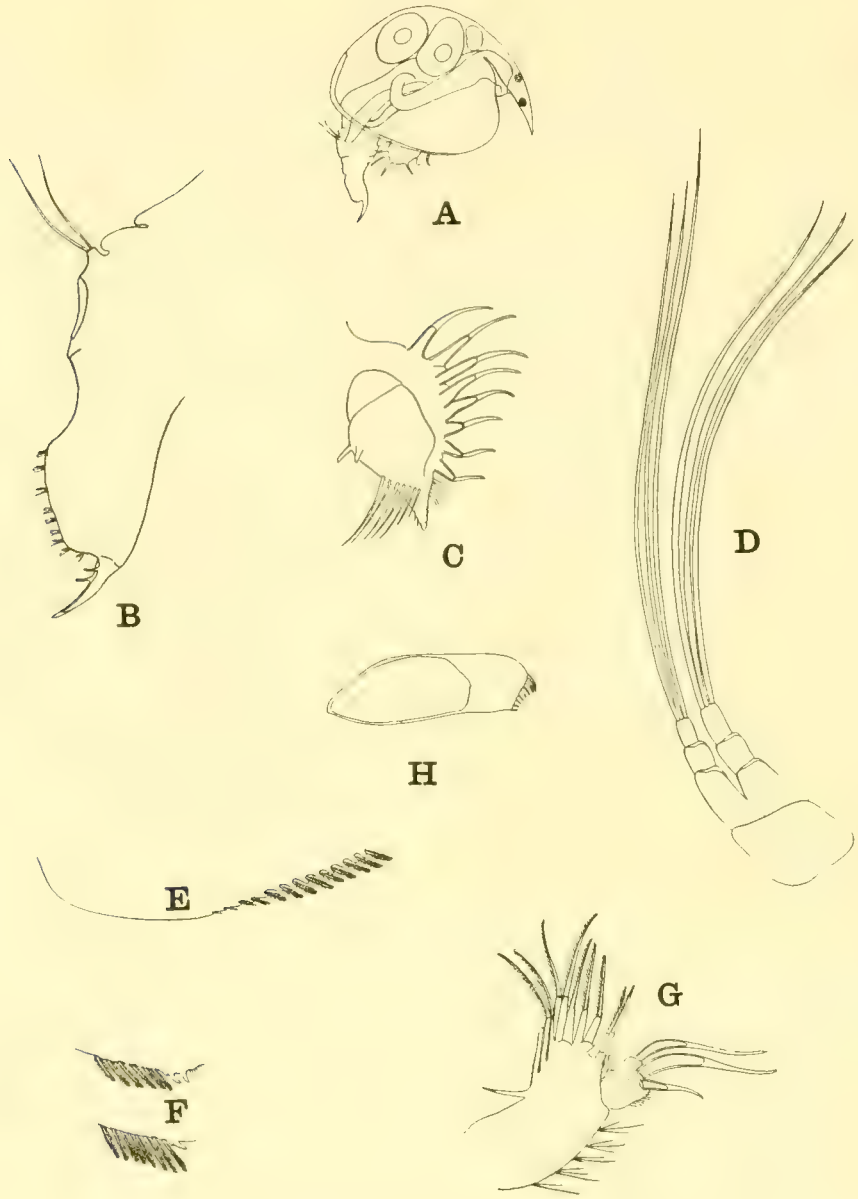


Figure 64. Chydorus simplex

A, Adult, habit sketch. B, Postabdomen. C, Second foot. D, Antennule. F, Plumed hairs on posterior distal margin of shell, showing where plumed hairs pass into teeth of anterior angle. G, First foot. H, Mandible.

than antepenultimate and slightly shorter than last; last two joints very heavy and armed with stout spines. Second antennæ with fourth joint distinctly separated, the outer branch with terminal claw longer than claw of inner branch. The tuft of spines on outer margin of third joint of inner branch, nearer to apex than base. Mandibles at masticatory margin broader than at insertion of palpus; palpus with respiratory plate not distinctly separated, but its three spines are large, recurved and heavily plumose; the terminal portion of palpus distinctly one-jointed; one large spine at base of palpus. Second leg with basal joint shorter than second, the fourth but little longer than third.

Subclass CLADOCERA

Chydorus simplex n. sp.

(Figure 64)

With *Diaptomus stagnalis* and *Cyprinotus californicus,* Mr. Hall took numbers of an exceedingly minute (length .4-.5 mm.) *Chydorus.* The anterior projection of the shell is long, very slender, and very sharp, and is frequently more closely incurved to the anterior margin of the shell than in the specimen drawn. The shell has a depth about three times the hind margin. The distal (lower) margin is edged with minute short plumed hairs to a point in front of the legs where the curve to the anterior angle begins, and from that point to the anterior angle they are replaced by small teeth. The postabdomen is long subrectangular, the terminal claws shorter than its greatest width and these claws provided with a rather strong lateral tooth behind. Lower hind border of postabdomen with a number of small tufts of short hairs which are longer distally. Two long spines occur above the anal opening. Posterior intestinal cœcum long and slender.

STUDIES IN LAGUNA ISOPODA

BLANCHE E. STAFFORD

In these and other studies, *Asellus communis* has been used more or less constantly as a basis of comparison, so that some drawings (Figures 65 and 66) of this species are presented in this paper. All of the other species were collected at Laguna Beach, California.

The most robust and active Isopoda were found in the sand high up on the beach where they were driven out by the incoming water at high tide, and among the rocks at the high water mark. Of the former, the sand Isopod, *Alloniscus perconvexus,* was a common type, and *Ligyda occidentalis* was the characteristic representative in the latter surroundings. Under dead seaweed on the border of a salt marsh two forms were collected in fair abundance, one of which, *Philoscia richardsonae*, has been described in this report. At the lower level, under the rocks which the low tide uncovered, various forms of the family Idotheidæ were found; of these *Idothea rectilinea* was most numerous. Under these same rocks the species *Cirolana harfordi* was exceedingly plentiful. Hardly a rock was turned over that did not abound in this form.

Occasional specimens were brought in from holdfasts which had drifted to shore from the kelp beds. These were generally very minute forms. From the sponges many curious tube-dwelling Isopods were collected. Rarely a parasitic form was discovered. The tide-pools furnished interesting members of the family Janiridæ. Of most of the latter and of the rarer species drawings and descriptions are not yet ready for publication.

Asellus communis Say.

Locality—Fresh waters of Massachusetts.

Body oblong and depressed, about three and a half times as long as wide, 17 mm. by 5 mm.

Head measures 1.25 mm. in length and about 1 mm. in width at upper margin and 2 mm. at posterior margin. Eyes small, composite, and placed at the middle of lateral margins. First pair of antennæ have basal article of peduncle broader than those distal to it. Second and third are narrow, third shorter than second; flagellum composed of fifteen articles. Second antennæ have a peduncle of six articles; first very small, wider than long; second, third and fourth subequal; fifth and sixth long and narrower; sixth longer than fifth; flagellum multi-articulate, composed of about sixty-two articles. Maxillipeds

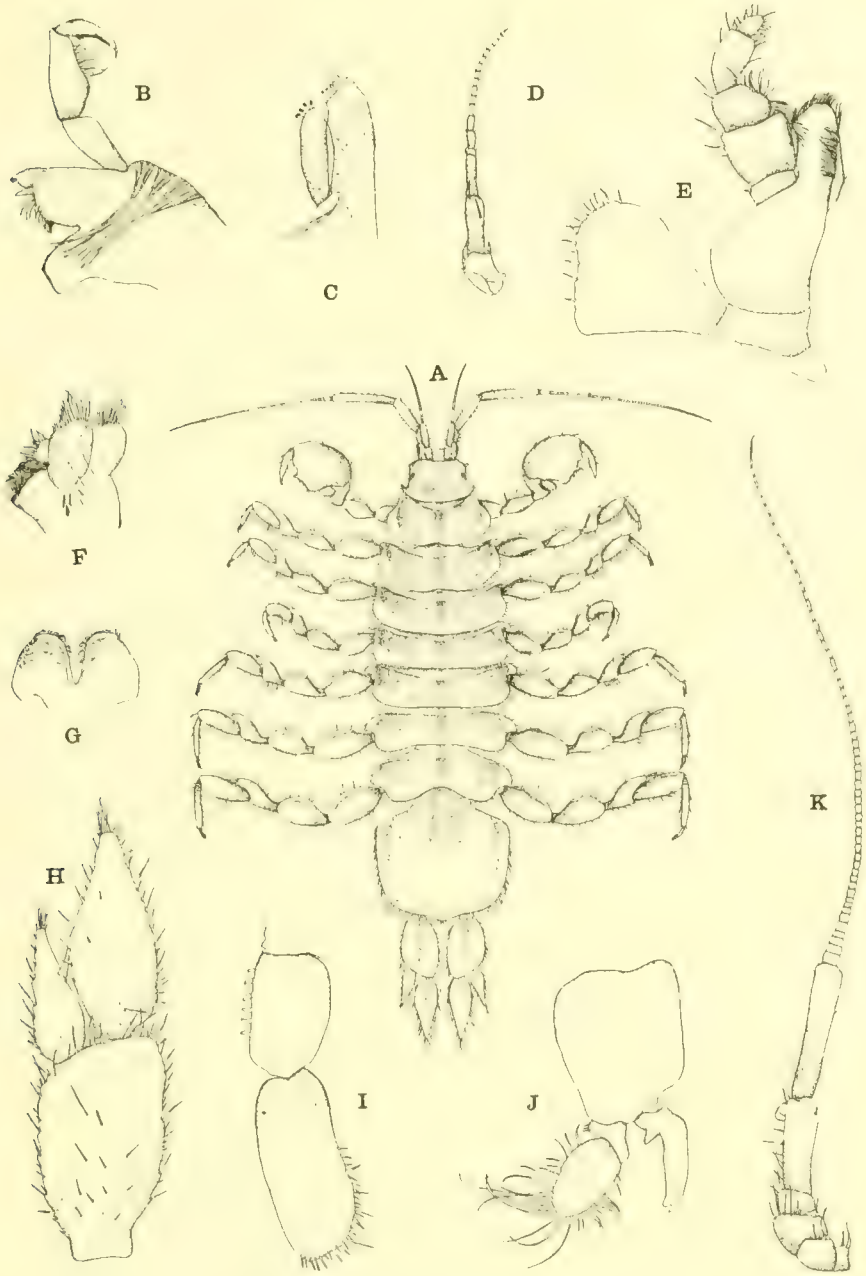


Figure 65. Asellus communis Say

A, Dorsal view. B, Mandible. C, First maxilla. D, First antenna. E, Maxilliped. F, Second maxilla. G, Lower lip. H, Uropod. I, First pleopod of male. J, Second pleopod of male. K, Second antenna.

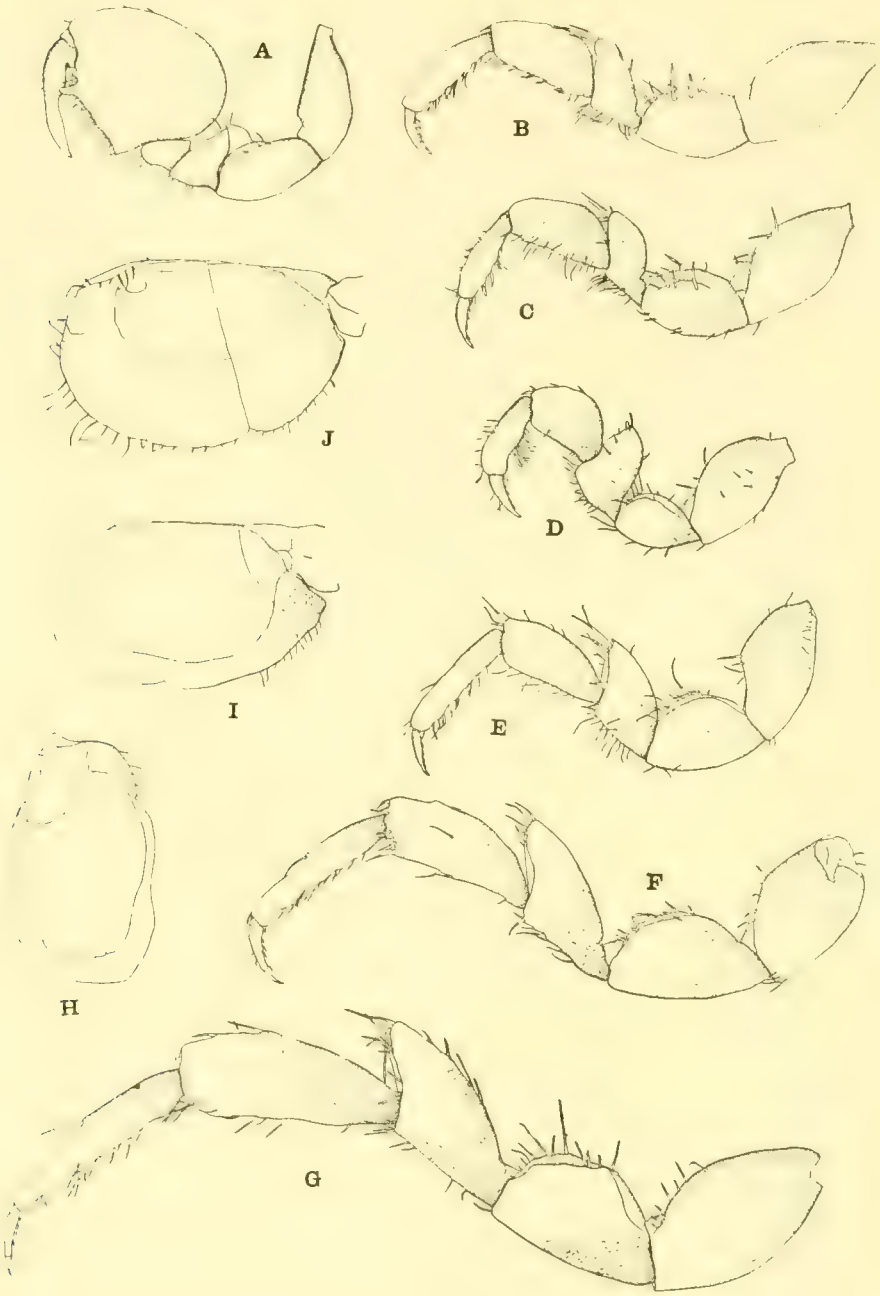


Figure 66. Asellus communis Say

A, First leg. B, Second leg. C, Third leg. D, Fourth leg. E, Fifth leg. F, Sixth leg. G, Seventh leg. H, Fifth pleopod of male. I, Fourth pleopod of male. J, Third pleopod of male.

provided with a palp of five articles; mandibles have a palp of three articles.

Thorax has first segment longer than those succeeding, but narrower; remaining segments subequal. Small epimera occur on all the segments at the antero-lateral angles. Legs all ambulatory excepting the first pair, which are prehensile. Propodus of first pair very much expanded; its inferior margin has one long triangular process at the distal end, and one short process at the proximal end.

Abdomen composed of two very short segments and one large terminal segment; latter is slightly wider than long, 5 mm. by 4 mm., is narrower at posterior margin than at anterior. Post-lateral angles rounded, posterior margin produced medially into a sharp lobe between the uropoda. Uropoda about as long as terminal abdominal segment, 5 mm.; peduncle about as long as inner ramus; both rami end sharply. First pair of female pleopoda are attached close together and are unsegmented. First and second pleopoda of male are modified. Second pleopoda of female are lacking.

Ligyda occidentalis (Dana)

(Figures 67 and 68)

Locality—On the rocks at the high tide mark where they are very numerous, at Laguna Beach, California.

Color—Sordid gray and brown; sometimes checkered in gray; legs tipped with orange.

Body ovate and elongate, about two and a half times as long as wide, 22 mm. by 9 mm. Surface covered with granules.

Head twice as wide as long with anterior and lateral margins rounded. Eyes very large, composite and elongate. First antenna very minute and rudimentary, composed of three articles. Second antenna measures 16 mm. First and second articles of peduncle subequal; third a little longer; fourth and fifth elongated; fifth longer and narrower than fourth; flagellum composed of thirty-one articles. Maxilliped has a palp of five articles.

First four segments of thorax subequal and longer than those succeeding; last three have their post-lateral angles produced further than the preceding four. The epimera are united to the segments and are only faintly perceptible. Legs all ambulatory; have the dactylus bi-unguiculate. Propodus of first leg in male more dilated than that of the other legs and has a process on the inner distal margin in the male. Carpus and merus of first and second and third legs more dilated in male and have striated margins.

First and second abdominal segments short and subequal. Succeeding segments longer and narrower. Last abdominal longest and narrowest of all the abdominal segments. Its post-lateral angles are

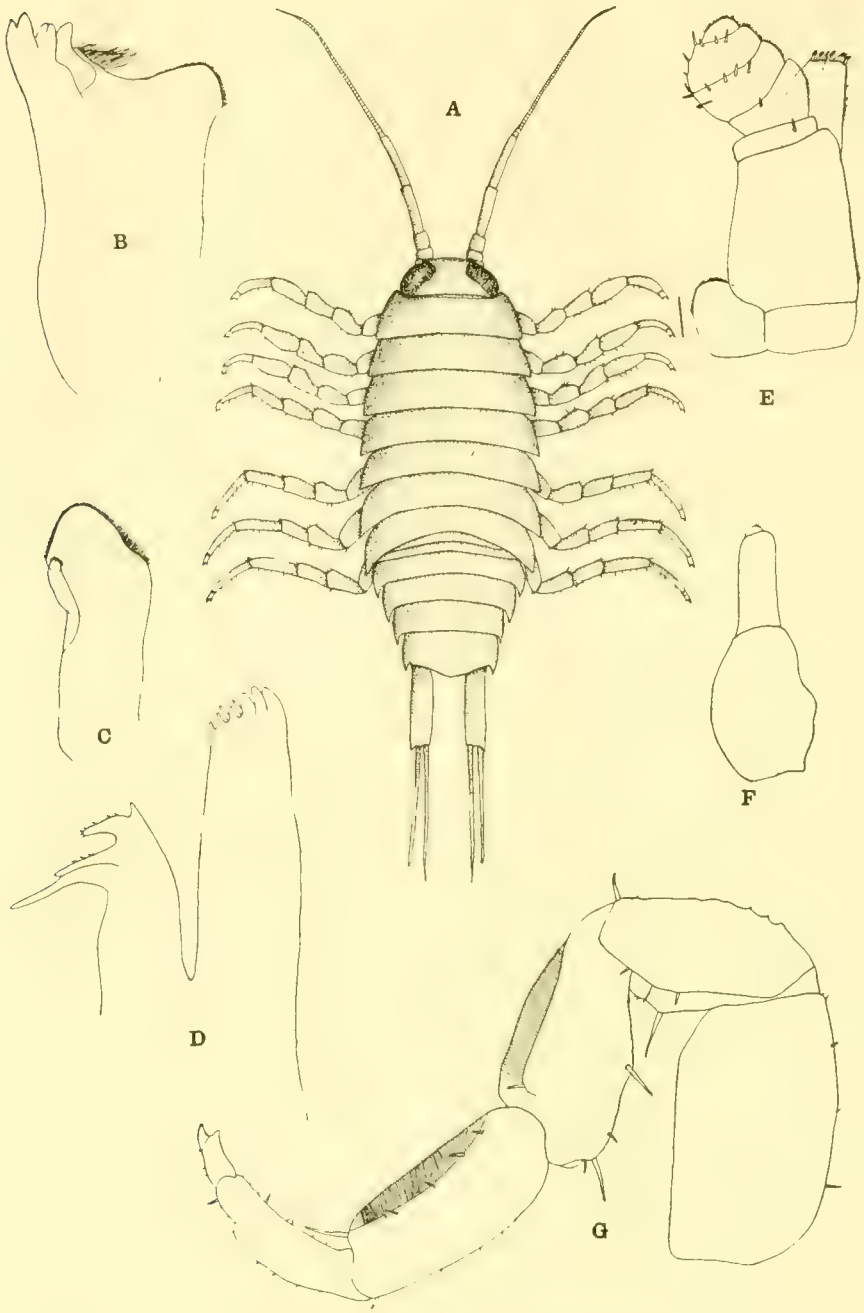


Figure 67. Ligyda occidentalis (Dana)

A, Dorsal view. B, Mandible. C, Second maxilla. D, First maxilla. E, Maxilliped. F, First antenna. G, First leg of male.

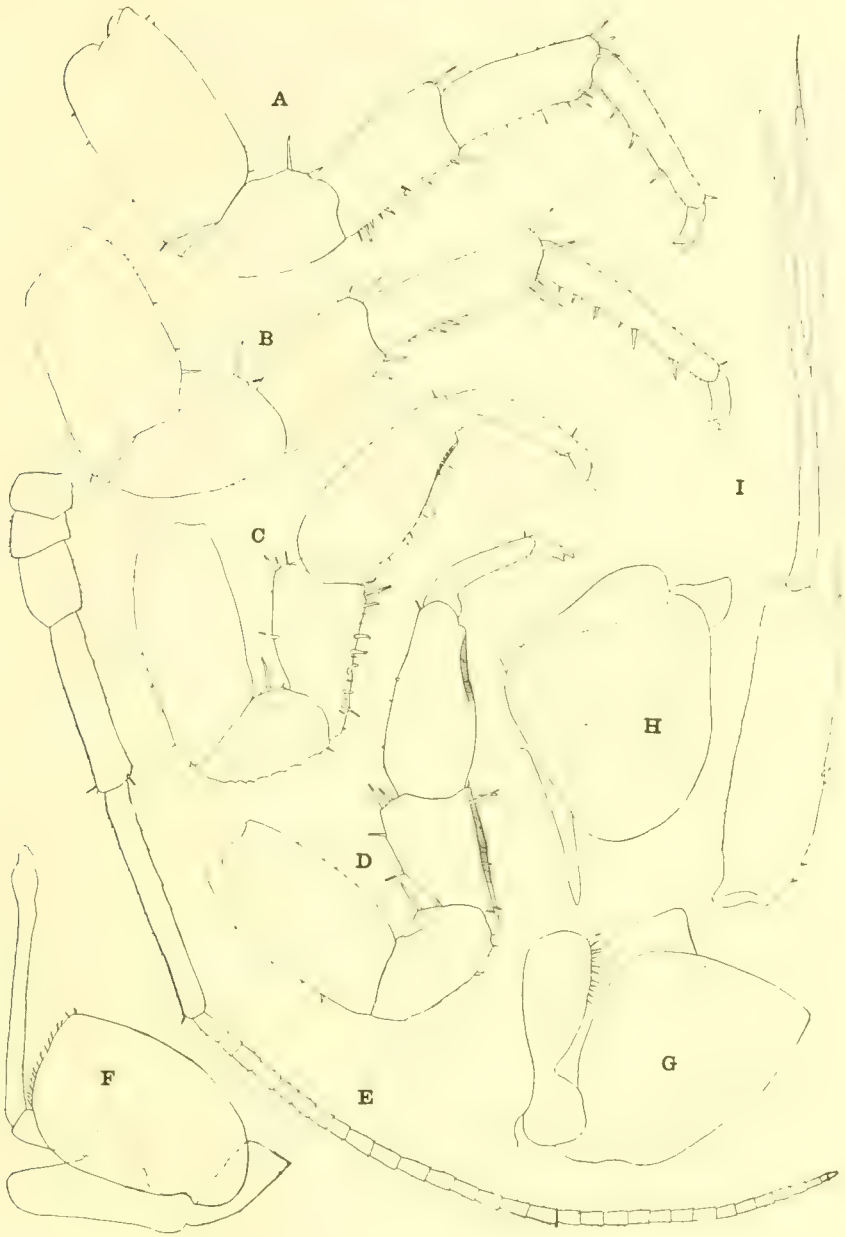


Figure 68. Ligyda occidentalis (Dana)

A, Fourth leg of male. B, Fifth leg of male. C, Second leg of male. D, Third leg of male. E, Second antenna. F, Second pleopod of male. G, Third pleopod of male. H, First pleopod of male. I, Uropod.

sharp and short. Uropoda about half the length of the body, 11 mm.; peduncle 3.5 mm., and about two-thirds as long as the outer ramus; outer ramus slightly shorter than inner, which is armed with a single spine.

Alloniscus perconvexus Dana

(Figure 69)

Locality—Abundant in sand of upper beach under kelp; very abundant at high tides when driven out by the water.

Color—Dull gray mottled with black and white.

Body ovate and convex, about twice as long as wide, 15 mm. by 7 mm. Head has frontal margin produced in the middle into a rounded lobe; antero-lateral angles into an acute process extending slightly beyond the eyes. Eyes composite and situated close to lateral margins. First pair of antennæ very small and rudimentary, consisting of three small articles. Second antennæ composed of five articles and a flagellum. First two articles short, third and fourth longer and subequal, fifth over one and a half times as long as fourth. Flagellum has three subequal articles. Second antennæ thickly covered with small spines. Maxillipeds have a palp of three articles. Palp of mandible wanting.

First segment of thorax longer than the others, which are subequal. On the first segment of the thorax a faint suture line extends a short distance from the posterior margin and at an obtuse angle, indicating the epimeron. On the next three segments sutures extend the length of the segments. On the last three segments epimera are not visible. Legs ambulatory, thickly spined.

Abdomen consists of six segments, five subequal in length, the sixth somewhat longer. First two are covered laterally by the last thoracic segment. Last abdominal segment triangular and narrower than all the preceding segments. Uropoda very short, about the length of last abdominal segment; inner branch about half as long as outer.

The whole surface of the body is covered with minute spines.

Idothea rectilinea Lockington

(Figure 70)

Locality—Abundant in pools, under rocks, on *Phyllospadix* and among fucus at low tide.

Color—Male usually a light brown; female usually a very dark brown with antennæ and legs of light brown.

Body narrow and elongate; sides almost parellel and segments very closely articulated; five times longer than wide, 20 mm. by 4 mm. Dorsum depressed longitudinally on either side of median line.

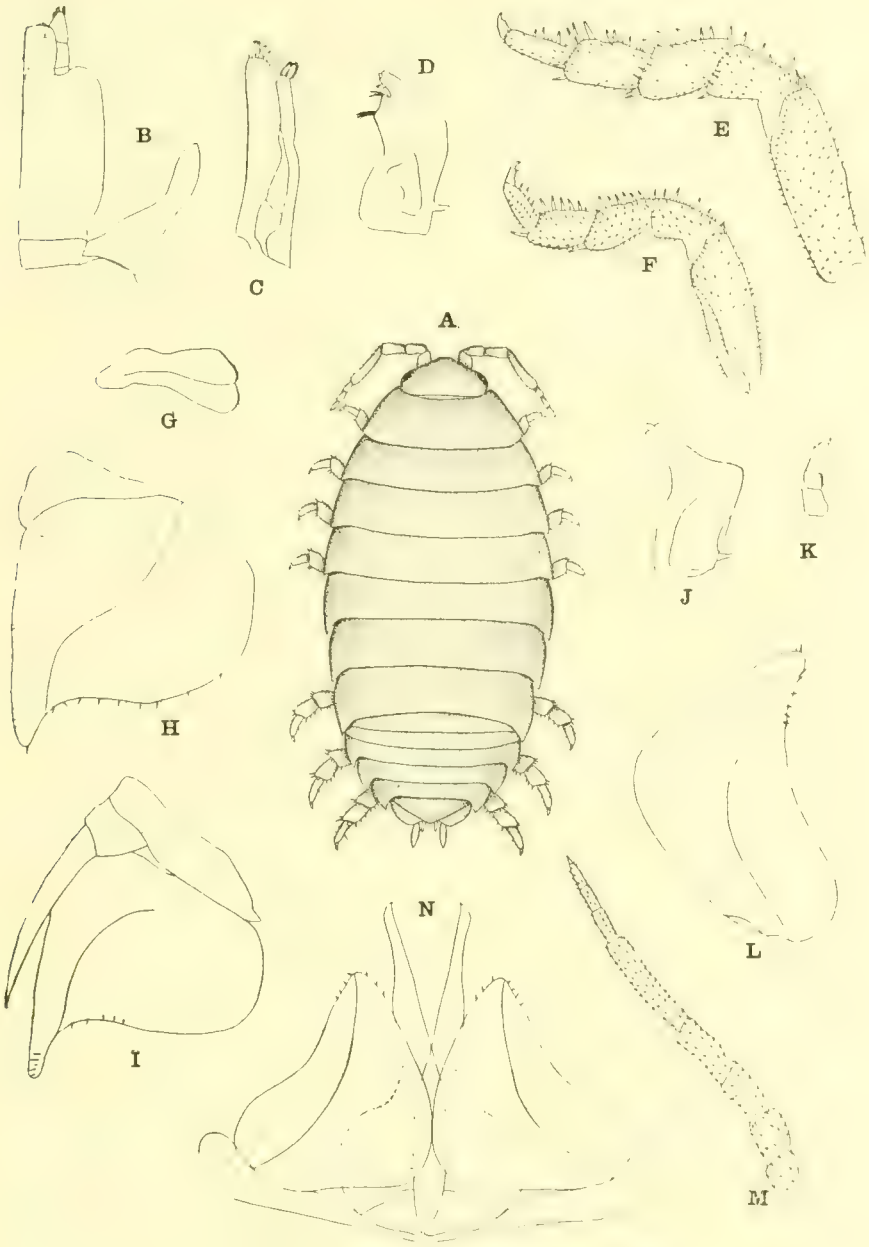


Figure 69. Alloniscus perconvexus (Dana)

A, Dorsal view. B, Maxilliped. C, First maxilla. D, Mandible. E, Seventh leg. F, First leg. G, Second maxilla. H, Third pleopod of male. I, Second pleopod of male. J, Mandible. K, First antenna. L, First pleopod of female. M, Second antenna. N, First pleopoda of male.

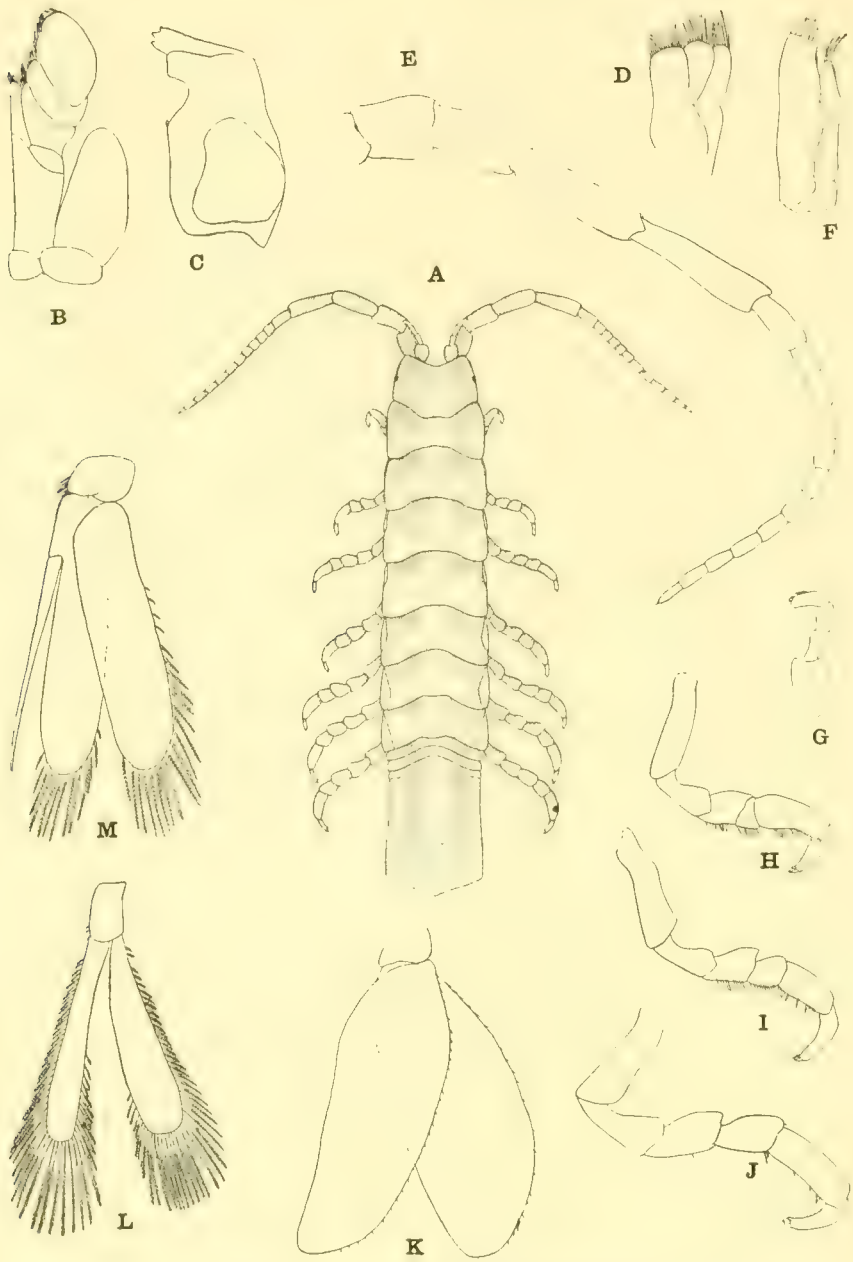


Figure 70. Idothea rectilinea (Lockington)

A, Dorsal view. B, Maxilliped. C, Mandible. D, Second maxilla. E, Second antenna. F, First maxilla. G, First antenna. H, First leg. I, Second leg. J, Seventh leg. K, Posterior pleopod of male. L, First pleopod of male. M, Second pleopod of male.

Head wider than long; anterior margin broadly emarginate and slightly narrower than posterior margin. Eyes very small, compound and placed on the middle of the extreme lateral margin. First antennæ have four articles; basal article enlarged much broader than the other articles. Fourth article clavate and finely haired on the superior margin. Second antennæ composed of peduncle of five articles and a flagellum of twelve. Basal article of peduncle very small. Second slightly longer than wide; third somewhat longer than second and almost twice as long as wide; fourth and fifth about equal in length and longer than the third. The maxilliped has a palp of four articles. The mandible is without a palp.

The first segment of the thorax is only half as long medially as laterally. The rest of the segments are more regular in shape and sub-equal in length; last two slightly shorter than the others; posterior margins of all slightly excavate. The epimera of second and third segments occupy slightly less than half the lateral margin; epimeron of fourth occupies about half and like the other two is very narrow; epimeron of fifth segment is broader and occupies about two-thirds the lateral margin; epimera of sixth and seventh segments occupy the whole length of lateral margin.

The legs are all similar in structure; propodus di-dactylous and slightly haired with short hairs; the three preceding segments provided with longer hairs which are more abundant except on the last two pairs of legs, where they are very scant.

Abdomen consists of three distinct and one partially coalesced segment. First segments are very short, last is long and produced medially to a point.

Philoscia richardsonae Holmes and Gay.

(Figure 71)

Locality—Under old seaweed on the edge of a salt marsh, Laguna Beach, California.

Color—Brown, microscopic examination shows distinct pigment markings over the whole surface.

Body oblong ovate; length slightly over twice the greatest width, 6 mm. by 2.5 mm. Surface of body thickly covered with fine spines.

Head twice as wide as long, with arched frontal margin and lateral angles subacute. Antenna long; first article of peduncle about half as long as second; second and third subequal in length; fourth twice as long as third and narrower; fifth somewhat longer than fourth; flagellum composed of three articles, of which the second is slightly shorter than the first or third; the latter ends in a large spine and the whole antenna is provided with numerous short spines, especially on the margins. Antennule rudimentary, only vis-

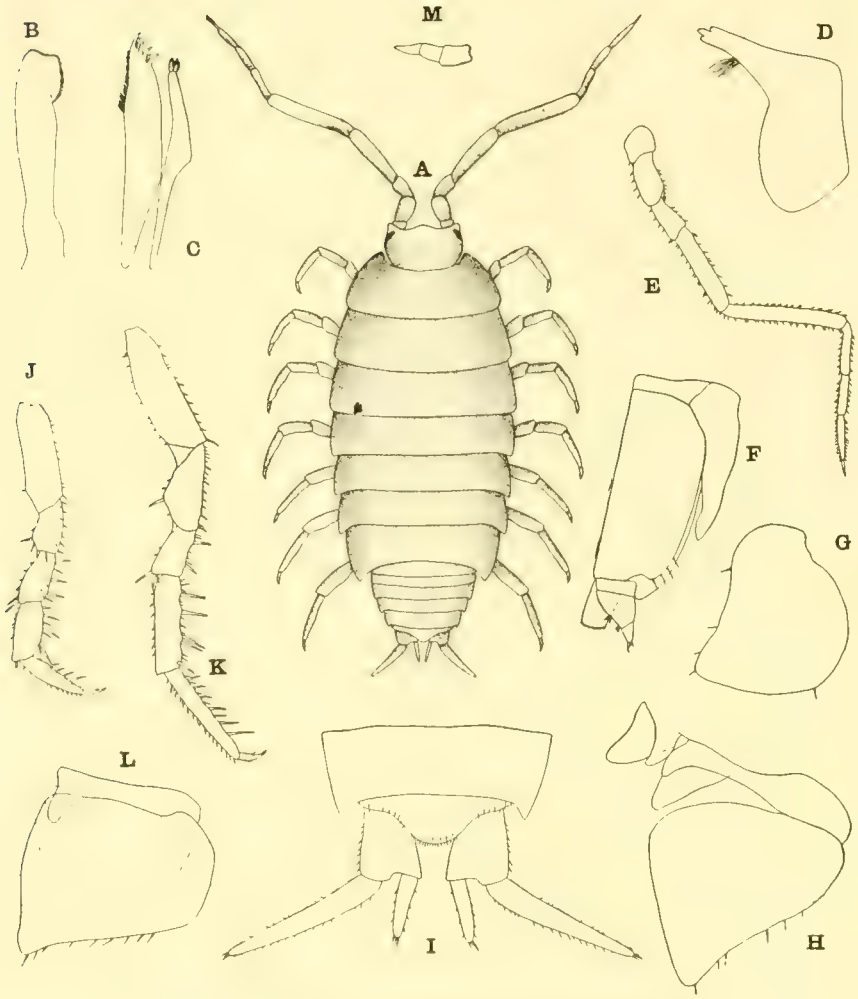


Figure 71. Philoscia richardsonae (Holmes and Gay)

A, Dorsal view. B, Second maxilla. C, First maxilla. D, Mandible. E, Second antenna. F, Maxilliped. G, First pleopod of female. H, Second pleopod of female. I, Terminal segment of abdomen. J, First leg. K, Seventh leg. L, Third pleopod of female. M, Antennule.

ible by dissection, composed of three small articles. Maxillipeds have a palp of three articles. Palp of mandibles wanting.

Segments of thorax subequal; post-lateral angles of last three very marked and produced. Epimera not distinct. Legs all similar, ambulatory, very much spined and increasing in length from first to seventh.

Abdomen abruptly narrower than thorax; first five segments subequal. Post-lateral angles of third, fourth and fifth produced. Last abdominal segment produced medially. Median length about half the greatest width. Basal segment of uropod about as wide as long and extends beyond last abdominal segment; inner ramus a little less than half as long as the outer; both rami are spined.

Dynamene glabra Richardson

(Figure 72)

Locality—Found on *Phyllospadix* at Laguna Beach, California.

Color—Pale orange brown, somewhat mottled, with white spot on telson; become dark brown in alcohol.

Body convex ovate, about twice as long as wide, 3 mm. by 1½ mm.; surface smooth.

Head small and rounded anteriorly. Eyes placed in the post-lateral angles. First pair of antenna with first article of peduncle less than twice as long as wide; second and third articles subequal and narrower that first. Flagellum composed of twelve articles. Second antenna with first article of peduncle about as long as wide, small; second twice as long as first; third about the same length as first; fourth similar to second; fifth one and a third times as long as fourth. Flagellum composed of sixteen articles. Maxilliped provided with a palp of five articles. Mandible with a palp of three articles.

Thorax has first segment longer than those succeeding, which are subequal. Post-lateral angles of last three are produced. Legs all ambulatory; dactylus bi-ungulate.

Abdomen has the penultimate segment composed of several coalesced segments, though the suture lines were not clear in the specimens at hand at the time of the drawing. Other specimens found later showed two short suture lines. Last abdominal segment triangular with a median fissure at the posterior extremity. Inner ramus of uropod about as long as telson and immovable; outer branch half as long as inner, and movable.

Cirolana harfordi var. **spongicola** n. var.

(Figure 73)

Locality—Sponges at low tide mark, Laguna Beach, California.

Color—White, but marked with fine black dots.

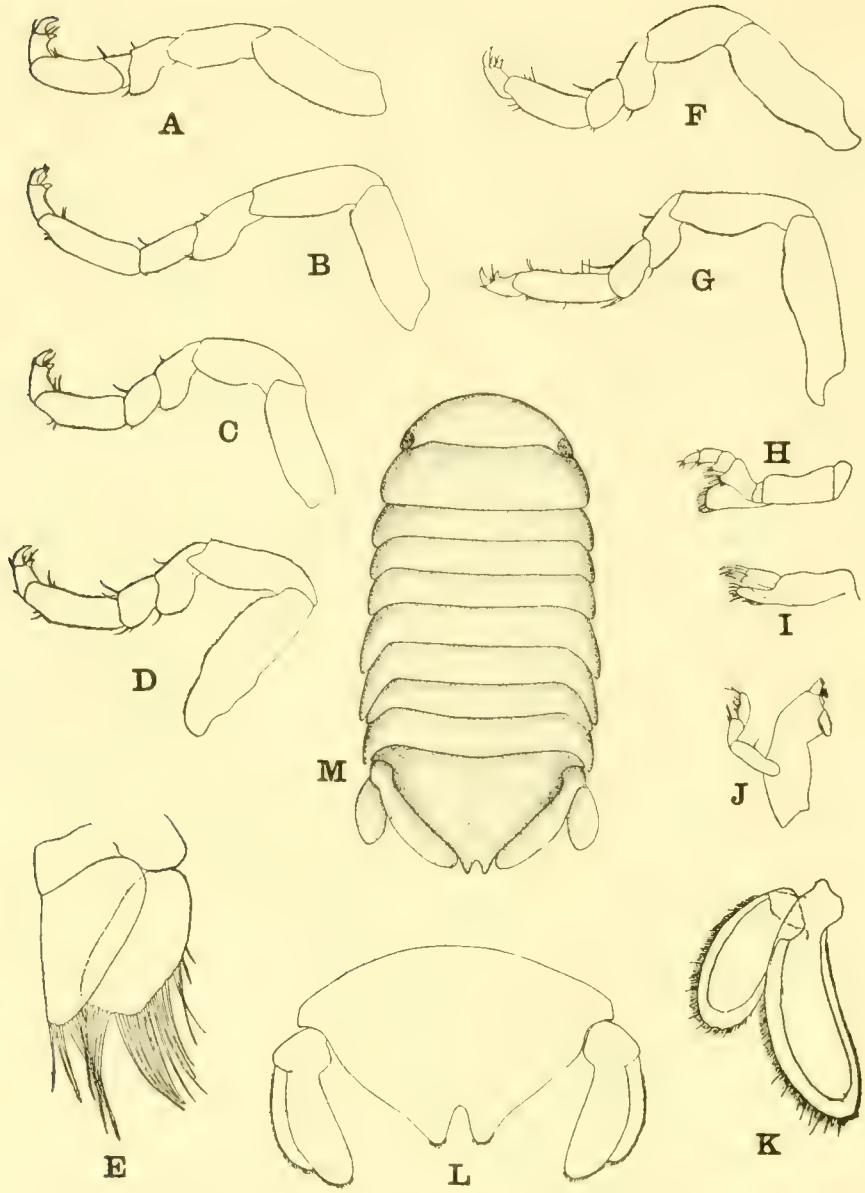


Figure 72. Dynamene glabra (Richardson)

A, First leg. B, Second leg. C, Third leg. D, Fifth leg. E, First pleopod of male. F, Sixth leg. G, Seventh leg. H, Maxilliped. I, Second maxilla. J, Mandible. K, Uropod. L, Telson.

Body very convex and oblong, about three times as long as wide, 7 mm. by 2.5 mm. being the dimensions of a small specimen.

Head twice as wide as long with frontal margin rounded. Eyes composite, occupying lateral margins of the head. Second antenna has a peduncle of five articles; the first three are small; fourth about as long as first three; fifth longer and narrower than fourth; flagellum composed of twenty-two articles; in five specimens examined the number of articles varied from twenty-two to twenty-nine, average twenty-four. Antennule has a peduncle of three articles; first two small and subequal; third half as wide and equal in length to the first two; flagellum composed of twelve articles, average out of five specimens examined, ten articles; maxillipeds composed of seven articles; last five provided with many long plumose spines; third article has two blunt hooks. Mandible robust, broad and strong distally where it ends in a tridentate margin. Mandibular palp has three articles. Frontal lamina short and broad and is sub-triangulate at the distal end.

First segment of thorax longer than the following three, which are subequal. Last three longer than the three preceding. Epimera distinct on all but first segment. Last four segments marked with an oblique, first two with a longitudinal carina. Epimera of last three, especially of last two, segments produced at post-lateral angles. First three legs prehensile, last four ambulatory. In the first pair the propodus has three spines on the inner margin which increase in size toward the distal end, where one long slender spine also occurs; on the outer distal end there are one or two slender spines. The carpus usually has but one long spine; the merus has five or six thick, blunt spines on the inner margin and two or three sharp ones. On the outer distal end there are two long slender spines; the ischium has one blunt spine on the inner distal margin similar to the blunt spines on the merus; there is one long, stout one and one long, slender spine on the outer distal end. The propodus of the second and third legs has on the inner margin four spines increasing in length toward the distal end. The carpus has three blunt spines on the inner distal end. The merus has eight or nine large spines on the inner margin; one long and strong and from one to four shorter ones on the outer distal end. The ischium has two very blunt spines at the inner distal end, and two or three smaller spines at the outer distal extremity. Last four legs provided with many stout spines.

Abdomen composed of six visible segments. Last, triangular, gradually narrows to a rounded apex which is provided with about eight teeth and numerous long hairs. Peduncle of uropod is produced to two-thirds the length of the telson; inner ramus is wider

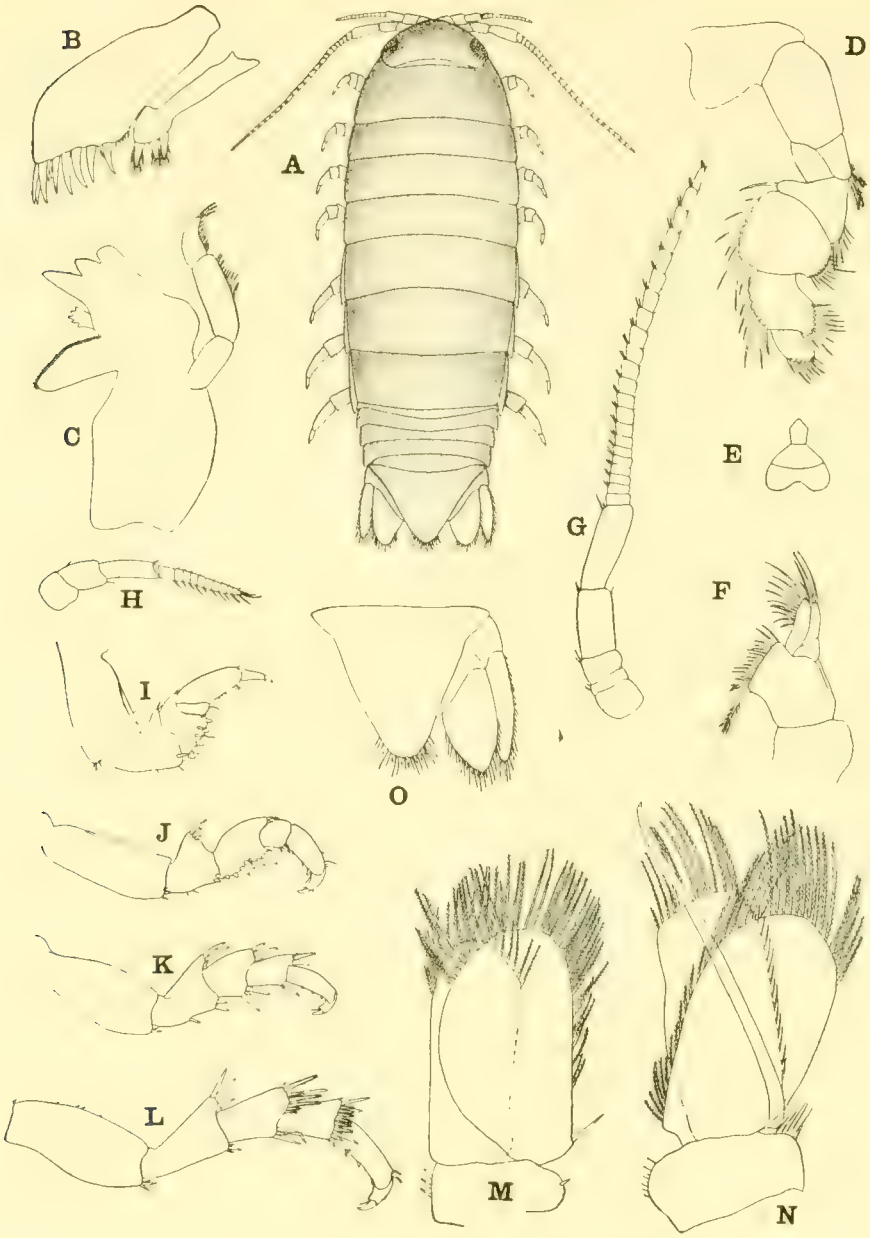


Figure 73. Cirolana harfordi var. spongicola

A, Dorsal view. B, First maxilla. C, Mandible. D, Maxilliped. E, Frontal lamina, clypeus and labrum. F, Second maxilla. G, Second antenna. H, First antenna. I, First leg. J, Second leg. K, Fourth leg. L, Seventh leg. M, First pleopod of male. N, Second pleopod of male. O, Telson and uropod.

Note:—The extremities of both the inner and of the outer rami are very distinctly serrate, especially the outer.

than the outer and somewhat longer, provided with spines and teeth. Outer branch is also thickly spined. Both the inner and outer rami are very markedly serrate, especially the outer, in which the extremity is so sharply divided that it appears bifurcated.

These specimens found in the sponges appear to be very closely related to *Cirolana harfordi* (Lockington) but the marked difference in the number of spines at the extremity of the telson and the evident difference in the extremities of the uropod rami, which are more rounded and much less emarginate in *Cirolana harfordi* seems to warrant a varietal distinction. The lateral margins of the telson of *Cirolana harfordi* are curved near the base; in the specimens obtained from the sponges these margins are straight. These differences, with those of size and habitat, allow at least a distinction in variety.

STUDIES IN LAGUNA AMPHIPODA

VINNIE R. STOUT

Orchestia traskiana Stimpson

(Figures 74 and 75)

Numerous specimens taken agree very well with the description of *O. traskiana* in Das Tierreich, except in having the distance between the eyes varying from considerably less to a little more than one diameter, also in having the flagellum of antenna II with the flagellum somewhat longer than peduncle and 16-18 jointed in male, all the female specimens observed having fourteen joints. Color, dull shades of grayish brown and green, with the appendages bluish.

Very common under decaying algæ about edges of a brackish water slough which is reached by salt water only at times of extreme high tides. Laguna Beach, California. Coll. V. R. Stout.

Amphithoe corallina n. sp.

(Figures 76 and 77)

The color of the body varying from a fairly bright brownish green 282 (Valette) to dull orange-green 182 and 178; antennæ about tone of green 203; other appendages light and transparent; back, sides, legs, and antennæ spotted with white; females carrying bright orange colored eggs.

Body robust and smooth. Head very broad and deep. Eyes small, subrotund, black. Antennæ one and two nearly the same in length, a little more than half as long as the body. First joint of peduncle of antenna one a little longer than the second joint and almost three times as long as the third; flagellum about twenty-six-jointed and a little longer than the peduncle. Antenna two stouter, peduncle longer than the twenty-four-jointed flagellum; ultimate joint of peduncle a little shorter than the penultimate. Lower lip similar to that of *A. flindersi*. Mandibular palp large, third joint longer than second and armed with six long spines. Maxilla two normal with inner plate fringed with compound hairs. Gnathopods one and two about the same length; gnathopod two broader and more thickly setose. Second joint of peræopods one to five slightly expanded, joint of peræopod three most strongly so. Propodus of peræopods one and two strongly narrowed distally; propodus of peræopod four expanded distally, and propodus of peræopod five slightly expanded distally. Pleopods one to three thickly clothed with long setæ; basal joint of rami about one-third as long as pedun-

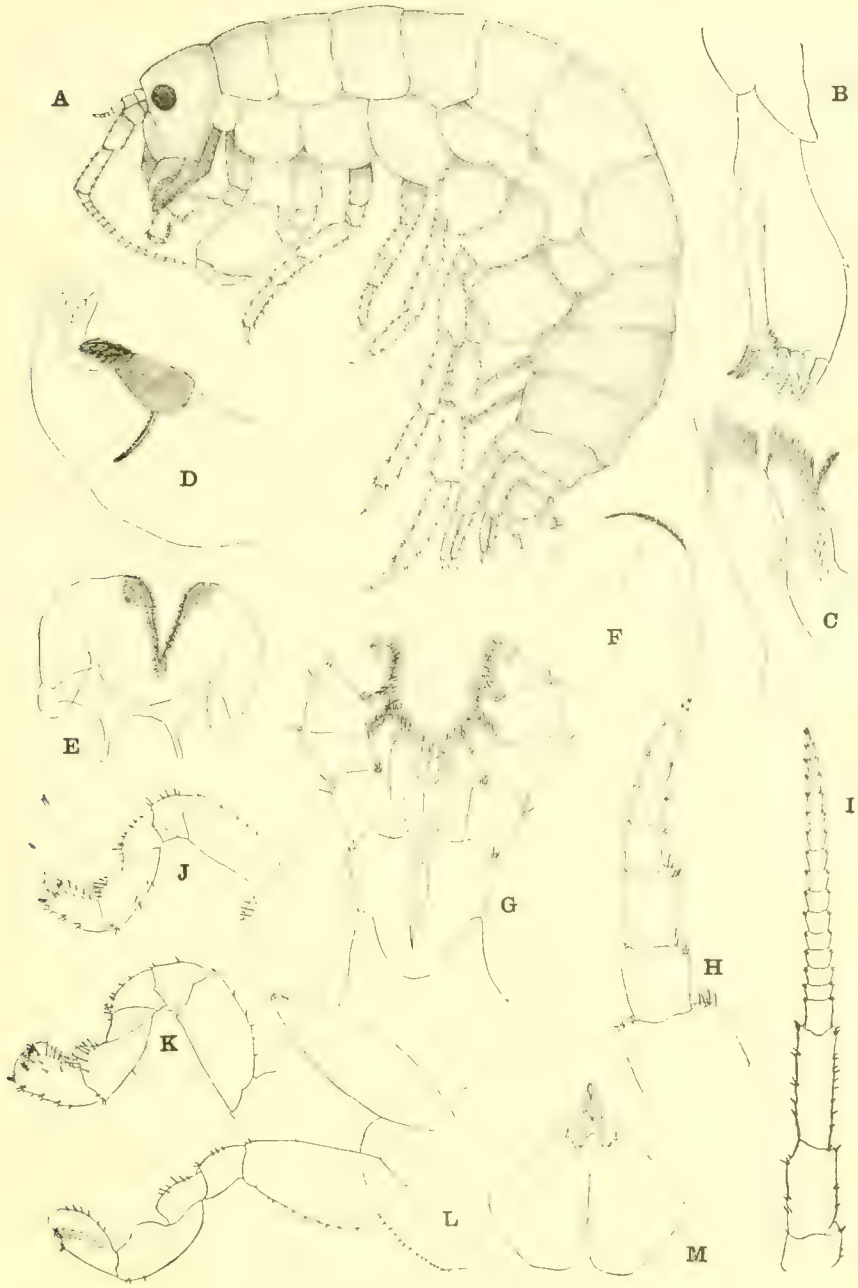


Figure 74. Orchestia traskiana

A, Adult male. B, First maxilla. C, Second maxilla. D, Mandible. E, Lower lip. F, Upper lip. G, Maxillipeds. H, First antenna. I, Second antenna. J, First gnathopod of female. K, First gnathopod of male. L, Second gnathopod of female. M, Telson.

cle; rami subequal. Uropods one to three normal, two reaching not quite as far back as one and three; none of the rami as long as their peduncles; outer rami in one and two shorter than inner, in three longer than inner. Telson somewhat broader than long, bluntly triangular, with several lateral spinules. Length 6-8 mm.

Laguna Beach, California. Occasional in tufts of coralline algæ between tides. Coll. V. R. Stout.

Amphilochus litoralis n. sp.

(Figure 78)

Entire animal colored a delicate pink, varying from red 21 to 3B (Vallette).

Body smooth, stout, and quite compact, the dorsum strongly arched. Rostrum long. Side-plate very small and convex in front. Antennæ short and stout, less than one-fourth the length of the body. Antenna one with the six-jointed flagellum longer than the peduncle. Antenna two more setose, and with the peduncle nearly twice as long as the six-jointed flagellum. Upper lip incised, with somewhat un-

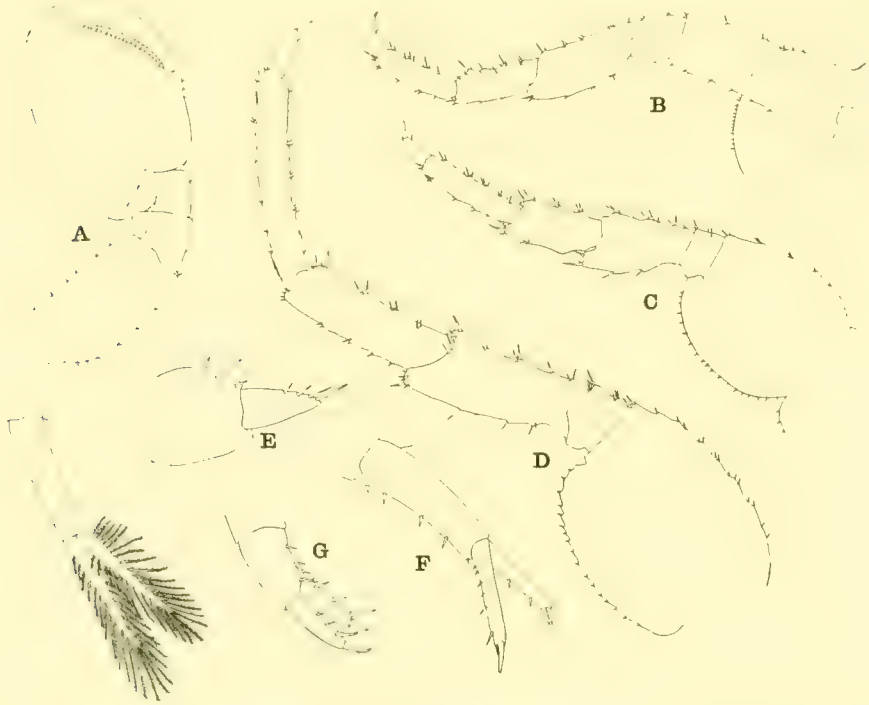


Figure 75. Orchestia traskiana

A, Second gnathopod of male. B, First peraeopod. C, Third peraeopod. D, Fifth peraeopod. E, Third uropod. F, First uropod. G, Second uropod. H, First pleopod.

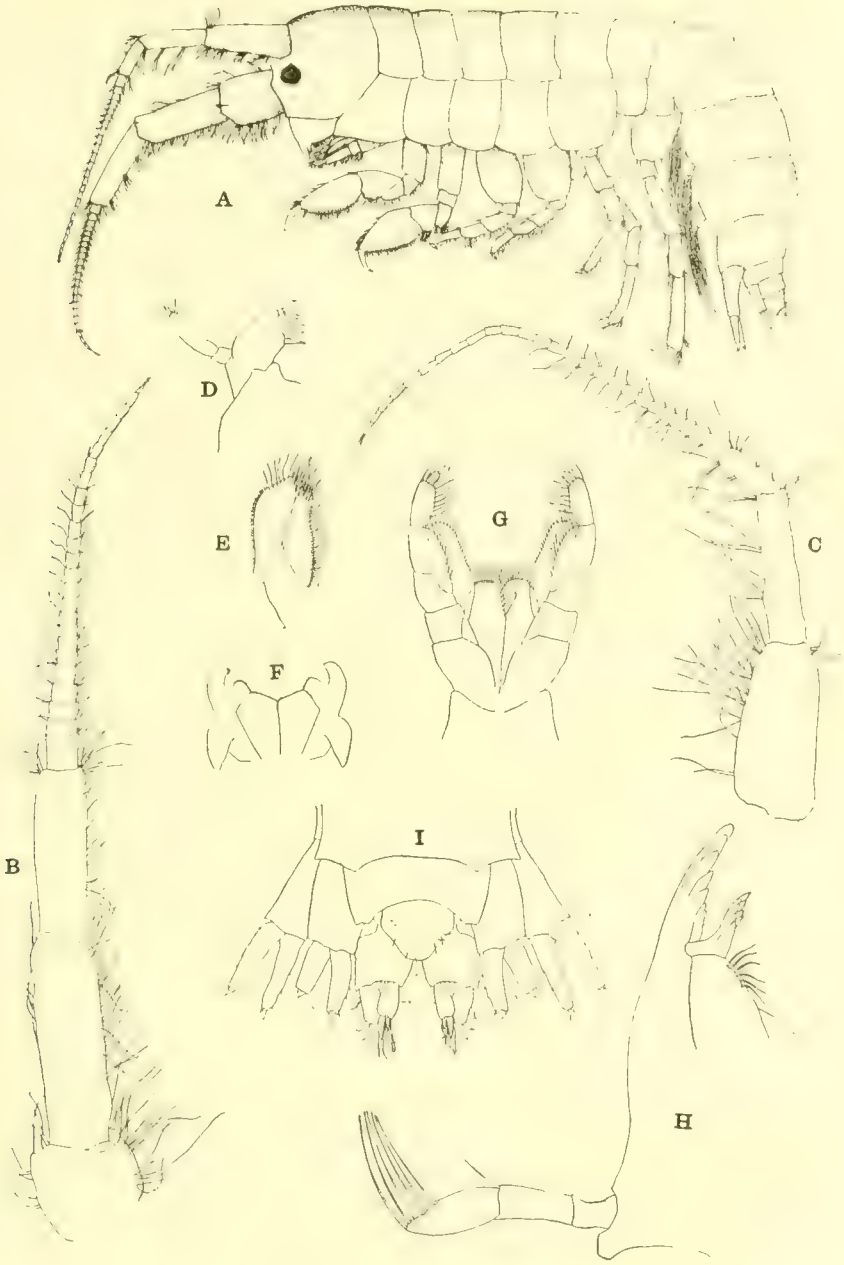


Figure 76. Amphithoe corallina

A, Adult male. B, Second antenna. C, First antenna. D, First maxilla. E, Second maxilla. F, Lower lip. G, Maxillipeds. H, Mandible. I, First, second and third pairs of uropods, and telson.

Figure 77. Amphithoe corallina

A, First gnathopod. B, Second gnathopod. C, First peraeopod. D, Second peraeopod. E, Third peraeopod. F, Fifth peraeopod. G, Fourth peraeopod. H, Third pleopod. I, First pleopod.

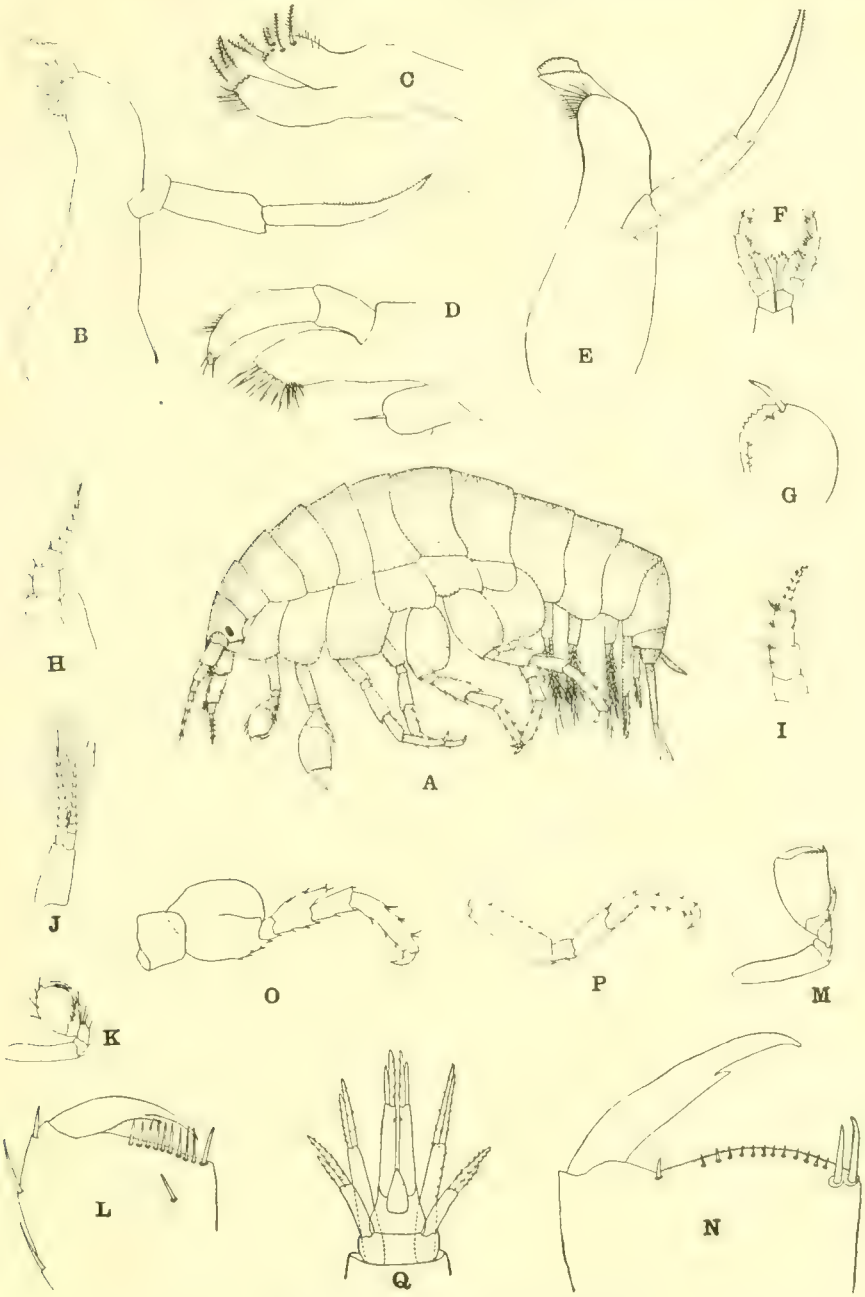


Figure 78. Amphilochus litoralis

A, Adult male. B, Right mandible. C, Second maxilla. D, First maxilla. E, Left mandible. F, Maxillipeds. G, Inner plate of maxillipeds. H, First antenna. I, Second antenna. J, Second pleopod. K, First gnathopod. L, Palm and finger of first gnathopod. M, Second gnathopod. N, Palm and finger of second gnathopod. O, Fifth peraeopod. P, First peraeopod. Q, First, second and third pairs of uropoda, and telson.

symmetrical front lobes. Lower lip without inner lobes; outer lobes edged with long, slender spinules. Mandibles with three-jointed palp; third joint of palp longer than both the first and second, and armed with short, scarcely discernible setules. Left mandible with inner plate, which is more finely toothed than the outer; molar obsolete. First maxilla with small inner plate bearing a single spine at the slightly concave apex; outer plate with seven spines at the oblique apex, and a bunch of small setæ at the inner edge of the spine-row; two-jointed palp with three short spines at the apex. Outer plate of maxilla two-tipped with three compound spines, and fringed on the outer margin with slender setæ; inner plate tipped with six compound spines. Maxillipeds with slender inner plates reaching about to distal end of the first joint of the palp, and bearing three short spines at the apex; outer plate broader, extending a little beyond the first joint of the palp, the broadly rounded distal margin bearing one long spine, several small spines on the inner part, and finely serrate on the outer part; the joints of the palp gradually diminishing in size from the first to the finger.

Gnathopod one the smaller, fifth joint with spines extending almost to the palm, which bears ten slender spines. Second gnathopod with the sixth joint widening to the oblique palm, the front margin of which bears a row of twelve small spines, and at the apex two strong spines; in neither one does the finger extend quite to the apex of the palm. Peræopods one and two slender, nearly equal. Peræopods three to five with second joint greatly expanded into a broad, flat plate, gradually increasing in size to the fifth. The rami of the subequal pleopods bear long, finely compound setæ. Uropod one extending almost to distal end of uropod three, peduncle much longer than the subequal rami. Uropod two much shorter, the peduncle of equal length with the inner ramus; the outer ramus narrow and more than half as long as the inner. Uropod three extending beyond uropods one and two; peduncle much longer than the rami; inner ramus the longer. Telson about half as long as the peduncle of uropod three, about twice as long as broad, and converging slightly to the pointed apex. Length 2 mm.

This species resembles most closely *A. marionis,* but differs especially in the characters of the mandible, maxillipeds, uropods, and telson.

Laguna Beach, California. Common in *Phyllospadix.* Coll. V. R. Stout.

Genus **Dulichiella** n. gen.

Body slender; peræon segment one the shortest, sixth and seventh not coalesced. Pleon of six segments beside the telson, third most elongate; some of the pleon segments toothed posteriorly.

Head not produced in front. Antennæ strong and setose; antenna one much longer than antenna two, flagellum longer than peduncle, accessory flagellum present; antenna two with peduncle about twice as long as flagellum. Mouth parts normal. Gnathopod one subchelate, fifth joint longer but not broader than sixth. Gnathopod two in female and left gnathopod two in male similar to gnathopod one, though with the sixth joint longest and strongest. Right gnathopod two in male with sixth joint very large and powerful. Peræopods one and two long and slender. Peræopods three to five stronger and very long; much alike, fifth slightly longest; second joint expanded, sixth joint longer than any other except second. Uropods one and two with rather strong, unequal rami. Uropod three a concave, spinose plate projecting over lateral margin of telson. Telson rectangular.

This genus is evidently nearest the genus *Dulichia,* but differs from it particularly in the character of the first antenna, second right gnathopod of male, shape of peræopods three to five, presenec of rudimentary third uropods and shape of telson.

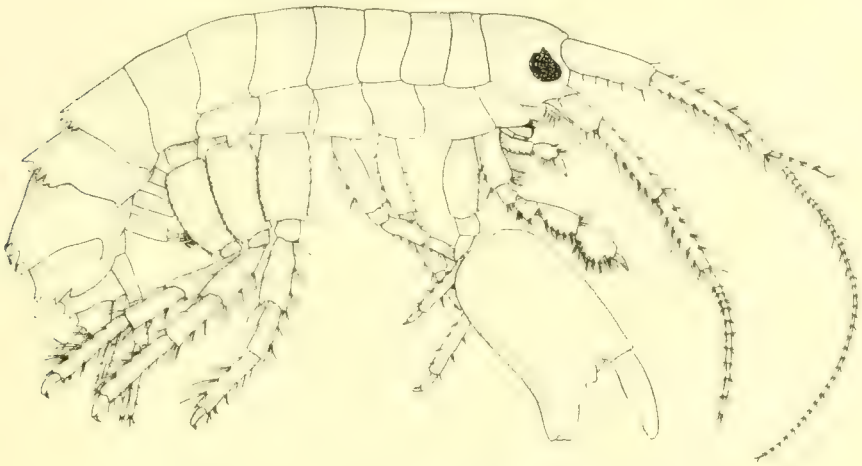


Figure 79. Dulichiella spinosa. Adult male

Dulichiella spinosa n. sp.

(Figures 179 and 180)

Body colored a pale, delicate green 228C (Valette), speckled with dark red 27.

Body slender and smooth. Head longer than broad, but not greatly produced in front. Eyes large, black, and irregular. Antenna one with thirty-eight-jointed flagellum, which is longer than the peduncle; accessory flagellum five-jointed; second joint of

Figure 80. Dulichiella spinosa

A, Second antenna. B, First antenna. C, Lower lip. D, First maxilla. E, Maxillipeds. F, Mandible. G, Second maxilla. H, Second right gnathopod of male. I, First gnathopod of male. J, Second left gnathopod of male. K, First paraeopod L, Fifth peraeopod. M, First pleopod. N, First uropod. O, Second and third pair of uropoda, and telson.

peduncle somewhat longer than the first joint and about three times as long as the third joint. Antenna two about two-thirds as long as antenna one; thirteen-jointed flagellum about one-half as long as peduncle. Upper lip slightly bi-lobed. Mandibular palp quite large, second joint broader and longer than the third, both armed with long, slender spines. Maxilla one with rather large, triangular shaped inner plate, fringed with fine setæ on the inner edge, and armed with one compound, apical spine. Maxillipeds with outer plates much larger than the inner, and carrying several compound setæ along the apical margin, finely toothed and setose along the inner margin; palp long and strong. Pleopods rather large and very much alike, the sub-equal rami bearing long, compound setæ. Telson long. Pleon segments all toothed posteriorly. Length 5-7 mm.

Laguna Beach, California. Frequent in kelp holdfasts from deep water. Coll. V. R. Stout.

Genus **Acanthogrubia** n. gen.

Head without rostrum. Side-plates one to five well developed, fifth the broadest and deepest. Antenna one not as long as peduncle, with four-jointed accessory flagellum. Antenna two, two-thirds as long as antenna one, with peduncle slightly longer than flagellum. Mouth parts prominent. Upper lip broadly rounded. Lower lip with well developed inner lobes, and bifid outer lobes with prominent mandibular processes. Mandible normal, third joint of palp broadly rounded at apex, and armed with numerous long setæ. Maxilla one armed with ten apical spines, second joint of palp broad with several spines on the apex and inner margin. Maxilla two outer plate the broader; inner plate as long as outer and thickly fringed on inner margin. Maxillipeds, outer plates large. Gnathopods one and two subchelate, gnathopod two the larger. Peræopods one and two long, slender, second joint slightly expanded. Peræopod three, second joint expanded, broader than long. Peræopods four and five the longest. Uropod three, outer ramus with two hooks. Telson short and broad, armed only with setæ.

This genus differs from *Amphithoe* in having an accessory flagellum on the first antenna. It also differs from *Paragrubia* in having a four-jointed instead of one-jointed accessory flagellum, in having the flagellum of the second antenna not elongate, and the second joint of the third peræopod as broad as long.

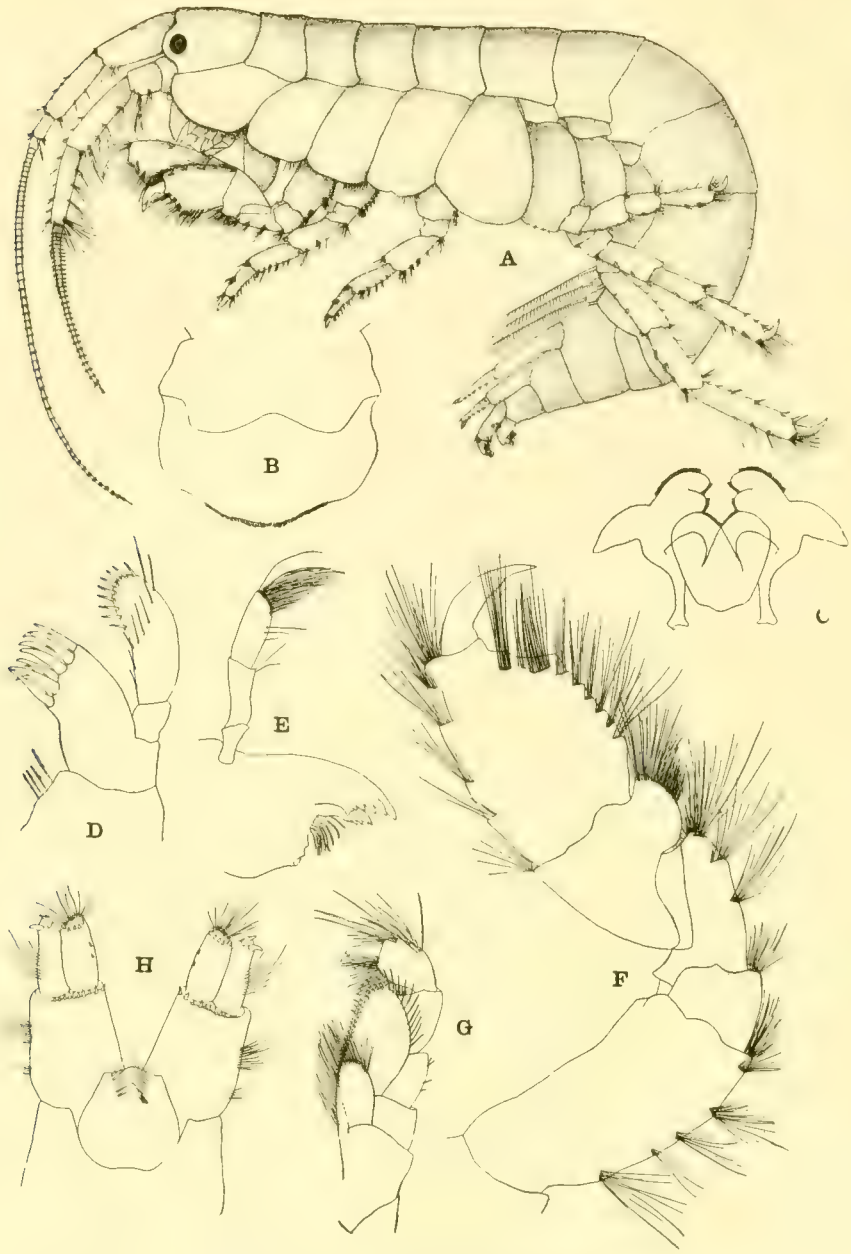


Figure 81. Acanthogrubia uncinata

A, Adult male, the lines separating the two lobes of side-plate 5 to be considered as a groove. B, Upper lip. C, Lower lip. D, First maxilla. E, Mandible. F, Second gnathopod. G, Maxillipeds. H, Third pair of uropoda, and telson.

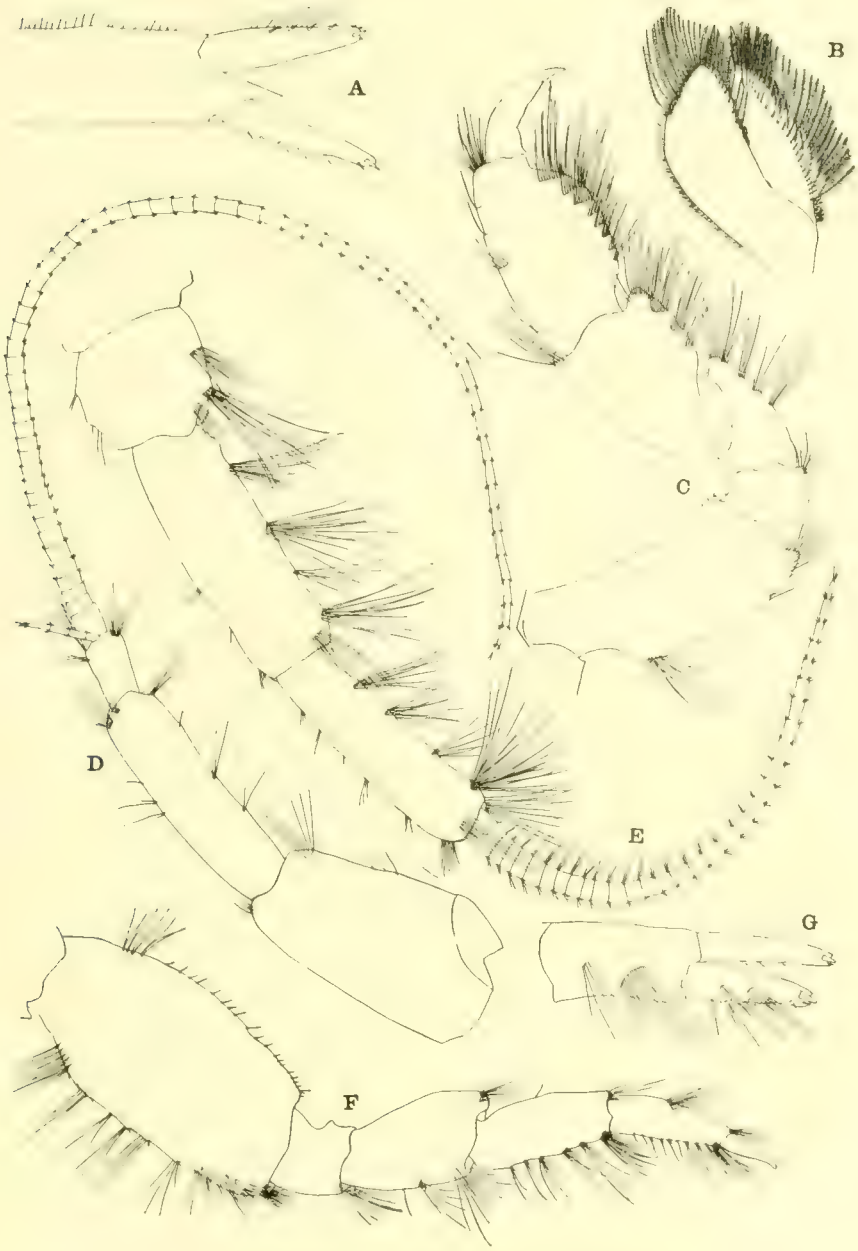


Figure 82. Acanthogrubia uncinata

A, First uropod. B, Second maxilla. C, First gnathopod. D, First antenna. E, Second antenna. F, First peraeopod. G, Second uropod.

Acanthogrubia uncinata n. sp.

(Figures 81, 82 and 83)

Entire body varying between the two tones of orange-green 152 and 177 (Valette). Flagella of antennæ ringed with white. Eyes bright rose.

Body robust. Head produced in front of eyes. Side-plate one produced forward. Side-plate five with very deep front lobe and small hind lobe. Eyes small, subrotund. Antenna one, first joint of peduncle slightly longer than second, and four times as long as third; flagellum forty to sixty-jointed, accessory flagellum as long as first four joints of primary flagellum. Antenna two, stout, setose; second joint of peduncle longer than third, and about twice as long as first; flagellum thirty-one-jointed. Mandible, palp stout, third joint fringed with compound setæ on the broadly rounded apex, principal and secondary plates dentate, toothed spines in spine-row, molar small. Maxilla one, outer plate with ten spines, second joint of palp broad with nine small spines around the apex and inner margin, with a diagonal row of slender setules around the whole joint. Maxilla two, both plates thickly fringed with compound setæ. Maxillipeds, outer plates fringed with two rows of short spines; inner plate thickly fringed with long, compound setæ.

Gnathopod one, fifth joint long, but not so long as the oval sixth; sixth joint setose, palm not defined, finger faintly serrate. Gnathopod two in female thickly setose, similar to gnathopod one, but with shorter and broader fifth joint; enlarged sixth joint, with palm distinct and curved, finger longer than palm and faintly serrate. Peræopods one and two, second joint long and narrowly rectangular, sixth joint narrowing distally. Peræopod three, second joint expanded, as broad as long, sixth joint with fine spines. Peræopods four and five much longer and proportionately narrower; second joint somewhat expanded and narrowing towards the distal end; sixth joint with six spines and not narrowing distally. Pleopods with unequal rami fringed with long compound spines. Uropods one and two, peduncle longer than the unequal rami. Uropod three, peduncle a little longer than the rami, with a transverse row of short spines on the apical margin; outer ramus with two spine-like hooks; inner ramus broader with a transverse row of short spines, one apical spine, and a row of setæ. Telson as broad as long. Length 8-23 mm.

Laguna Beach, California. Occasional in tubes in kelp holdfasts from deep water. Coll. V. R. Stout.

Figure 83. Acanthogrubia uncinata
A, Fifth peraeopod. B, First pleopod. C, Third peraeopod.

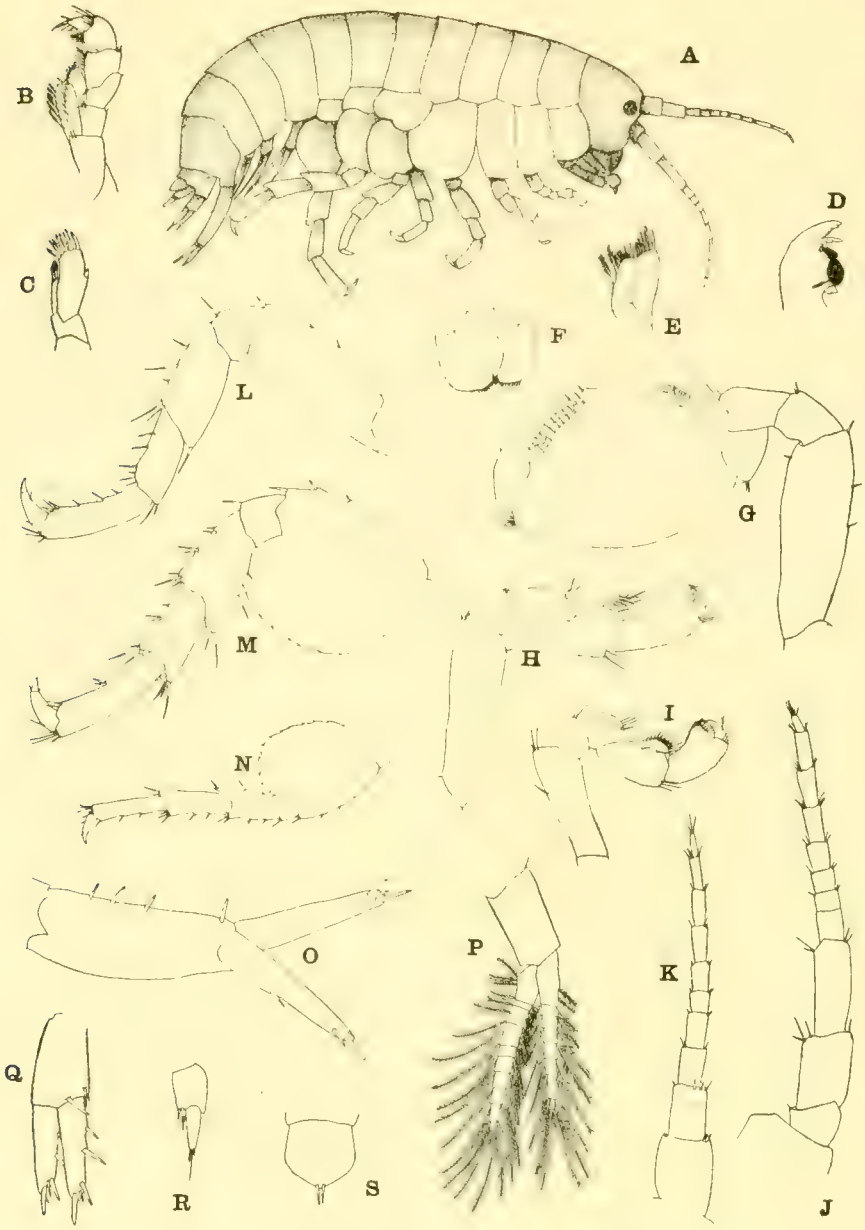


Figure 84. Hyalella azteca

A, Adult female. B, Maxillipeds. C, First maxilla. D, Mandible. E, Second maxilla. F, Lower lip. G, Second gnathopod of male. H, Second gnathopod of female. I, First gnathopod. J, Second antenna. K, First antenna. L, Second peraeopod. M, Third peraeopod. N, Fifth peraeopod. O, First uropod. P, First pleopod. Q, Second uropod. R, Third uropod. S, Telson.

Hyalella azteca (Sauss)

(Figure 84)

Body smooth, slightly compressed. Pleon segments one and two each produced into a small dorsal tooth. Side-plates one to four somewhat rectangular. Eyes nearly round. Antenna one, five to eight-jointed, flagellum longer than peduncle; joints of peduncle successively diminishing in length. Antenna two, slightly longer, the seven to ten-jointed flagellum longer than peduncle; joints of peduncle successively increasing in length. Maxillipeds, inner plate tipped with three short, stout spines, and edged on the inner side with slender compound setæ; outer plate with nine toothed spines and very small palp. Maxilla two, both plates apically fringed with fine spinules, which, on the inner plate, are edged with two plumose setæ. Mandible normal, principal and secondary plates dentate, plumose spinules in spine-row, molar large, with compound seta.

Gnathopod one, small, slender, fourth joint with small pellucid boss on the distal hind end; fifth joint with bulging hind margin, fringed with row of spines and short teeth; sixth joint not so wide, but sub-equal in length, hind margin covered with fine, short hairs, curved finger reaching to end of the transverse, toothed palm. Gnathopod two in both male and female, with bulging fifth joint edged with spines, sixth joint in male very large and stout, longer than broad, oblique palm with two notches underneath the strong, curved finger. Finger not reaching to hinder margin of palm, but closing between two spines just in front of a third notch. Gnathopod two in female, longer and stronger than gnathopod one, fifth joint considerably produced behind, sixth joint twice as long as widest part; hind part produced somewhat beyond the small curved finger and the convex, transverse palm. Peræopods three to five, second joint broadly expanded, serrate; peræopods four and five nearly equal in length. Pleopods plumose. Uropod three, ramus slender, tipped with setæ, and subequal to peduncle. Telson, broad as long; rounded apical margin with slender seta on either side of tip.

Specimens agreeing well with description of *H. azteca* in Das Tierreich, except in being smaller, and in having, commonly, fewer joints in the antennæ. They differ from the family description of *Talitridae* in having the inner plate of maxilla one tipped with three plumose setæ, and in having the fine spinules of the inner plate of maxilla two edged with two plumose setæ.

Color varying from light bluish green to light green and brown.

Frequent in fresh water pond about five miles inland from Laguna Beach, California. Coll. H. V. M. Hall.

SOME DIPTERA OF LAGUNA BEACH

F. R. COLE

Laguna Beach is an excellent collecting ground for *Diptera*. The hills and inland vegetation extend almost to the ocean in many places, and with the varied topography and conditions, the insects are very varied. The beach with its rocks, sand stretches, beach plants, and decaying wrack, is swarming with *Diptera*. A small, shallow brackish water lagoon at the inner edge of the beach gave some interesting results in *Diptera*, but *Diptera* were collected on the rocks even to within reach of the salt spray.

The collection of this year is but a mere beginning. I spent only a few weeks at Laguna, and a large part of this time was consumed in anatomical studies. Most of the flies reported in the present paper are either peculiar to the beach itself, or are found in the varied vegetation of the upper beach.

Without extensive assistance from Prof. J. M. Aldrich of the University of Idaho, it would have been impossible to present this paper at this time. Messrs. Knab and Hine have also kindly made determinations. The accompanying habit sketches of new species will be amplified by drawings of anatomical details, during the coming summer.

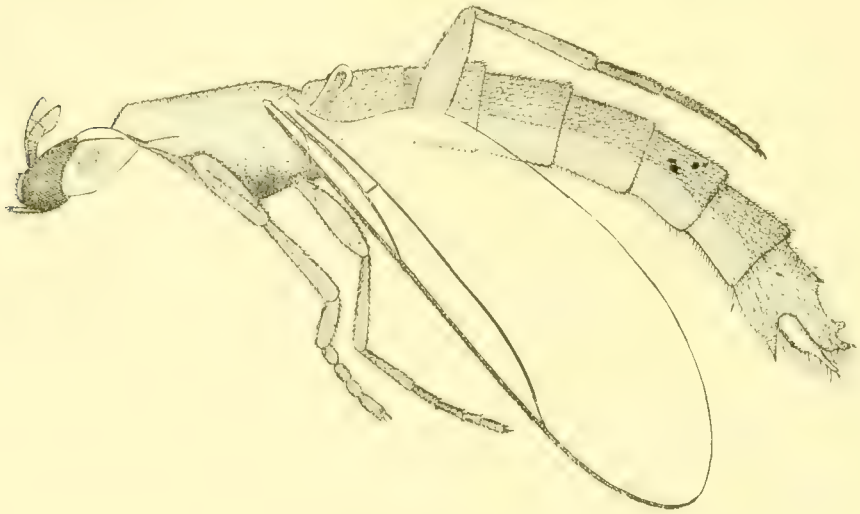


Figure 85. Scatopse californiana n. sp.

CULICIDAE

Aedes squamiger Coq.

This mosquito was common and occasionally annoying at Laguna, breeding in great numbers in the small brackish water lagoon. Determination by Mr. Knab.

BIBIONIDAE

Scatopse californica n. sp.

(Figure 85)

This is a small, slender black fly with polished body. The abdomen is about eight times as long as wide, and the head is long, narrow and flattened. The antennæ are large for the size of the head, and the eyes are long and narrow. The abdomen is thinly pilose, the hairs on the last segment and hypopygium longer than the rest. The tibiæ and tarsi are slender and broadened at the apical ends. The body is spineless. Last joint of antenna longest. Proboscis entirely black. Wings clear hyaline. Length 3 mm.

A single specimen collected by Prof. Baker. Apparently the first *Scatopse* noted as peculiar to the Pacific Coast.

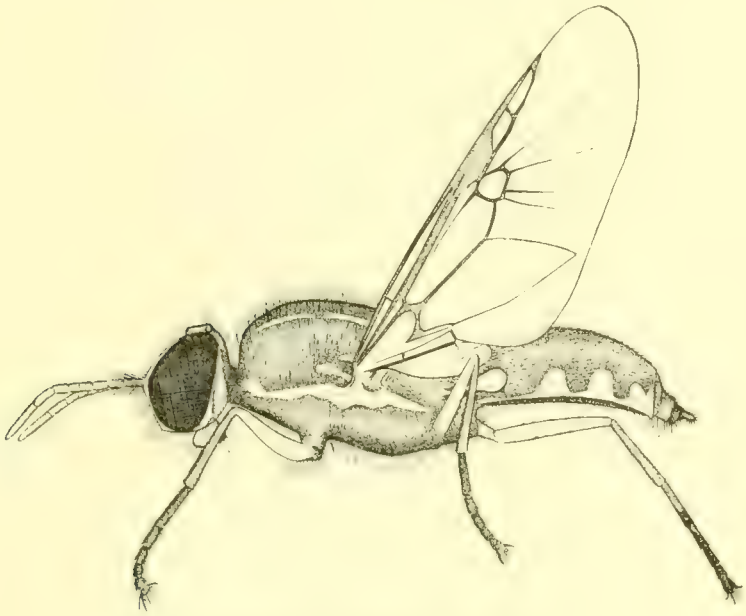


Figure 86. Euparyphus lagunae

STRATIOMYIDAE

Euparyphus lagunae n. sp.

(Figure 86)

A black, yellow marked fly, with a rather broad and flattened body. The last three joints of tarsi are black, the first two black on the distal ends. Body thinly pilose with long yellowish hair. Head flattened. Femora and tibiæ orange yellow, with no bristles. Front black and very narrow. Base of antennæ with two yellow stripes,

which pass part way down the face. Four basal joints of the antennæ with long dark bristle-like hairs. Last joint of antennæ slender and twice as long as any other joint. Two longitudinal narrow yellow stripes on the thorax do not quite reach the scutellum. Halteres lemon yellow. This fly is much darker than *E. bellus* or *E. ornatus*. Thorax above the wing with a small yellow patch, and a round yellow patch on the lower corner of each abdominal segment as seen from above. Last segment with base only black, the remainder yellow. Ventrally the first segment of the abdomen is black, the rest sordid yellow. Thorax black ventrally; there is a lateral narrow yellow stripe running from the base of the wing, the length of the thorax. Occiput convex and black. Mouth parts yellow. Most of the subcostal, and the end of the costal cell, is brown, the rest of the wing hyaline. Length 5.5 mm.; length of wing 5 mm.

A single specimen collected by Prof. Baker at Laguna Beach.

BOMBYLIDAE

Toxophora pellucida Coq.

Several specimens.

THEREVIDAE

Psilocephala costalis Lw.

Psilocephala laevigata Lw.

Psilocephala marcida Coq.

The above three flies were taken in vegetation just back from the beach.

ASILIDAE

Mallophora fautrix O. S.

Not uncommon. This species was described from Mexico.

Stichopogon trifasciatus Say.

(Figure 87)

This *Asilid* is widely distributed in the United States. At Laguna it was common on the beach sand. It is a silver gray fly, with black markings, and its colors blend with the sand perfectly. This protective coloration makes it very hard to locate when at rest. In habits it is a typical robber-fly. Determined by Prof. Hine.

EMPIDIDAE

Drapetis nitida Melander

This fly was very common on the beach sand. It is quite small and jet black, and runs rapidly here and there over the sand, seldom flying to any distance. It is also found on the edge of the lagoon and is very quick and hard to catch.

Figure 87. Stichopogon trifasciatus

Figure 88. Parathalassius melanderi

Parathalassius melanderi n. sp.

(Figure 88)

A small black fly, silvery gray pruinose, with all the bristles white. The hypopygium is darker. The vertex is broad and concave, and the face below the antennæ narrow, broadening again at the gray clypeus. The antennæ are dark brown, the first two joints small, the terminal arista slender and about twice as long as the third joint of the antennæ. The lower half of eye covered with fine white pubescence. A fringe of bristles around the eye as in *P. aldrichi.* The proboscis is small and blackish. The abdomen has a transverse basal row of black pits on each segment. The hypopygium is large and globular, the top almost bare, and attached to the left side of the body as in *P. aldrichi.* The legs are slender and covered with short white bristles, and with no apical spurs, as in *P. aldrichi.* Under side of front and hind femora with heavy white bristles, the knees and tarsi yellow. Halteres whitish. Three conspicuous black pits along the lower edge of each abdominal tergite. There are six pairs of long dorso-central bristles on the thorax, two scutellar bristles, but no pleural or supra-alar bristles. Anal vein not much longer than anal cross vein. The ends of the wings are broadly brownish. Length 2 mm.

Two specimens collected at Laguna, on the wet sand at the very edge of the surf.

PHORIDAE

Trineura velutina Meig.

Occasional about decaying kelp.

PIPUNCULIDAE

Chalurus spurius Fall.

SYRPHIDAE

Nausigaster unimaculatus Twns.

Paragus tibialis Fall.

Eristalis tenax L.

The above four flies are frequent in the vegetation just back of beach.

CONOPIDAE

Occemyia baroni Will.

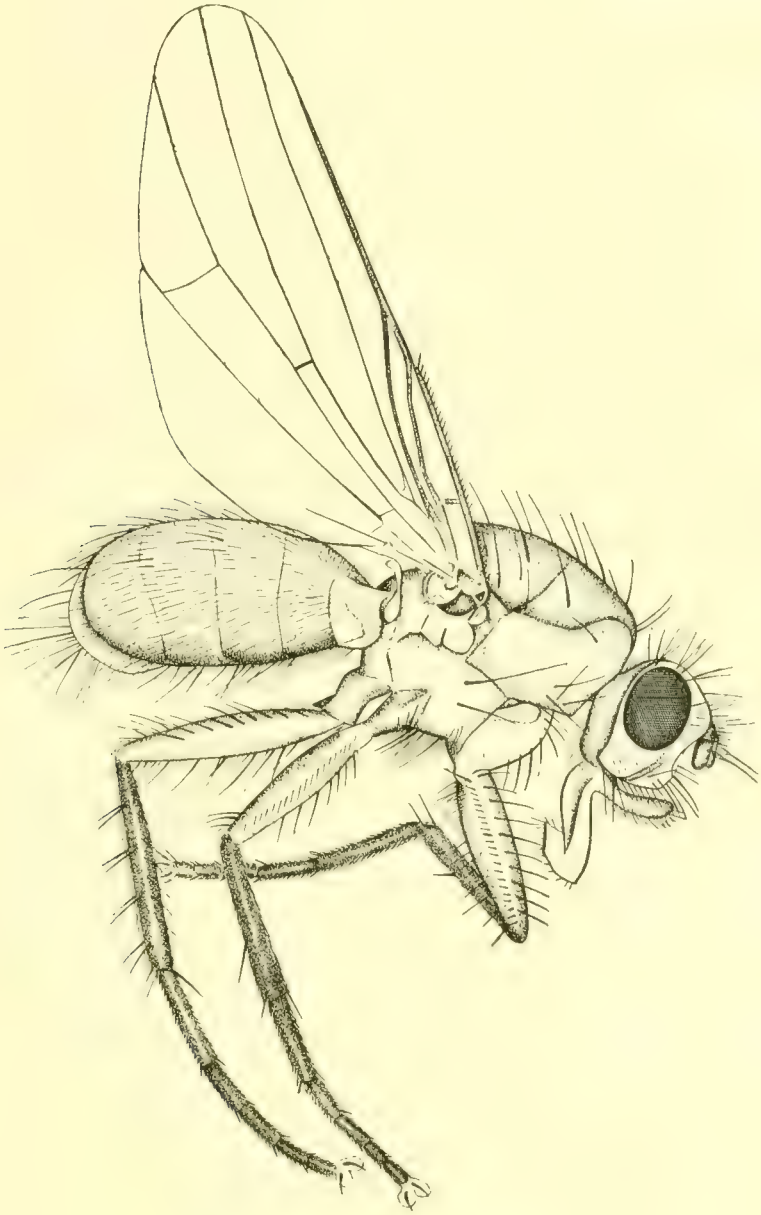


Figure 89. Fucellia rufitibia

TACHINIDAE

Clausicella setigera Thom.
Plagiprospherysa parvipalis V. d. W.
Senotainia trilineata V. d. W.
Goniochaeta plagioides Twns.

Aldrich says of this: "New to me, and one of the few that Coquillet did not include in his Revision. This is a big find." Townsend described this from Las Cruces, N. M.

MUSCIDAE

Chrysemyia nigripes Wheeler
Pseudopyrellia cornicina Fab.
Myiospila meditabunda Fab.
Muscina stabulans Fall.

The above four flies were very common.

ANTHOMYIDAE

Hylemyia alcathoe Wlk.
Pegomyia affinis Stein
Caricea nana Zett.

The above three flies are common in vegetation back of beach.

Fucellia costalis Stein

This species is quite common on decaying kelp. They are large, quick flies. They seem to be at least partially predaceous in habit, as I have seen them pounce upon weakened sand-hoppers and by their numbers soon overcome them.

Fucellia rufitibia Stein
(Figure 89)

There are myriads of this fly swarming over the decaying kelp. They are found with *F. costalis,* which, however, they vastly outnumber. They are slow of flight and easy to catch.

PHYCODROMIDAE

Coelops frigida Fall.

Common on decaying kelp.

SAPROMYZIDAE

Sapromyza flaveola Coq.

Abundant in vegetation near beach.

Sapromyza fraterna Lw.

Occasional with the last species.

Figure 90. Lauxania pacifica n. sp.

Lauxania pacifica n. sp.

(Figure 90)

A shining black fly, with front and face brownish red, base of antennæ lighter. Abdomen gray pruinose, and quite thickly covered with reclinate bristles. Antennæ three-jointed, third joint about four times as long as wide; dorsal arista is slender and bare, and about the length of the antenna. Halteres yellowish. Legs light brown; a long spine on the under side of front femora, and a long spine on the mesopleura. There are four long scutellar bristles, and one sternopleural bristle. The lateral bristles of the abdomen are quite long. The length of the costal cell is about four times its width. The subcostal cell reaches hardly half way to the tip of the wing, and the basal cells are very small. Wings yellowish hyaline. Length about 4 mm.

Collected at Laguna Beach by Prof. Baker. I have compared this with descriptions of *variceps, longicornis, nigrimana, cinerea,* and *lutea.*

ORTALIDAE

Chaetopsis aenea Wd.

Euxesta compta n. sp.

(Figure 91)

Light reddish brown, gray pruinose, the abdomen more gray. Differs widely from *notata, nitidiventris, stigmatus, fascipennis,* and *abdominalis,* which are either black or bluish in general coloration. Antennæ red brown, the arista and third joint at base darker. The occiput is rather convex. Legs same color as body, the last four joints of the metatarsi darkened. Head quite large, front broad, bristles black. This species is perhaps closest to *laticeps* in color, but darker. Like *laticeps,* the body is thinly gray pruinose. The antennæ are not so bare as in laticeps. Four bristles on the vertical triangle, two in front and two behind. Abdomen well clothed with bristles. Costal cell and end of wing smoky. Length 4 mm.; wing 3.25 mm.

Collected at Laguna Beach by Prof. Baker.

TRYPETIDAE

Eutreta sparsa Wied.

Ensina humilis Lw.

Euaresta abstersa Lw.

Euaresta aequalis Lw.

Urellia maverna Wlk.

All of the above Trypetids were frequent in the vegetation back from the beach.

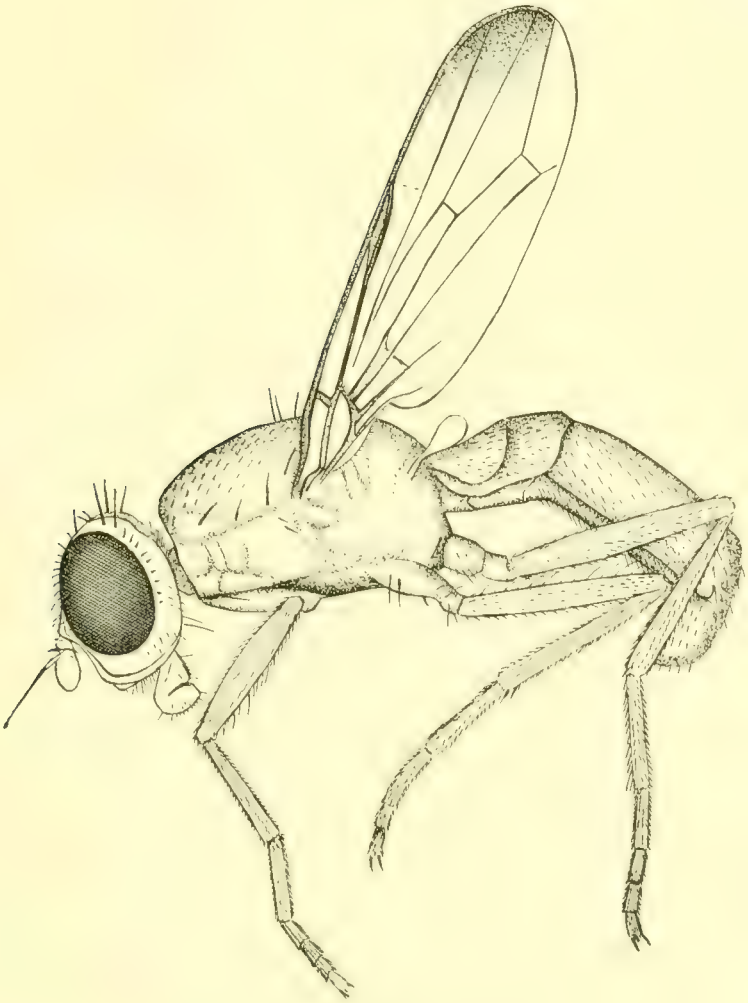


Figure 91. Euxesta compta n. sp.

EPHYDRIDAE

Notiphila quadrisestosa Thoms.
Allotrichoma litoralis n. sp.

(Figure 92)

A very small dark gray fly. Third joint of antennæ hairy, and with a dorsal pectinate arista. The femora are quite stout. Eyes reddish. Halteres whitish. Front very broad and gray pruinose. The thorax with many reclinate spines. Lateral facial spines long. Proboscis large and fleshy. Two pairs of vertical bristles and two pair of ocellar bristles, one pair of the latter very small. The upper half of the eye is hairy. There are two metapleural spines, two sternopleurals, and one mesopleural spine. The wing is very simple, the basal cells small and not clear. The wings are smoky-hyaline. Length 1.25 mm.

A number of specimens taken at Laguna on the edge of the small brackish lagoon not far from the ocean, usually consorting with *Limosina*. *Allotrichoma abdominalis* is reported from West Indies and Brazil.

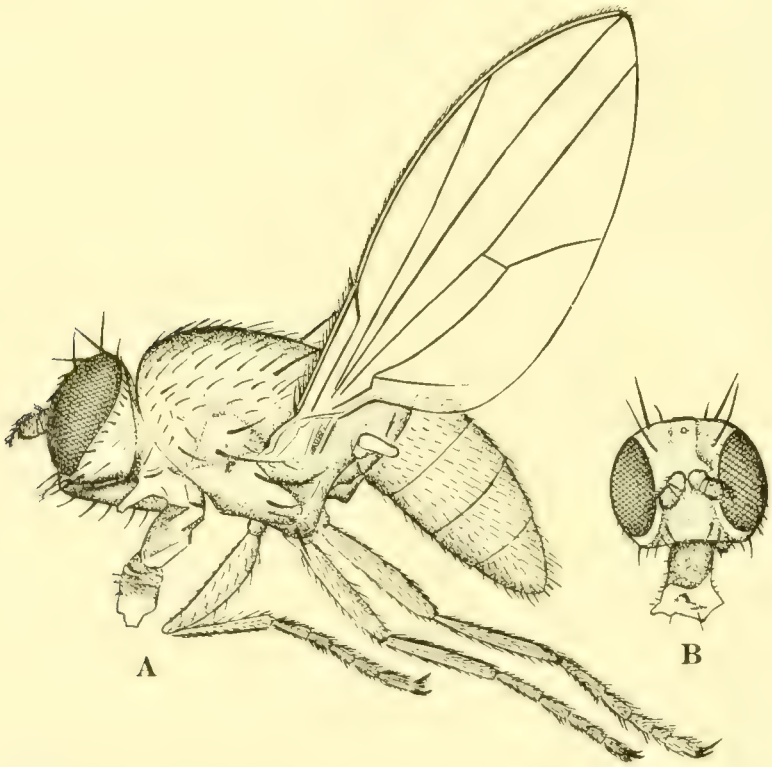


Figure 92. A, Allotrichoma littoralis n. sp. B, Face of Allotrichoma

Figure 93. Lipochaeta slossonae

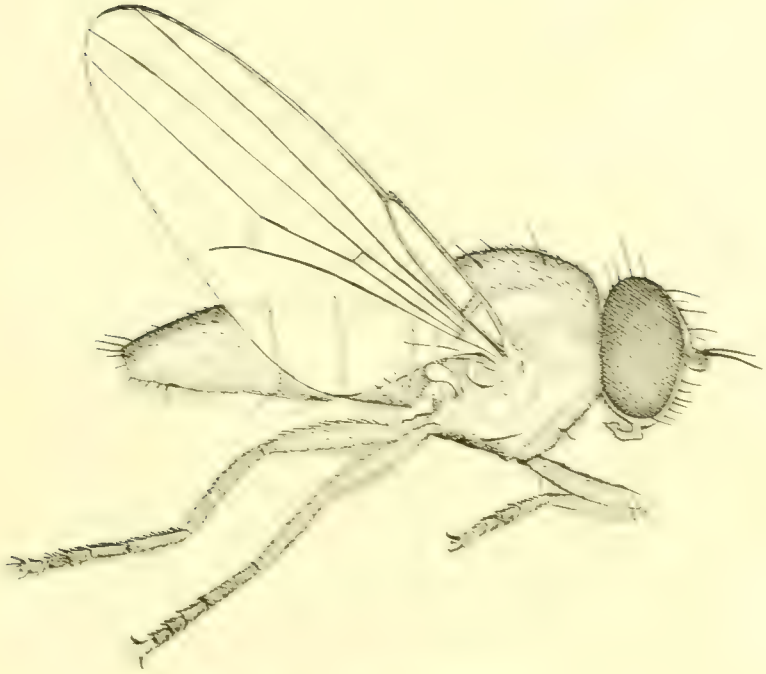


Figure 94. Milichiella nigrella

Psilopa atra Lw.

Psilopa mellipes Coq.

Both of these *Psilopas* were occasional about the lagoon.

Ephydra gracilis Pack.

Aldrich says of this: "Described from Great Salt Lake, where it is inconceivably abundant, even stopping trains. I did not find it any where on my recent trip except at that lake, though the U. S. Nat. Museum has it from Salton Sea and Yuma, Arizona. The *opaca* of Jones is a synonym."

Ephydra subopaca var. **millbrae** Jones

Occurs with the above.

Lipochaeta slossonae Coq.

(Figure 93)

Frequent on the beach at Laguna.

OSCINIDAE

Mosillus subsultans Fab.

The *aeneus* of the Aldrich Catalog. Very common on the beach and in the vicinity of the brackish water lagoon.

GEOMYZIDAE

Scyphella flava L.

AGROMYZIDAE

Rhicnoessa parvula Lw.

Milichiella nigrella n. sp.

(Figure 94)

A polished jet black fly, with black legs. Halteres white. Eyes gray. Antennæ very short, the third joint rounded and covered with short fine gray hairs. The dorsal arista is bare and slender. The last four joints of the metatarsi very short. Last segment of abdomen longest and with long lateral spines. One long supra-alar spine, and many short reclinate spines on thorax and abdomen. Scutellum small and rounded and with two long spines. Two pairs of vertical bristles, and one quite long heavy spine on the second joint of the antenna; two pairs of short fronto-orbital spines. The first vein of the wing is very heavy and brown in color. A dark spot at the tip of the costal cell; wings otherwise hyaline. Length 3 mm.; length of wing 2.75 mm.

A number of specimens were taken on the beach at Laguna but it is not common.

LEPIDOPTERA COLLECTED AT LAGUNA BEACH, CALIFORNIA

HARRISON G. DYAR

The following moths flew to light in Prof. Baker's tent at Laguna Beach the past summer. The character of these few accidental specimens indicates what very interesting work might be done at Laguna Beach by a little systematic effort in this direction. It is to be hoped that active work in the Lepidoptera will be continued there.

ARCTIIDAE

Apantesis proxima autholea Boisduval

One male specimen.

NOCTUIDAE

Copibryophila angelica Smith

Nine specimens.

Autographa brassicae Riley

One specimen.

GEOMETRIDAE

Hydriomene custodiata Guenée

Four specimens.

Chlorechlamys chloroleucaria Guenée

One specimen.

Cosymbia serrulata Packard

Six specimens.

Eois ptelearia Riley

One specimen.

Sciagraphia californiaria Packard

One specimen.

Platea californiaria Herrich-Schaeffer

One specimen.

Animomyia morta Dyar

Two specimens.

PYRALIDÆ

PYRAUSTINAE

Nomophila noctuella Dennis and Schiffermuller

Two specimens.

Glaphyria reluctalis Hulst

One specimen.

PHYCITINAE

Ephestiodes gilvescentella Ragonot

Three specimens.

Maricopa mirabilicornella Dyar

One specimen.

CRAMBINAE

Dicymolomia metalliferalis Packard

One specimen.

Thaumatopsis lagunella n. s.

Thorax and fore wing ochre yellow, the wing shaded with gray in a band below median vein and on terminal third; medial vein narrowly white; discal venules also white; a black streak in lower part of cell, continued beyond to apex, where it is bent sharply upward; an oblique brown median line from end of cell to inner third of wing on inner margin, flexuous in the middle; a submarginal gray line parallel to termen; a terminal row of black dots; a bright leaden line at base of fringe. Hind wing gray. Expanse 26 mm.

One female specimen.

Type No. 14349, U. S. National Museum.

Allied to *fernaldella* Kearfott, but with the cross-lines more distinct, the discal venules paler and relieved on a gray ground.

The identification of this form leads me to make some passing comment on Mr. W. D. Kearfott's article on *Thaumatopsis* (Proc. U. S. Nat. Mus., XXXV, 386, 1909), to which I naturally turned for the identification of the specimen. An analytical key to the species is there given, but to me it proves worthless, for the characters given are quite contradictory to the actual species as I know them. For example, *edonis* Grote is given with a white median streak, which is in fact conspicuously absent; *pexella* Zeller is said to have no median streak, whereas it is always more or less evident, often distinctly white. Lest this be thought to be a transposition, due to the accidents of typography, we find *gibsonella* Kearfott and *coloradella* Kearfott also under the heading "median streak not white," which is certainly

true of *gibsonella,* a northern degraded form of *edonis,* and true also to a certain degree of *coloradella,* a small degenerate form of *pexella;* but the separation of *coloradella* and *pexella* is more apparent than real, *coloradella* being called "whitish brown," *pexella,* "pale ocherous." As a matter of fact they are of the same color, *coloradella* being only a smaller, less distinctly marked form. *Pectinifer* Zeller stand under the heading "fore wing chocolate brown," whereas Zeller says in his original description that it is "bleich ockergelb." No mention is made of *daeckeellus* Kearfott (Journ. N. Y. Ent. Soc., XI, 149, 1903), but this is not improbably due to the tacit acceptance of its reference to the synonymy of *striatella* Fernald, which I once made to Mr. Kearfott by letter. Mr. Kearfott's article was published in the Proceedings of the U. S. National Museum, and is therefore supposed to have been founded upon museum material. To comply with this requirement, the author of the paper deposited types of many of his species in the collection. What was my surprise to discover that of five cotypes of *coloradella* so deposited, two of them especially labelled by Mr. Kearfott, no less than four were spurious types, the localities from which they came not being mentioned in the original description at all! Moreover, two of them are true *pexella,* and not the form *coloradella.*

However, it is not my purpose to write a hostile criticism of Mr. Kearfott's paper, much as it failed me in an emergency. Perhaps if he had written by daylight instead of by electric light, he would have seen the specimens in the same colors that I do. The separation of *repanda* Grote and *crenulatella* Kearfott by the pectinations of the male antennæ shows careful observation, while the description of *fernaldella* corrects a prevalent misidentification, this form being still called "*pectinifer* Zeller," even recently in the British Museum.

Diatraea epia n. s.

White, silvery, the body parts grayish white; fore wing largely overwashed with pale ochre scales, in, below and beyond the cell and along submedian space; subterminally are ochre streaks between the veins, uniting to form a submarginal line, a powdering of dark brown scales about the yellow patch beyond the cell and throughout the submedian fold, also subterminally on the veins and in diffuse patches terminally; fringe white with brown central line and brown tips. Hind wing pale gray outwardly. Expanse, 21 mm.

One female.

Type, No. 14351, U. S. National Museum.

Diatraea prosenes n. s.

White, silvery, the body parts grayish white; fore wing shaded with dull ocherous brown broadly between the veins, the streaks

nearly filling the cell and subcostal region, but not strongly separated or contrasted from the white ground; a curved line of this color close to the outer margin; some brown scattened scales on the veins, forming lines outwardly on veins five and seven and more diffused marks at the bases of veins three and four; some diffused marginal groups of brown scales; fringe interlined and tipped with brown. Hind wing pale gray outwardly. Expanse, 22 mm.

One female.

Type, No. 14352, U. S. National Museum.

These two specimens, though very much alike, represent distinct species, I think. The collection of series only will make the matter certain.

MICROLEPIDOPTERA FROM LAGUNA BEACH, SOUTHERN CALIFORNIA

AUGUST BUSCK

I am under obligation to Prof. C. F. Baker for some Microlepidoptera, which flew into his tent last summer at Laguna Beach, Southern California.

The collection has been deposited in U. S. National Museum and contained the following species:

Platyptilia marmarodactyla Dyar

U. S. Nat. Mus. Bull. 52, No. 4938, 1903.

Bactra lanceolana, Hübner

U. S. Nat. Mus. Bull. 52, No. 5006, 1903.

Eucosma ridingsana Robinson

U. S. Nat. Mus. Bull. 52, No. 5083, 1903.

Eucosma pulveratana Walsingham

U. S. Nat. Mus. Bull. 52, No. 5122, 1903.

Phthorimaea operculella Zeller

U. S. Nat. Mus. Bull. 52, No. 5616, 1903.

Gnorimoschema henshawiella Busck

Proc. U. S. Nat. Mus. XXV, p. 831, 1903.

Gnorimoschema laguna n. s.

Labial palpi light ochreous; extreme base and a small dot on terminal joint just below apex brown. Face light ochreous. Head and thorax light reddish ochreous; pata gina deer-brown. Forewings deer-brown with a large basal dorsal area light reddish ochreous; this area extends from base to apical third along dorsum and is produced up beyond the fold in a large triangular spur to the middle of the cell and in a smaller wave at basal third. Cilia ochreous, dusted with brown. Hindwings light silvery fuscous; cilia light ochreous. Abdomen ochreous, lighter underneath, with velvety deep ochreous spots on upper side of basal joints. Legs brown with the joints ochreous.

Alar expanse, 19 mm.

Habitat—Laguna Beach, Southern California; C. F. Baker, coll.

U. S. Nat. Mus. Type, No. 14335.

This species belongs to the *gallae-solidaginis* group and is close to the type of the genus, but easily distinguished by the light ochreous head and the lighter general color.

Gelechia figurella n. s.

Labial palpi silvery white, dusted with stone-gray exteriorly; tuft on second joint well developed, furrowed, longer at base than at tip. Face silvery white. Head and thorax ochreous, thickly suffused with stone-gray and dark ochreous scales, which totally obscure the ground-color except on the veins, which stand forth as clear-cut thin whitish ochreous lines; the entire venation even to the fork at base of vein 1^b is plainly pictured on the upper surface of the wings. Cilia silvery white. Hindwings silvery white. Abdomen and legs light ochreous.

Alar expanse, 21 mm.

Habitat—Laguna Beach, Southern California. C. F. Baker, coll.

U. S. Nat. Mus. Type, No. 14336.

Allied to *Gelechia striatella* Busck, but a larger and much lighter and neater species.

Scythris sponsella Busck

Journ. N. York Ent. Soc. XV, p. 139, 1907.

Paraneura simulella Dietz

Trans. Am. Ent. Soc. Phil. XXXI, p. 12, 1905.

Amydria coloradella Dietz

Trans. Am. Ent. Soc. Phil. XXXI, p. 6, 1905.

Setomorpha rutella, Zeller

Kongl. Svensk. Vet. Ak. Handl., p. 93, 1852.

Setomorpha operosella Zeller

U. S. Nat. Mus. Bull 52, No. 6549, 1903.

Acrolophus occidens Busck

Proc. Wash. Ent. Soc. XI, p. 186, 1909.

Acrolophus flavicomus n. s.

Labial palpi curved, ascending, short, hardly reaching vertex; loosely tufted on first joint and in less degree on second and third joint; light ochreous; terminal joint dark brown above. Head and thorax ochreous brown. Forewings light, ochreous brown with two dark ill-defined streaks, forming an irregular cross; one from the middle of dorsum to costa just before apex; the other from tornus to basal fourth of costa; the latter is often more or less broken up

and is easily partly lost in rubbed specimens. Still more easily lost and in fact only preserved in perfect specimens is a series of five undulating lines of white raised scales across the wing; on the fold in the central one of these white lines is an ill-defined black dot and the outer crossline contains two or three small patches of black scales before the terminal edge. Cilia light ochreous. Hindwings dark fuscous. Abdomen dark fuscous. Legs ochreous fuscous with faintly annulated tarsal joints.

Alar expanse, 19 mm.

Habitat—Laguna Beach, Southern California. C. F. Baker, coll.

U. S. Nat. Mus. Type, No. 14337.

This species belongs to the group, described under the generic name *Eulepiste* Wlsm. and comes closest to *cressoni* Wlsm. and *maculifer* Wlsm., but is amply distinguished by the ornamentation. The various genera, erected in the family *Acrolophidae* on the secondary sexual characters of the labial palpi can not be maintained. (See Proc. Wash. Ent. Soc. XI, p. 186, 1909).

SOME COLEOPTERA OF THE BEACH AT LAGUNA

WITH DESCRIPTIONS OF NEW SPECIES BY DR. M. BERNHAUER

C. F. BAKER

No thorough collecting of Coleoptera was done at Laguna during the first year. However, in all our work along the beach and near the beach, beetles were collected wherever possible. Masses of decaying kelp on the upper beach commonly swarmed with myriads of *Staphylinidae, Cercyon,* and *Acritus.* Common on the sand of the upper beach and driven out in considerable numbers by unusually high tides occurred *Dyschirius marinus, Pontomalota opaca, Emphyastes fucicola* and *Phycocoetes testaceus.* The *Dyschirius, Pontomalota* and *Phycocoetes* are remarkably protected on the sand, by their color. All four of these beetles appeared to be much more active in the late afternoon.

The vegetation of the upper beach included the usual array of maritime plants like *Salicornia, Heliotropium, Atriplex, Frankenia,* etc., and at the mouth of a small stream, *Cyperus, Salix, Typha,* etc. A few beetles were also taken among these latter plants. The whole locality would doubtless yield rich returns by careful collecting, as is evidenced by the new *Lappus,* the new *Endalus* found commonly on *Cyperus,* and by various new Staphylinidæ.

The determinations of species have mostly been made by Prof. H. C. Fall, to whom we are much indebted for this and other favors. Dr. Bernhauer has worked up the Staphylinidæ, a task for which he is always very willing.

CARABIDAE

Dyschirius marinus Lec.

Common on open sand areas of the upper beach.

HYDROPHILIDAE

Cercyon fimbriatum Mann.

Occasional in masses of rotting kelp.

STAPHYLINIDAE

Pontomalota bakeri Bernhauer nov. sp.

"Rufotestacea, opaca, abdomine ad apicem minus opaco, segmento sexto parum obscuriore, thorace parum transverso, angulis posticis subrotundatis; abdomine antice opaco-reticulato, postice subtiliter

dense punctato, segmento septimo maris asperato-punctata. Long. 3 mm.

Von Dr. Fenyes in Sud-Kalifornien (Redondo) entdeckt. Mit *Pontomalota opaca* Lec. sehr nahe verwandt und leicht mit ihr zu verwechseln, jedoch durch den vorn ganz maten, glanzlosen Hinterleib sowie weiters noch durch folgende Merkmale leicht zu unterschieden: breiter und kurzer. Der Halsschild ist um ein guter Stuck breiter als lang, die Hinterecken weniger angedeutet, verrundet. Der Hinterleib ist auf den vorderen 3 frei leigenden Tergiten gleichmassig dicht chagriniert matt, wahrend bei *opaca* Lec. diese Tergite deutlich und dicht punktiert, sind, auch treten mehr oder minur auffallig 2 dunklere Langsflecke zu beiden Seiten der chite dieser Tergite auf, welche nach hinten convergieren, wahrend solche Makeln bei *opaca* nicht vorhanden sind. Ursprunglich hist ich, da ich einerzeit die neue Art unter dem Namen *opaca* Lec. erhalten hatte, die echte *opaca* Lec. fur eine neue Art. Nach der Leconte'schen Beschreibung kann aber als *opaca* nur die auf den vorderen Tergiten deutlich punktierte Art, angeschen werden, da Leconte ausdruck, lich nur den Vorderkorper als mattchagriniert bezeichnet.

Pontomalota opaca Lec. wurde von Prof. Baker in S. Kalifornien (Laguna Beach) erbeutet.''

Pontomalota opaca Lec.

Common at Laguna running over the sand of the upper beach.

Tarphiota pallidipes Casey

Common in decaying kelp.

Cafius canescens Makl. var.

Common in decaying kelp.

Cafius lithocharinus Lec.

In myriads in decaying kelp.

Cafius luteipennis Morn.

Common under decaying kelp.

Cafius sulcicollis Lec.

Abundant in kelp.

Bledius albidipennis Bernhauer nov. spec.

''Niger, subopacus, subænescens, elytris praeter basius angustam suturam que albidis, antennis oreque piceis, pedibus læte flavis, thorace subcordato, sat transverso canaliculato, dense alutaceo, subtiliter minus dense punctato. Long. 4 mm.

Sud-Kalifornien: Laguna Beach (leg. Baker). Eine durch ihre farbung und die Skulptur, namerlich des Halsschildes sehr ausgezeichnete Art. Schwarz mit weisgelben flugeldecken, deren ausserste Basis und Naht dunkel gefarbt sind, deutlich etwas erglanzend, die fuhler und der Mund schmutzig gelb, die ersteren gegen die Spitze schwarzlich, die seine blassgelb. Der Kopf ist ausserst dicht und fein chagriniert, vollkommen matt und uber dies weitlaufig und ausserst zart kaum whr nehmbar punktiert. Halsschild um ein gutes Stuck schmaler als die flugeldecken, fast um die Halfte breiter als lang, vorn aus geschnitten mit spitzen Vorderecken, nach ruchwarts aus geschweift verengt die Hinterecken zahnformig vortretend, in den Mittellinie scharf gefurcht, uberall aussertst dicht, jedoch ziemlich gron chraginiert und uber dies fein und wenig dicht punktiert, mit sehr geringem Glanze. Flugeldecken fast doppelt so lang als der Halsschild, fren und sehr dicht punktiert, glanzender als der Halsschild. Hinterleib ziemlich fein und wenig dicht, an den Seiten dichter punktiert und daselbst lang begaart.

Herr. Professor Baker fiend diese schone Art an der Meereskuste unter ausgeworfenem Tang.''

COCCINELLIDAE

Hippodamia ambigua Lec.

Coccinella californica Fab.

Scymus marginicollis Mann.

All these coccinellids are common on the upper beach.

HISTERIDAE

Acritus maritimus Lec.

Common under decaying kelp.

MALACHIDAE

Attalus trimaculatus Mots.

Frequent on upper beach among plants.

Trichochrous aenescens Lec.

Common on upper beach.

Trichochrous squalidus Lec.

Frequent on upper beach.

SCARABAEIDAE

Cyclocephala villosa Burm.

Frequent at light.

Serica mixta Lec.

Common at light.

CHRYSOMELIDAE

Pachybrachys punctatus Bowditch

Common on upper beach.

Glyptoscelis squamulatus Cr.

Occasional on upper beach.

Trirhabda flavolimbata Mann.

Common on willows.

Psylliodes punctulatus Mels.

Occasional on upper beach.

Longitarsus livens Lec.

Abundant on *Heliotropium curassavicum*.

ANTHICIDAE

Notoxus constrictus Casey

Common on upper beach.

Lappus n. sp.

Also common on upper beach.

CURCULIONIDAE

Emphyastes fucicola Mann.

We found this but rarely in the masses of decaying kelp, but it was common crawling over open sand just above the upper tide limit.

Endalus n. sp.

Found resting in ripe seed heads of a *Cyperus* just back of the beach, sometimes several in a head.

Phycocoetes testaceus Lec.

Abundant crawling over sand.

Epimechus mimicus Dietz

Occasional on upper beach. Both this and the preceding species present, by reason of their pale yellowish color, a most remarkable adaptation to life on the sand.

MALLOPHAGA FROM BIRDS AT LAGUNA BEACH, CALIFORNIA

JOHN H. PAINE
STANFORD UNIVERSITY, CALIFORNIA

The following list of determinations, with one new species, was made from material collected at Laguna Beach, California, by Mr. Leon Gardner.

Docophorus communis Nitzsch

A number of specimens from *Zamelodia melanocephala*, the Black-headed Grosbeak.

Docophorus lari Denny

Two specimens from *Larus occidentalis*, the common Western Herring Gull.

Docophorus excisus var. **major** Kellogg

One female of this species, with its curiously incised clypeus, from *Petrochelidon lunifrons*, the Cliff Swallow.

Nirmus foedus Kellogg and Chapman

Specimens from *Zenaidura macroura*, *Sayornis nigricans semiatra* and *Tyrannus verticalis*.

Nirmus splendidus Kellogg

A number of specimens from the California Thrasher, *Toxostoma redivivum*, and from the Roadrunner, *Geococcyx californianus*.

Nirmus maritimus Kellogg and Chapman

A large number of specimens from *Ptychoramphus aleuticus*, the Cassin Auklet.

Nirmus fuscus Nitsch

Two individuals from a Sparrow Hawk (*Falco sparverius desertícola*).

Nirmus longus Kellogg

Six specimens from *Petrochelidon lunifrons*.

Lipeurus baculoides n. sp.

(Figure 95)

Numerous males and females from the mourning dove, *Zenaidura macroura*. This species resembles *L. baculus*, the common parasite of pigeons, possessing the two modified hairs on the clypeus, a char-

acteristic of *L. baculus*. However, the male antennæ differ markedly in the new species, which is also much smaller, with shorter abdomen.

Description of male: color pale with chestnut and black markings; head resembling *L. baculus*, but with broader, rounded temples; two peculiarly flattened, modified hairs on the clypeus. Length of segments of antennæ similar to those in female, excepting second which is slightly longer; third segment with slight indication of an appendage. (Figure 95 D and E).

Thorax pale in color with dark, often black, markings. Abdomen elongate, shorter and broader than in *L. baculus* with pale median blotches and dark lateral bands. Last segment consisting of two rounded lobes; last segment in the female formed of two larger triangular lobes.

	Male		Female	
	Length	*Width*	*Length*	*Width*
Body	2.06		2.24	
Head	.52	.30	.56	.32
Thorax	.38	.28	.38	.30
Abdomen	1.16	.36	1.30	.40

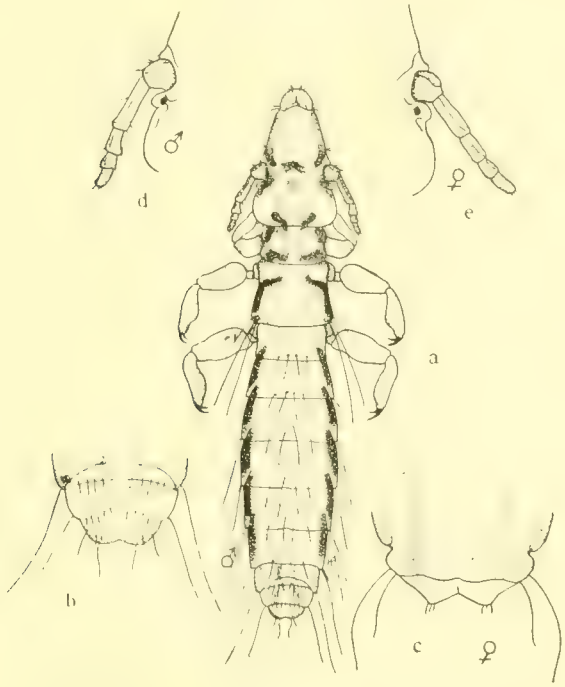


Figure 95. Lipeurus baculoides Paine

A, Adult male. B, posterior segments of male. C, Posterior segments of female. D, Antenna of male. E, Antenna of female.

Colpocephalum timidum Kellogg

Numerous specimens from *Limosa fedoa,* the Marbled Godwit.

Colpocephalum kelloggi Osborn

One male from a buzzard (*Cathartes aurea*), Aliso Canyon.

Menopon malleus Nitzsch

One female specimen of this rather rare species from the Cliff Swallow (*Petrochelidon lunifrons.*)

Menopon dissimile Kellogg

Two specimens also from the Cliff Swallow (*Petrochelidon lunifrons*).

Menopon alternatum Osborn

A small number collected from a buzzard (*Cathartes aurea*), Aliso Canyon.

Menopon funereum Kellogg and Chapman

Three specimens from *Aphelocoma californica,* the California Jay.

SOME MARINE AND TERRESTRIAL ACARINA OF LAGUNA BEACH

HARRY V. M. HALL

During the summer we picked up quite a series of mites, many of them new species. From this material I describe the following mites which are mostly marine or littoral. Among them the Gamasidæ are represented by a species that is parasitic on the large beach amphipods, a Sarcoptid was taken from one of the birds, the Trombididæ are represented by a large red Rhyncolophid common on the dry sand of the upper beach, the Hydrachnids by a new marine species and the Halicaridæ by three new species. In the last two families good series were obtained but only by means of much towing and patient search.

Seius orchestoideae n. sp.

(Figure 96)

Length without rostrum 641 micrm., 542 micrm.; width 410 micrm., 320 micrm. Length of legs one and four about 520 micrm.; length of legs two and three about 400 micrm. Color of female light straw, that of male still lighter; smooth but not polished. Dorsal plate entire and covering whole dorsum. Shape ovoid, the anterior end somewhat sharper (especially so in the male) and the posterior end rather flattened (also most marked in the male). Body broadest one-third of the way from the posterior end. The outline form above runs to the rounded anterior point without any shoulder-like bulge in either sex. Dorsal surface evenly convex. Mandibles greatly retractile (shown extended in the figure but can be drawn wholly within the body). Both arms of chelæ short, stout. The fixed arm with a terminal beak proximal to which is one other tooth; the movable arm has two teeth which fit between and proximal to those on the fixed arm. From the movable arm and pointing outward and forward is a cylindrical process slightly swollen at the end in the male but not so swollen in the female. This process is about the same diameter as one of the leg-spines measured at the base of such a spine. Coxæ almost contiguous and legs long, without apophyses in either sex; all legs sparsely set with short, stout spines and terminated by short caruncles with claws on all legs. Dorsal surface with a few very heavy spines, over twice the diameter of those on the legs and placed as follows: (except for the first pair at anterior margin and close together, all these spines are directed

backwards): A double row of four pairs of spines extends back through the medial section of the dorsum as far as back edge of coxa three. Beginning over the front edge of coxa two, a sub-marginal row of three, and a marginal row of three, extend back as far as back edge of coxa three. The longest pair of spines in the dorsum are situated behind and equally distant from the terminal spines of the medial and sub-marginal rows of their respective sides. Around the posterior end of the abdomen on dorsal and ventral sides are scattering, fine, short spines. Peritreme long and only slightly bent around coxa two and extending forward past coxa one. Anal plate separate in both sexes, large, broad, and not pointed behind but

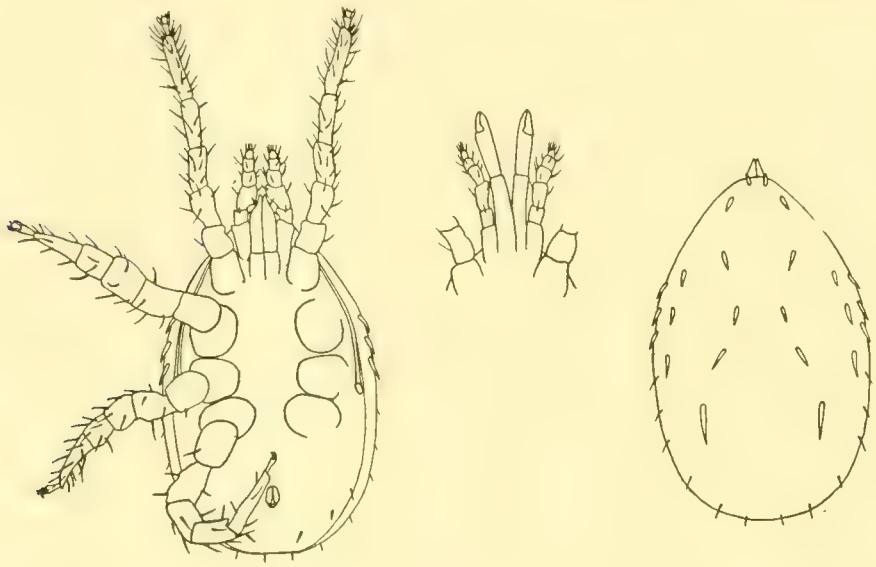


Figure 96. Seius orchestoideae

with the posterior margin straight across; all corners rounded. Anal opening in the center. Male genital opening on anterior margin of sternal plate; no teeth on the legs.

From the foregoing characters this species according to Banks's key belongs in the genus Seius, which however he says has been divided by Ribaga into four sub-genera. As I have not been able to obtain Ribaga's paper, it seems best to place my specimens provisionally in the genus Seius sens. lat. This species was taken from the large amphipod *Orchestoidea californiana,* which is common on the beach. The mites were fastened underneath the body and as many as twenty-seven were taken from one amphipod, and great

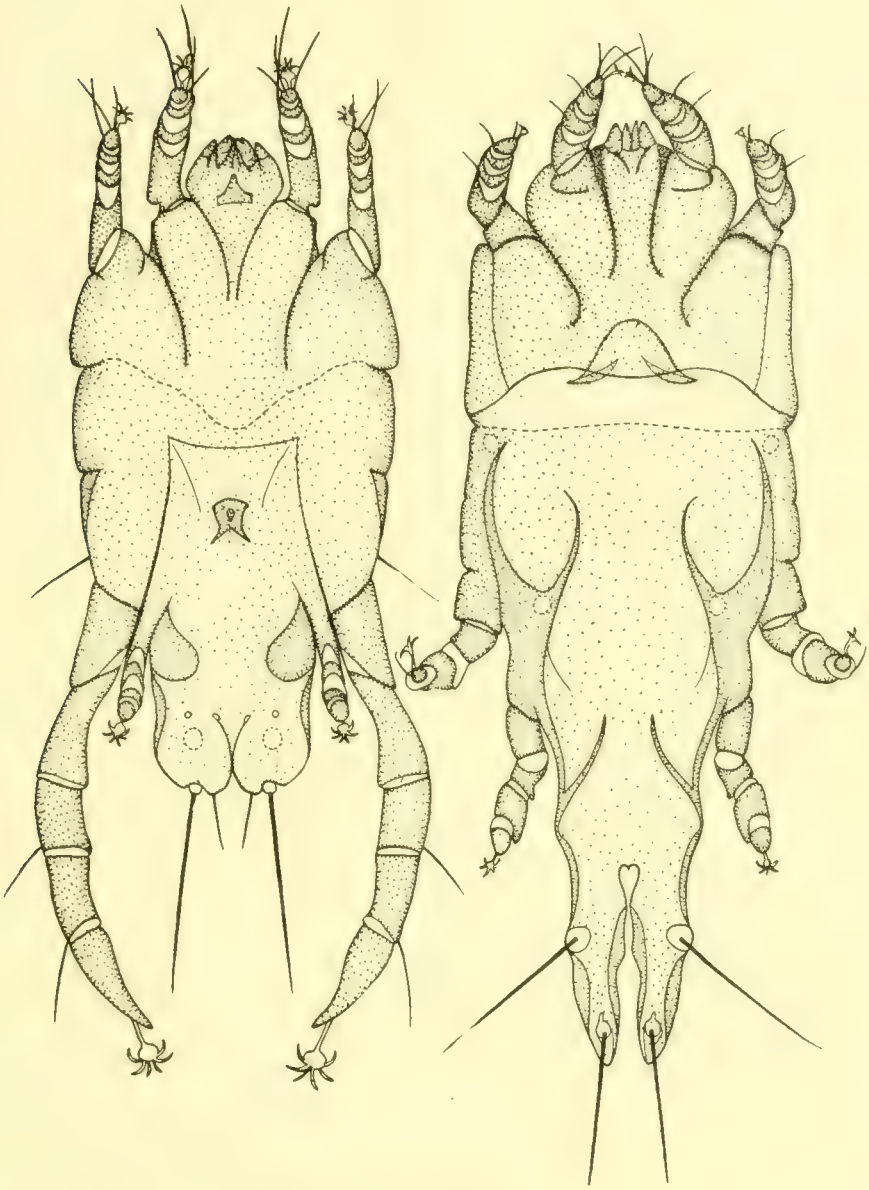


Figure 97. Pteronyssus bifurcatus. Male at left, female at right.

numbers of the amphipods were infected. It also occasionally occurs on certain other large gammarids found near high-tide mark.

Pteronyssus bifurcatus n. sp.

(Figures 97 and 98)

Integument strongly chitinized; anterior legs without "thorns." No cuff-like projections on terminal joint of any leg. Male with anal suckers well developed; first hind leg of male more developed than second. Tarsal sucker larger on this leg than on the others. Abdomen shortly bi-lobate, without leaf-like appendages; two bristles on each lobe, the medial bristle short, the other one as long as two-thirds the width of the body and arising from a prominent tubercle.

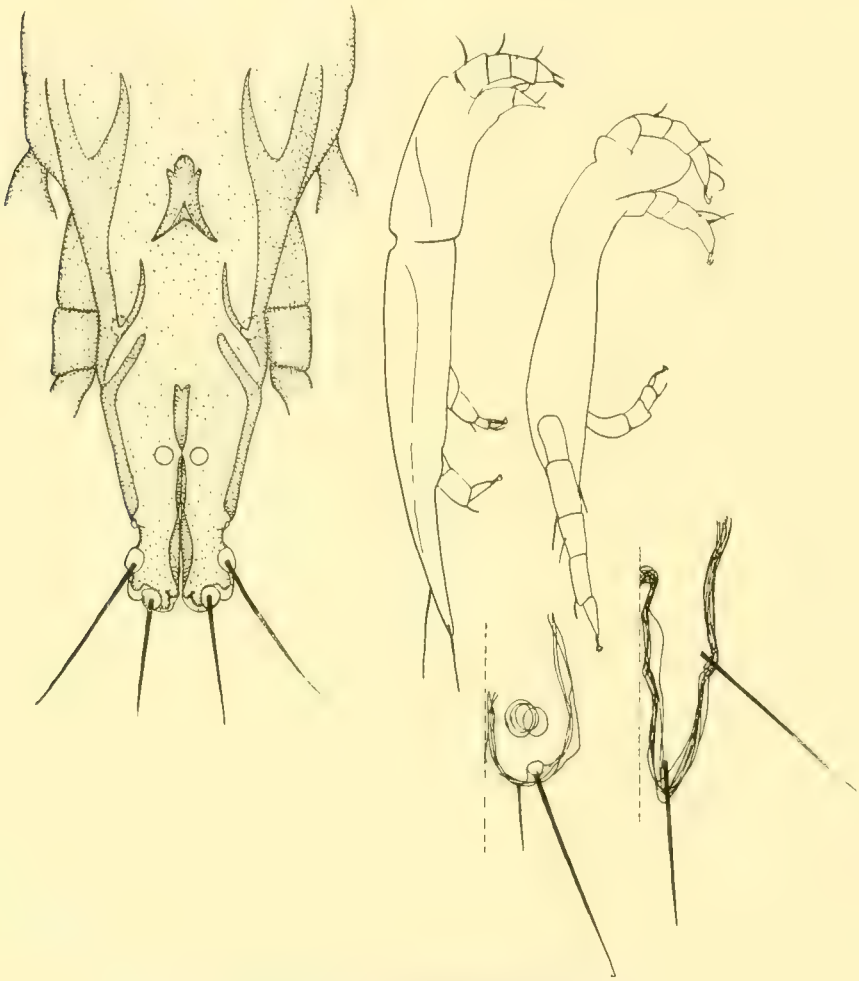


Figure 98. Pteronyssus bifurcatus

Anal suckers, while well defined, are small and separated by more than twice their diameter. A bristle projects laterally from the base of the first hind leg. This leg exceeds the end of the abdomen by the last three joints. The second hind leg does not reach the end of the abdomen. A bristle on the outer apex of the third and fourth joints of first hind leg. Length of the five males, 318 to 327 micrm. Width, 143 micrm.

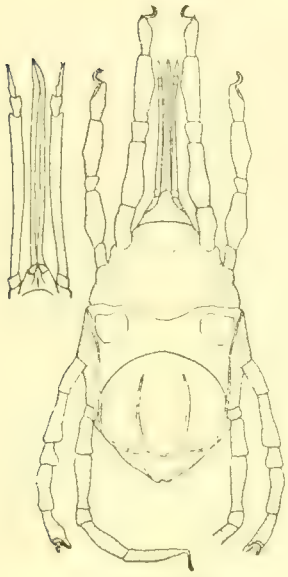


Figure 99.
Copidognathus californicus

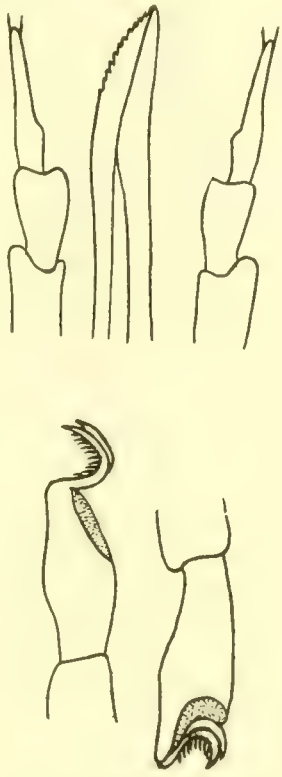


Figure 100.
Copidognathus californicus

Legs of female all of approximately equal development and length. Abdomen without appendages, tapered behind and cleft half way from tip of abdomen to coxæ four. Two stout bristles on each side of this forked abdomen; the posterior pair situated near the tip, pointing directly back, and a little shorter than the other pair which are situated one-third of the way from the tip of abdomen to coxa four, and point to the side and about 30 degrees back. Length of the seven females, 410 to 450 micrm. Width, 143 micrm.

Among the thirteen specimens which I took from *Petrochelidon lunifrons,* there was one female which differed from the others as

follows: The two stout bristles on each side of the posterior part of the abdomen arise from tubercles which are situated at the end of the abdomen, which, while bifurcated, is not as pronouncedly so as in the other females. I have traced the outlines carefully with the camera lucida of all the tips of abdomens, male and female and assembled them, according to sex, with reference to their center lines. The variation of outline thus shown in Figure 98, is not pronounced enough to include the outline of this other, unusual form. In the latter, anal suckers are present, and the arrangement of the chitinous plates running up toward the genital opening from the sides of the abdomen, is strikingly different. Length of this single specimen, 400 micrm. Width, 143 micrm. Since this specimen occurred

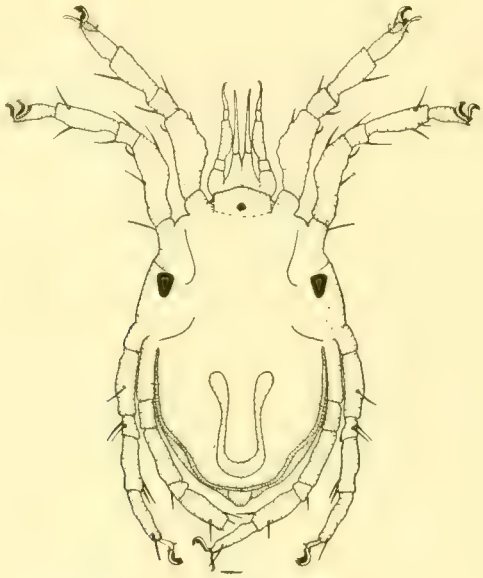


Figure 101. Copidognathus curtus

on the same bird with the others of the species just described, it is probably best to consider it as an aberrant form of the same species. As this species does not agree with the generic description in regard to the bifurcated condition of the abdomen in the female, this variation just described, in which the bifurcation is not so marked, may indicate a transition form.

Copidognathus californicus n. sp.

(Figures 99 and 100)

Length of body, 610 micrm. "Schnabelteil" not apparent (probably very short). First two pairs of legs stouter than the others but not greatly swollen. Armor not very strong. Eye-plates irregular

in shape with fairly sharp corner in front and to the outside of the body. Eye-spots lacking. Central back ribbon narrow and U-shaped, and fuses in back with outer ribbon. Outer ribbon also narrow, more broadly U-shaped and extending forward to a point half way between coxæ two and three. Body is ellipsoid in outline with bluntly wedge-shaped ends and is so much flattened dorso-ventrally that it is very hard to tell even by careful focussing whether a feature is on the dorsum or venter. The figure shows the dorsal view; the dotted lines indicate sutures that show through from the venter. The plain line running across the body just anterior to the eye-plates is probably on the venter but the flatness of the body makes it uncertain. No hairs on body or legs. Claws furnished with combs and folding back into grooves, on all four legs. Mouth parts long. The smaller figure shows the serrate tip of the mandibles enlarged. One specimen, in tide-pool, Laguna Beach, July.

Copidognathus curtus n. sp.

(Figure 101)

Length of body, 428 micrm. "Schnabelteil" not apparent (probably very short). First and second pairs of legs stout and swollen, especially the third and fifth joints. Armor rather strong. Eye-plates poorly outlined but with strongly pigmented eye-spots. There is also a median, smaller, similarly pigmented spot between and above the coxæ of legs one. Central back ribbon broad and U-shaped, the other thin and following approximately the outline of the abdomen as far forward as coxa three. Body oval in outline and without hairs. Legs with a few stout spines. Claws with combs on all legs and folding back into grooves on the first two pairs of legs. Movable on other two pairs of legs but grooves not apparent. Three specimens in tide-pools, and towed among *Phyllospadix,* Laguna Beach, July. Nearest to *C. spinula* but differs in proportions of the legs, presence of combs on all the claws and in other important characters.

Pontarachna cruciata n. sp.

(Figure 102)

Length 424-443 micrm. Body highly arched, globular; integument smooth. Three pairs of bristles as shown in the side view, project in front of the eyes. Maxillary shield broad with rounded corners at back; about twice the length of second joint of palpus. Epimera of legs one fuse behind maxillary shield with each other and with the genito-ventral plate. Epimera two and three fuse at the base and about half way to the edge of the body. Epimera three and four fuse at base. Genital opening a long narrow slit between bases

of epimera four and a little behind. Anus at the posterior, ventral corner of the body, and has two lateral flaps. Mandibles project downward. First four joints of the palpus sub-equal in length and the fifth joint about half as long and somewhat dentate, as shown in the side view of the mouth-parts. Palpus not quite as strong as the legs. Color from orange to almost colorless, marked on the dorsum with a black cross as shown in the smaller figures. Three pairs of bristles project in front and one pair behind as shown in the side view. Legs without true swimming hairs but furnished with stout spines. Claws with rudimentary combs suggesting those of the Halicaridæ. They also fold back into grooves in the end of their tarsi.

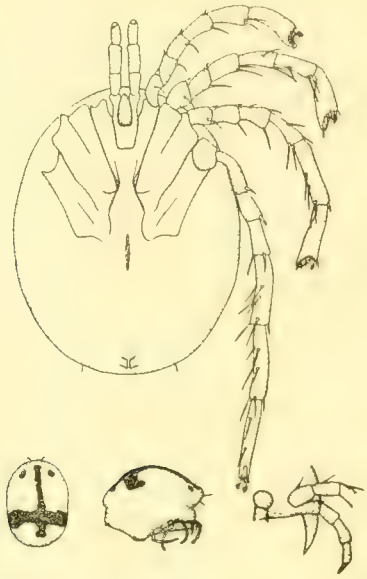


Figure 102. Pontarachna cruciata
Habit sketch and detail of side view of mouth parts.

Differs from *P. punctulum* in size of palpus, general arrangement of epimera, color, etc. The curved spur-like processes characteristic of the genus are entirely lacking as are also genital covers and hairs on the ventral surface. Leg four a little longer, and the other legs a little shorter than the length of the body. Differs from *P. tergestina* in the shape of mandible, absence of swimming hairs; from *P. lacazei* in the proportions of the palpus, unenclosed condition of the genital opening, and other features. Many specimens in tide-pools and towed from *Phyllospadix,* Laguna Beach, July.

Pontacarus californicus n. sp.

(Figure 103)

Length 428-542 micrm. Outline of abdomen gradually narrowing from broad shoulders to bluntly rounded end. Cephalothorax small and triangular. Palpi widely separated at the base, four-jointed, longer than the mandibles and movable. First two pairs of legs of equal diameter, the first a little the longer. Fourth joint of palpus with distal segment shorter than proximal. Armor very weak; outlines of the various plates too indistinct for good characters. Strongly pigmented eye-spots behind which a strong spine projects to the side; another shorter and weaker spine arises in front of and medially from the eye. The mandible ends in a stout claw. No feathered hairs on the legs. Twelve long hairs project from the posterior margin of the abdomen. Claws on the legs without combs, and no grooves on end of tarsus.

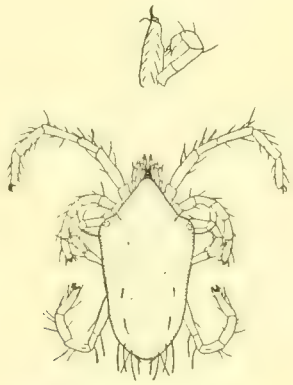


Figure 103. Pontacarus californicus

Quite common under stones well down toward the low tide mark. Many were also found in towings from *Phyllospadix*. Body of the female distended with eggs and consequently larger and more irregular in outline than that of the male which is shown in the figure. This species differs from *P. basidentatus* in having a short proboscis and no feathered hairs on the legs.

Rhyncholophus arenicola n. sp.

(Figure 104)

Length .785-1 mm. First three legs about the length of the body, the fourth pair about one-third longer. Usually bright red (one straw-colored specimen). Body variable in shape but usually broadest in the middle and broadly rounded behind, thickly clothed with

very fine feathered hairs. Eyes and dorsal groove not apparent. Last joint of leg one slightly longer than penultimate joint. On the other legs this condition is reversed. The last joint of leg four little more than half the length of the penultimate joint. Legs thickly set with fine hairs which are shorter than the diameter of the legs.

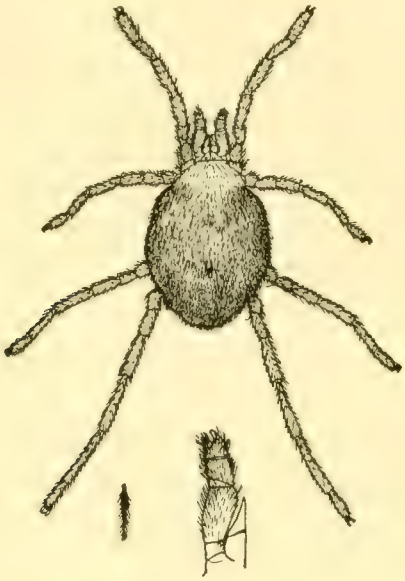


Figure 104. **Rhyncolophus arenicola.** Palpus and dorsal hair.

Palpi are short, similarly clothed with short hairs; last joint is a short thumb opposed to the preceding joint, the claw of which reaches as far beyond the thumb as the length of the thumb. Mandibles are stiletto-shaped and retractile. Small figures show the left palpus and a body hair enlarged. Quite common running over the dry sand of the upper beach all summer. Laguna Beach.

A PARTIAL ACCOUNT OF THE BIRDS IN THE VICINITY OF LAGUNA BEACH

LEON GARDNER

The following ornithological observations were made from the last of June to the middle of August. The country about Laguna is mostly in the Lower Sonoran Zone with some Upper Sonoran, and a few Transition Zone forms. The region is composed mostly of low hills, either open, or covered with sage and chapparal. There are some few small wooded spots in the canyons, especially in Aliso Canyon. About four miles up Laguna Canyon there are two fresh-water ponds bordered with tules; here many water birds were seen. Balboa Beach is a few miles up the coast, and at that point a good many water birds congregate about the bay.

In connection with the preparation of this study, especial thanks are due Mr. Charles W. Metz, who assisted in the accurate determination of various birds in doubt. Also several birds, the determinations of which were later questioned, were sent to the National Museum in Washington where they were identified by Mr. H. C. Oberholser, to whom acknowledgments are here made.

Podilymbus podiceps (Linn.) Lawr. Pied-billed Grebe.

A grebe was seen in the tule lakes, which appeared to be this species. It was so quick to dive, that when shot at from a very short distance, it succeeded in eluding the shot.

Ptychoramphus aleuticus (Pall.) Brandt. Cassin Auklet.

Professor Baker picked up a specimen of this species on the open beach. It had apparently met with some accident, as its head was crushed. Infested by *Nirmus maritimus.*

Larus occidentalis Aud. Western Gull.

These birds occur in great numbers along the coast, especially at Balboa. During this summer, no other gulls but *occidentalis* were seen. At Balboa, flocks of these gulls, to the number of several hundreds, congregate about the beach and pier. They are of great usefulness as scavengers. These gulls are very vicious when wounded, and defend themselves with the greatest of vigor. Many of the darker colored young were observed in the flocks during the summer. Infested by *Docophorus lari.*

Phalacrocorax penicillatus (Brandt) Heerm. Brandt Cormorant.

These birds usually kept pretty well out from the shore, but occasionally one would be seen on the beach. They appeared to be common about the large off-shore kelp beds, and on the small islets near the shore.

Pelecanus californicus Ridgw. California Brown Pelican.

A few of these birds were seen at different times in the kelp beds, but seldom if ever came to the shore. In the evenings a few gathered on two small islets.

Querquedula cyanoptera (Vieillot). Cinnamon Teal.

A small flock seen at the tule lakes. Whenever disturbed they always circled the lake two or th ree times before settling again, but otherwise were not at all shy, and did not hide in the tules like the coots. They were eating the duck-weed in which these lakes abound.

Ardea herodias Linn. Great Blue Heron.

Several times during the summer these magnificent birds were observed passing overhead. A pair frequented the tule lakes. They would stand motionless among the tules, and in that position seemed actually to disappear, it being almost impossible to distinguish them in such a position unless they moved.

Ardea virescens anthonyi Mearns. Anthony Green Heron.

One specimen taken at the tule lakes. When approached it would slip away among the tules, and when pursued, flew up with loud, harsh croaking.

Fulica americana Gmel. American Coot.

These birds were very common in the tule lakes. They were very shy and cunning and hid in the tules at the first sight of a person on foot, though they paid little attention to vehicles. The only way to get a specimen was to hide until they had forgotten the presence of danger, and had come out of their lurking places again. They were in friendly company with the teal, and were also feeding on duck-weed.

Limosa fedoa (Linn.) Sabine. Marbled Godwit.

Only one specimen of this fine bird was seen during the summer. It was exceedingly tame and would allow one to approach within twelve to fifteen feet before quietly flying a hundred yards or so down the beach. Its stomach was well filled with sand-crabs (*Eremita analoga*), and it was infested with *Colpocephalum timidum*.

Numenius hudsonicus Lath. Hudsonian Curlew.

Two rather large flocks of curlew were seen at different times. They were usually found on long open stretches of sandy beach, and were exceedingly shy, not allowing one to approach within three hundred yards. When flying from the beach after being alarmed, they flew directly out to sea for some hundred yards, and then followed the coast, finally alighting a good half mile from the danger point. They seemed to be feeding on sand-crabs, for the whole flock would run down the beach after each receding wave, and then back in front of the approaching one.

Aegialitis vocifera (Linn.) Bonap. Killdeer.

Large numbers of these birds frequented the mud flats around the tule lakes. They were constantly moving and kept up a continual noise. These birds are not at all shy.

Arenaria melanocephala (Vig.) Stejn. Black Turnstone.

One specimen taken on the beach among piles of dried kelp. It was very bold, showing no fear. It, also, appeared to be feeding on sand-crabs.

Lophortyx californicus vallicola (Ridgw.) Valley Quail.

This quail was abundant, feeding throughout the hills and canyons. Early in the mornings flocks of from fifty to a hundred were often seen. When flushed in some small gulch, the noise of their wings as they rise from the ground produces a most startling roar.

Zenaidura macrura (Linn.) Mourning Dove.

Abundant about all springs and water holes, especially those at a good distance from all houses. To one particularly lonely watering spot they came in great numbers and at all hours; here they were especially easy to approach. On August 19th a dove was flushed from its nest, which contained one egg. Infested commonly with *Nirmus foedus* and *Lipeurus baculoides.*

Cathartes aurea (Linn.) Spix. Turkey Vulture.

These buzzards were very abundant through the hills and canyons, possibly on account of the cattle herds. One of these birds shot and placed in a conspicuous spot soon drew at least thirty others to the place. A certain eucalyptus grove appeared to serve as a regular roost for these birds. They are infested by *Colpocephalum kelloggi* and *Menopon alternatum.*

Circus hudsonicus (Linn.) Vieill. Marsh Hawk.

Quite common about the bay at Balboa. One was seen devouring a freshly killed ground squirrel. They are not very shy and specimens are easily obtained.

Falco sparverius deserticola Mearns. Desert Sparrow Hawk.

Abundant through the hills and canyons. Usually seen hunting in pairs. A pair of this species appeared to have a nest in a crevice on a rocky cliff, judging from the sound which frequently came from that point. Infested by *Nirmus fuscus.*

Strix pratincola Bonap. Barn Owl.

In the eucalyptus grove mentioned above as a buzzard roost, one Barn Owl was taken.

Geococcyx californianus (Less.) Baird. Road Runner.

Quite common, all through the hills. One was seen on the beach, feeding at the water's edge. When frightened, they usually do not fly, but make for the nearest cactus patch or chapparal, at top speed, and their speed on foot is altogether remarkable. In a stomach examined were the remains of several cicadas, grasshoppers, and smaller insects. Infested by *Nirmus splendidus.*

Dryobates nuttallii (Gamb.) Ridgw. Nuttall Woodpecker.

Owing to the general absence of trees, very few woodpeckers were seen. One was taken in Aliso Canyon and proved to be this species.

Colaptes cafer collaris (Vigors). Red-shafted Flicker.

Uncommon here, and shy, only one or two being seen, and several heard.

Calypte anna (Less.) Gould. Anna Hummingbird.

Very common wherever flowering plants occurred. Undoubtedly *C. costae* occurs with this species.

Tyrannus verticalis Say. Arkansas Kingbird.

Common everywhere. They were especially frequent about eucalyptus groves. In the town they kept up a continual noise, and seemed to be very quarrelsome. Two of them easily drove away a sparrow hawk that seemed to be trespassing on their domain. Infested by *Nirmus foedus.*

Tyrannus vociferans Swains. Cassin Kingbird.

More retiring than *T. verticalis.* Far up Aliso Canyon one specimen was taken. Far inland, others also were seen. I did not notice them in company with *T. verticalis.*

Myriarchus cinerascens (Lawr.) Sel. and Salv. Ash-throated Flycatcher.

Often in the company of the noisy kingbirds. Many times single specimens were noted sitting quietly on some stump or wire waiting for a meal. They occasionally give a plaintive call that is very characteristic.

Sayornis saya (Bonap.) Baird. Say Phoebe.

On June 25, nestlings of these species about three days old were found. These birds are common in all the canyons, often in company with the kingbirds, and occur occasionally on the beach.

Sayornis nigricans semiatra (Vigors) Nelson. Western Black Phoebe.

These little birds were commonly found along and near the beach, and about the cliffs. They do not seem to be at all gregarious. Infested by *Nirmus foedus.*

Empidonax difficilis Braid. Western Flycatcher.

Many of these little flycatchers were seen among the trees along the sides of Laguna Canyon. They often occurred in the company of wren-tits, vireos, and other birds.

Otocoris alpestris actia Oberholser. California Horned Lark.

Common in all the fields and meadows, moving in flocks.

Aphelocoma californica (Vig.) Cab. California Jay

Very common everywhere. Where the canyons are slightly wooded they congregate in the early mornings and set the hillsides ringing with their calls. Infested by *Menopon funereum.*

Agelaius phoeniceus neutralis Ridgw. San Diego Red-wing.

Quite common in all marshy lowlands. Often seen hunting along the beaches, sometimes in company with the Brown Blackbird. Quite young birds were common in the flocks as late as the first of July.

Sturnella magna neglecta (And.) Allen. Western Meadow Lark.

The ringing call of this bird is frequently heard at Laguna. They are not at all common although the locality is apparently a favorable one for them.

Icterus cucullatus nelsoni Ridgw. Arizona Hooded Oriole.

These birds greatly exceeded *I. bullocki* in numbers. They seemed to be common throughout the region, apparently preferring eucalyptus groves to other places.

Icterus bullocki (Swains.) Bonap. Bullock Oriole.

About Laguna these birds are rare and shy. Near Claremont, far inland, they are quite bold, and are common, even nesting about the houses.

Scolecophagus cyanocephalus (Wagl.) Cab. Brown Blackbird.

Great flocks of these birds are common along the beaches. They assemble in great numbers about decaying vegetable matter, and seem to find a foul-smelling slough a specially desirable spot.

Carpodacus mexicanus frontalis (Say.) Ridgw. House Finch.

This bird is abundant in Laguna as it is in most other towns. On July 6 a nest was found in one of the canyons with three young a few days old. This bird also, is to be commonly seen on the beaches.

Astragalinus psaltria (Say.) Coues. Arkansas Goldfinch.

Quite abundant among the hills, feeding on the seeds of many common plants.

Chondestes grammicus strigatus (Swains.) Ridgw. Western Lark Sparrow.

This is one of the most common sparrows at Laguna. They were especially common about barnyards. One specimen taken was almost an albino.

Amphispiza belli (Cass.) Coues. Bell Sparrow.

This species seems to be fairly common in the chaparral at Laguna. They were often in company with the song sparrows.

Aimophila ruficeps (Cass.) Rufous-crowned Sparrow.

Frequent in the chaparral.

Melospiza melodia heermanni Baird, Br. and Ridgw. Heerman Song Sparrow.

These sparrows were very easily identified among others by their song and their sharper markings. They were very abundant in all the chaparral-covered hills. In the early morning the voices of great numbers of them could be heard.

Pipilo maculatus megalonyx (Baird) Coues. Spurred Towhee.

Very wild and exceedingly hard to obtain. Not many of these birds were seen near to Laguna, but in Aliso Canyon, where it is more rarely disturbed, it is more common.

Pipilo fuscus senicula Anthony. Anthony Towhee.

Abundant through all the hills and valleys.

Zamelodia melanocephala (Swains.) Coues. Black-headed Grosbeak.

Not very common about the town of Laguna but further inland met with more often. They commonly sing from the tops of tall trees in the early morning. Infested by *Docophorus communis.*

Guiraca caerulea lazula (Less.) Ridg. Western Blue Grosbeak.

Rare in all localities. Only three were encountered during the summer. One was seen at Balboa near the bay, and the other two at the tule lakes in Laguna Canyon. Though rare, these birds did not seem to be at all shy.

Petrochelidon lunifrons (Say.) Cassin. Cliff Swallow.

Very abundant about overhanging cliffs bordering the valleys. They swarmed over the hills and along the beaches. At one place the under side of certain cliffs is completely covered with their nests. On July 1 two young birds were just about ready to fly. These birds are very lousy, being infested with *Docophorus excisus* var. *major*, *Nirmus longus*, *Menopon malleus*, and *Menopon dissimilis*.

Lanius ludovicianus gambeli Ridgw. California Shrike.

Abundant along all of the valley bottoms. Early in the mornings they were often heard singing a low sweet song, which rather belies their character.

Vireo pusillus Coues. Least Vireo.

These little birds were rather common in thickly wooded places. They were always very quiet and shy.

Dendroica aestiva morcomi Coale. Western Yellow Warbler.

Along the willow bottoms, and in the lower portions of the canyons these birds appeared to be quite common.

Mimus polyglottus leucopterus (Vigors) Mearns. Western Mockingbird.

Very common in all the canyons and along the hills, and in those places very shy, which is surprising because they are quite bold in the towns. Seldom heard singing.

Toxostoma redivivum pasadenense (Grinnell) Richmond. Pasadena Thrasher.

Although this bird has been reported only from farther inland, a skin of certainly this form was taken here.

Toxostoma redivivum (Gamb.) Baird. California Thrasher.

These birds were very abundant everywhere. They are very bold, and set up a great clamor when disturbed. Seldom heard singing.

Catherpes mexicanus conspersus Ridgw.

Although *C. m. punctulatus* is more commonly reported from here I took a skin of this subspecies. It was critically examined by Mr. Chas. Metz and unquestionably determined as this form.

Thyromanes bewickii charienturus Oberh. Southwest Bewick Wren.

Fairly common in the canyons and among the chaparral-covered hills. Often observed in company with wren-tits.

Chamaea fasciata Gamb. Pallid Wren-tit.

Very common in all the valley bottoms. They were very bold and allowed very close inspection.

Psaltriparus minimus californicus Ridgw. Californian Bush-tit.

These tiny birds occur in great numbers, commonly ranging through the chaparral in large flocks.

Polioptila caerulea obscura Ridgw. Western Gnatcatcher.

Fairly common among bushes in the canyons. These are extraordinarily busy little birds.

NOTES ON THE MARINE ALGÆ OF LAGUNA BEACH

JOHN GUERNSEY

It was my intention during the first summer at Laguna Beach to make some beginning in anatomical and ecological studies of a few of the very numerous and interesting marine Algæ occurring there. In the course of this work, large collections accumulated. A set of specimens was submitted to Dr. W. A. Setchell and he has very kindly given the determinations of them, calling especial attention to the fact that many of the names applied to our west coast Algæ are as yet uncertain in their application, and that the nomenclature is in need of careful revision, as some of the species themselves are in need, quite as urgently, of more detailed anatomical studies. I

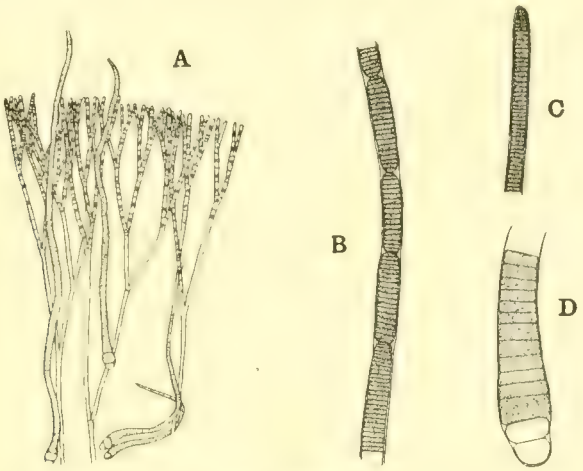


Figure 105. Calothrix parasitica (Chauv.) Thuret

have no desire to present this as a "mere list," since it means much more to me. It includes, however, a list of the commoner forms that any student will encounter at Laguna, and mostly in great abundance. We want to begin to know these things in their distribution and ecological relations, and this seems the logical and necessary first step.

CYANOPHYCEAE

Brachytrichia quoyi (Ag.) Bornet and Flahault

One small colony of this species was taken on the holdfast of a *Nereocystis* coming from about four fathoms. Dr. Setchell says this

collection "is a discovery, or rather rediscovery. This species was credited to our coast nearly forty years ago, but so far as I know has not been seen since."

Calothrix parasitica (Chauv.) Thuret

(Figure 105)

Commonly parasitic in *Nemalion lubricum*.

Calothrix contarenii (Zau) B. and F.

Colonies of this species are occasional on exposed rocks almost to high tide mark.

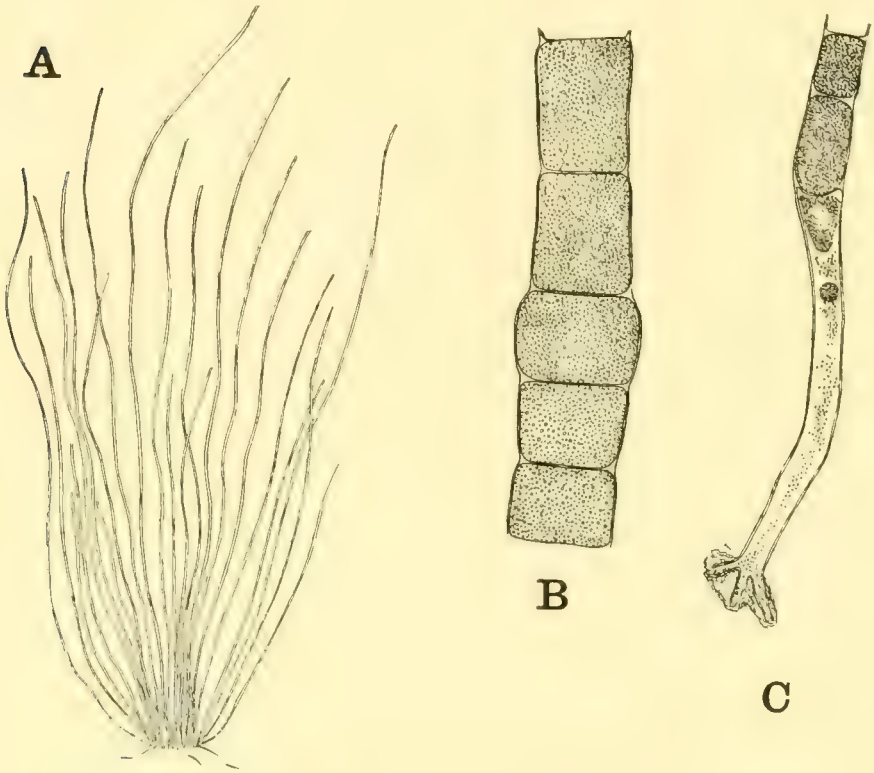


Figure 106. **Chaetomorpha aerea** (Dillw.) Kurtz

Calothrix fasciculata Ag.

Colonies common on exposed rocks almost to high tide mark. This and the preceding species form a slippery covering to the rocks that render them very treacherous for the pedestrian. During low tide on a hot day this little alga is seemingly completely dried out, and must be subjected to great heat, but always recovers promptly with the next tide.

CHLOROPHYCEÆ

ULVACEAE

Ulva californica Wille

Small tufts common on the rocks throughout the tidal zone.

Ulva lactuca L. var.

This "Sea Lettuce" is common on rocks and on other algæ throughout the tidal zone.

Enteromorpha flexuosa (Wulf.) J. Ag.

Similarly distributed and about as common as the two *Ulvas*.

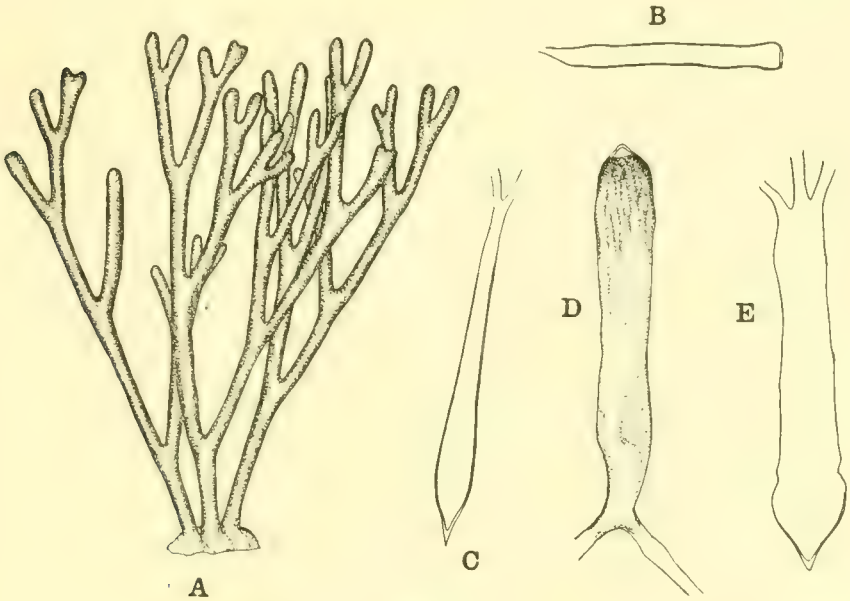


Figure 107

A, C, D, E, Codium mucronatum var. californicum. J, Ag. B, Codium adhaerans (Cabr.) Ag.

CLADOPHORACEAE

Chaetomorpha aerea (Dillw.) Kuetz

(Figure 106)

Frequent on the rocks of the high tidal zone, especially in high tide-pools. Length of filament commonly 15 cm.; cells .25 by .15 mm.

Cladophora trichotoma (Ag.) Kuetz

This and the preceding species are very commonly growing together, the long slender filaments of the *Chaetomorpha* sometimes being attached to the more stocky *Cladophora*.

CODIACEAE

Codium mucronatum var. **californicum** J. Ag.

(Figure 107, A, C, D, E)

Frequent on rocks of middle and lower tidal zone. Utricle .8 by .2 mm.

Codium adhaerans (Cabr.) Ag.

(Figure 107 B)

My specimens taken from a holdfast of *Nereocystis* coming from about six fathoms. Utricle .6 by .1 mm.

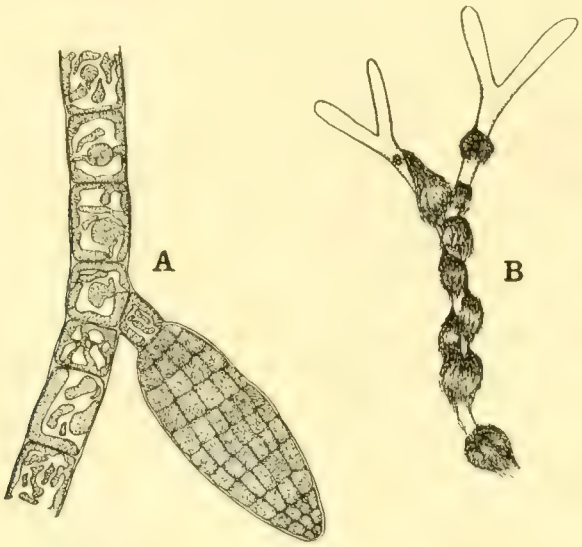


Figure 108. Ectocarpus hemisphaericus Saunders

PHÆOPHYCEÆ

ECTOCARPACEAE

Ectocarpus hemisphaericus Saunders

(Figure 108)

Abundant epiphyte on *Pelvetia fastigiata.* Sporangia .08 by .04 mm.

Ectocarpus tomentosus (Huds.) Lyngb.

Epiphytic on *Hesperophycus harveyanus.*

Ectocarpus tomentosoides Farlow

Frequent as an epiphyte on *Hesperophycus harveyanus.*

Ectocarpus mitchellae Harv.

A frequent epiphyte on *Phyllospadix torreyi.*

Ectocarpus globiger Kuetz

Colonies found growing on shells of *Pomaulax*. Dr. Setchell says of this determination: "I do not think that this species has been recognized on our coast before * * * but I feel fairly certain of the identification."

SPHACELARIACEAE

Sphacelaria plumula var. **californica** Saund.

A common epiphyte on *Nereocystis*.

Figure 109. Eisenia arborea Habit sketch.

ENCOELIACEAE

Colpomenia sinuosa (Roth.) Derbes and Solier

Epiphytic on *Sargassum agardhianum*.

Scytosiphon lomentarius (Lyngb.) J. Ag.

Frequent on rocks throughout the upper tidal zone.

Endarachne binghamiae J. Ag.

On rocks, more common through the middle tidal zone.

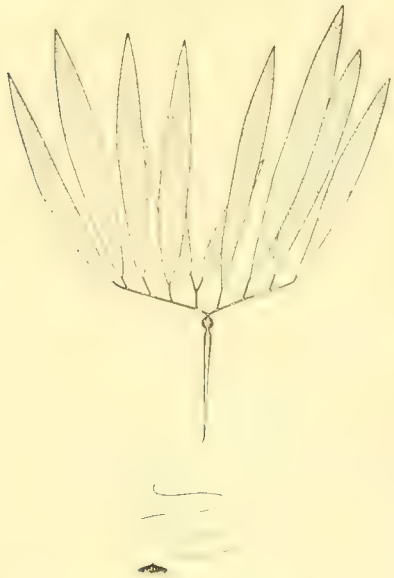


Figure 110.
Nereocystis gigantea Habit sketch.

Figure 111.
Macrocystis pirifera Habit sketch

Figure 112.
Egregia laevigata Setchell. Habit sketch.

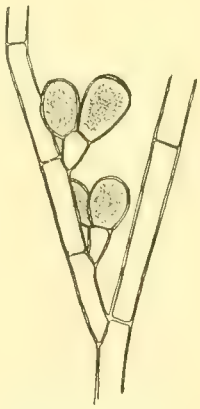


Figure 113.
Chantransia dictyotae Collins.

CHORDARIACEAE

Cylindrocarpus berkeleyi (Grev.) Crouan

Frequent on rocks and on shells in the middle tidal zone.

RALFSIACEAE

Ralfsia clavata (Carm.) Farlow

Frequent on rocks of the high tidal zone.

Hapterophycus canaliculatus A. and G.

In large colonies on the rocks of the lower tidal zone.

LAMINARIACEAE

Eisenia arborea Areschoug

(Figure 109)

Abundant on rocks about the low tide mark, commonly growing on the borders of deep channels, and attaining a length of six feet.

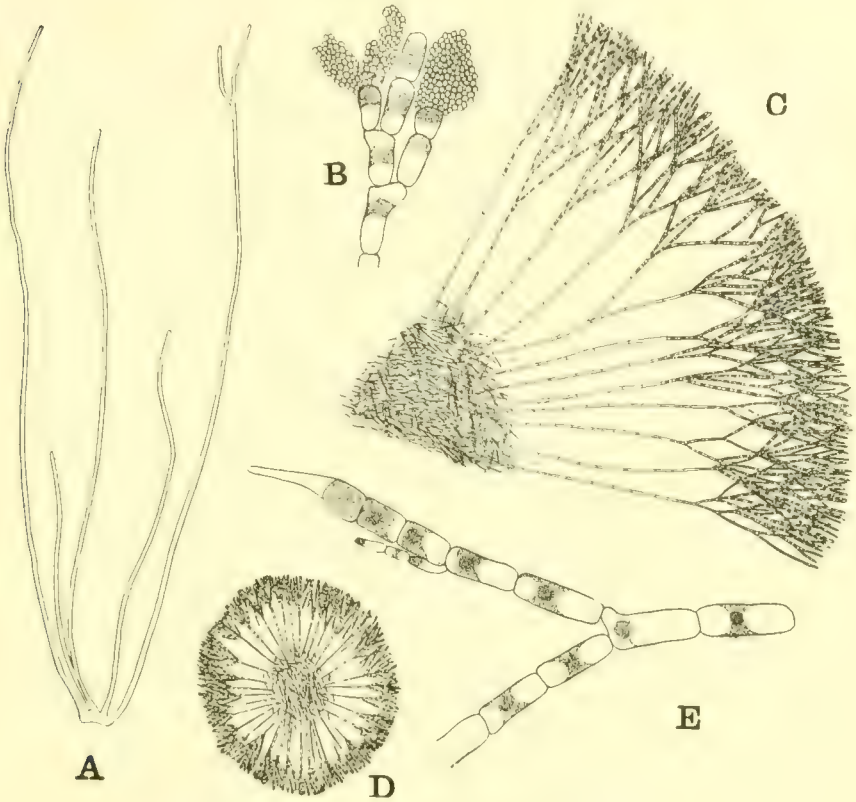


Figure 114. Nemalion lubricum Duby.

Nereocystis gigantea
(Figure 110)

Occasionally found growing at Laguna in from four to six fathoms of water. This immense "bladder kelp" attracts a great deal of attention from visitors to the beach. The long, slender stems below the bladder often measure as much as thirty feet in length,

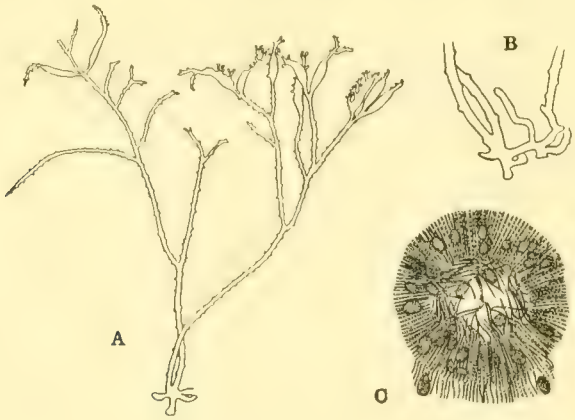


Figure 115. Endocladia muricata (P. & R.) J. Ag.

Figure 116. Laurencia virgata. Habit sketch.

with a holdfast below which may be as large as a bushel basket, and the great "leaves" may measure twelve feet in length. In the extensive beds of *Macrocystis* just off shore, they may be located by the fact that the large hollow bladders are commonly used as perches by the sea-gulls. The name "*Nereocystis gigantea*" may not be its correct name, but it is certainly an apt one, although it does not

equal in size the great bladder-kelp of northern waters, *Nereocystis lutkeana.*

Macrocystis pyrifera (Turner) Agardh

(Figure 111)

Enormously abundant in about six fathoms of water. This is the common kelp forming the great off-shore beds along the Southern California coast. It becomes above fifty feet in length at Laguna Beach. Immense quantities of it wash up on the beach. Investigations are being carried on elsewhere to determine its value as a fertilizer.

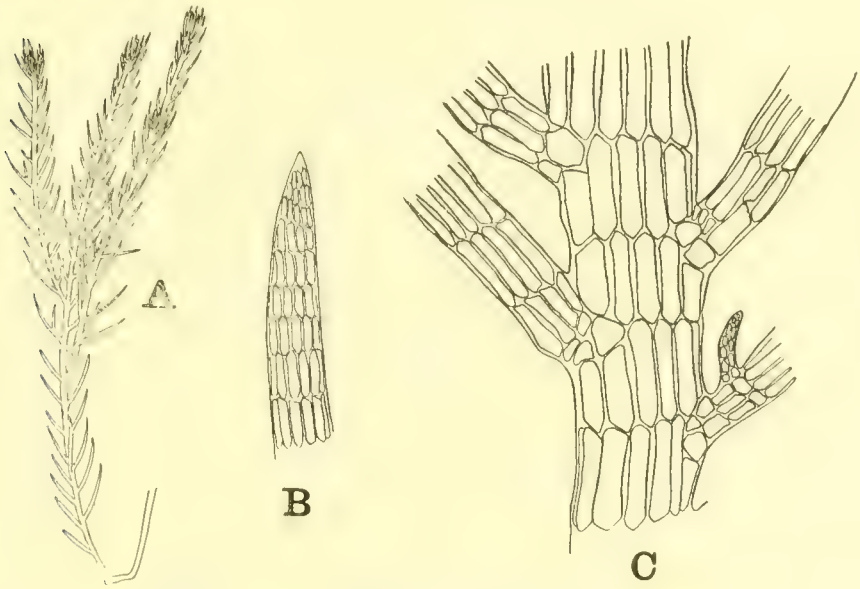


Figure 117. Polysiphonia verticillata Harv.

Egregia laevigata Setchell

(Figure 112)

Abundant near the low tide mark. Length very variable but often reaching over twelve feet. Commonly found in company with *Eisenia arborea,* and very variable in the form of the fronds.

FUCACEAE

Hesperophycus harveyanus (Decaisne) Gardner

(*Fucus Harveyanus* Decaisne)

Common on the rocks of the high tidal zone, growing most commonly along the lower limits of the zone of *Pelvetia fastigiata.*

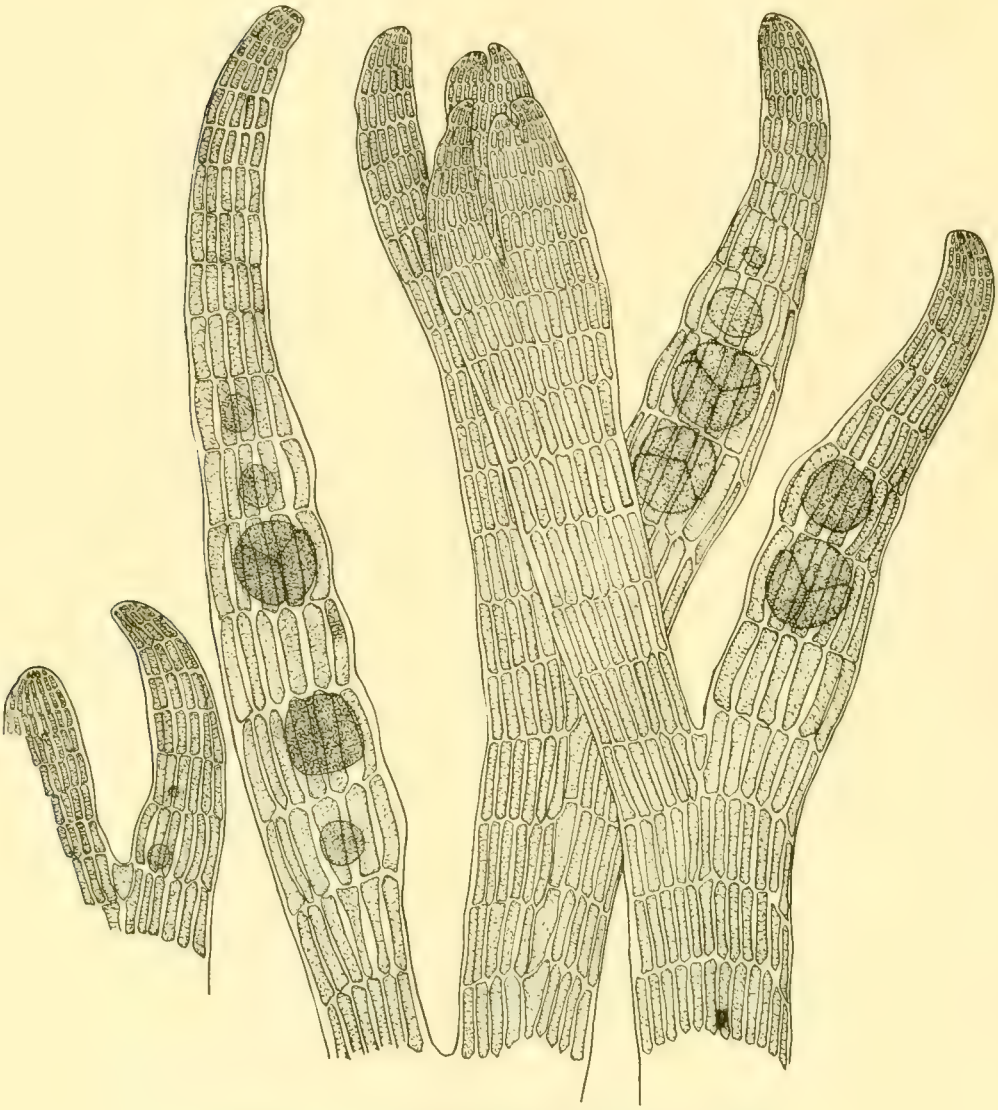


Figure 118. Pterosiphonia woodii (Harv.) Falk

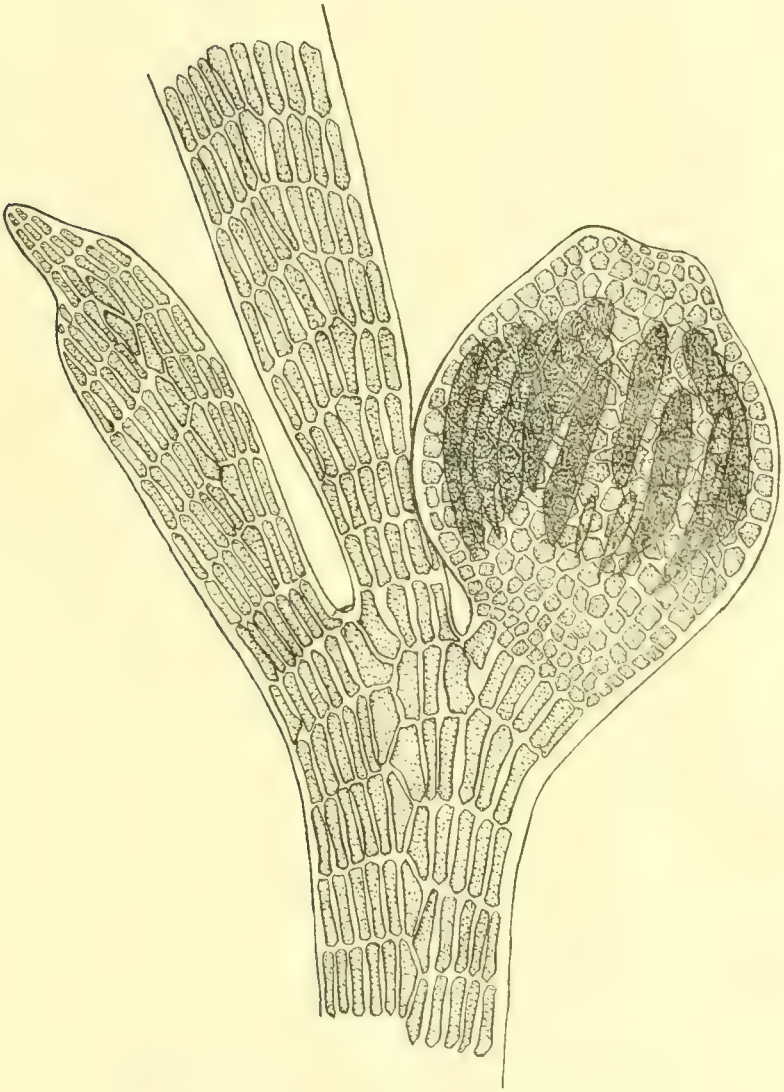


Figure 119. Pterosiphonia woodii (Harv.) Falk.

Pelvetia fastigiata (J. Ag.) deToni

In immense colonies on the rocks of the high tidal zone, forming a distinct zone which reaches almost to the upper limits of algal growth.

Cystoseira osmundacea (Mentz.) Ag.

A frequent component of the beach wrack. Dr. Setchell gives this determination with doubt.

Halidrys dioica Gardner

Common on the rocks of the lower tidal zone.

Sargassum agardhianum Farlow

Common on rocks near low tide mark.

DICTYOTACEAE

Zonaria tournefortii

Dictyopteris zonarioides Farlow

Dictyota binghamiae J. Ag.

Dilophus flabellatus Collins

The above four species are all frequent on rocks of the middle tidal zone.

RHODOPHYCEÆ

BANGIACEAE

Porphyra naiadum C. L. Anderson

Commonly epiphytic on basal portions of *Phyllospadix*.

HELMINTHOCLADIACEAE

Chantrasia dictyotae Collins

(Figure 113)

Abundant as an epiphyte on *Dictyota binghamiae*. Sporangia .02 mm. in diameter.

Nemalion lubricum Duby.

(Figure 114)

Common on rocks of the lower tidal zone, especially on the faces of rocks exposed to the direct pounding of the heaviest surf. Stem commonly 1.4 mm. in diameter.

Helminthocladia purpurea (Harv.) J. Ag.

Only seen twice, both times in the lower tidal zone.

GELIDIACEAE

Gelidium crinale (Surn.) Lamour. var.

Frequent on the rocks of the lower tidal zone.

Gelidium amansii Kuetz

Common on rocks of middle tidal zone.

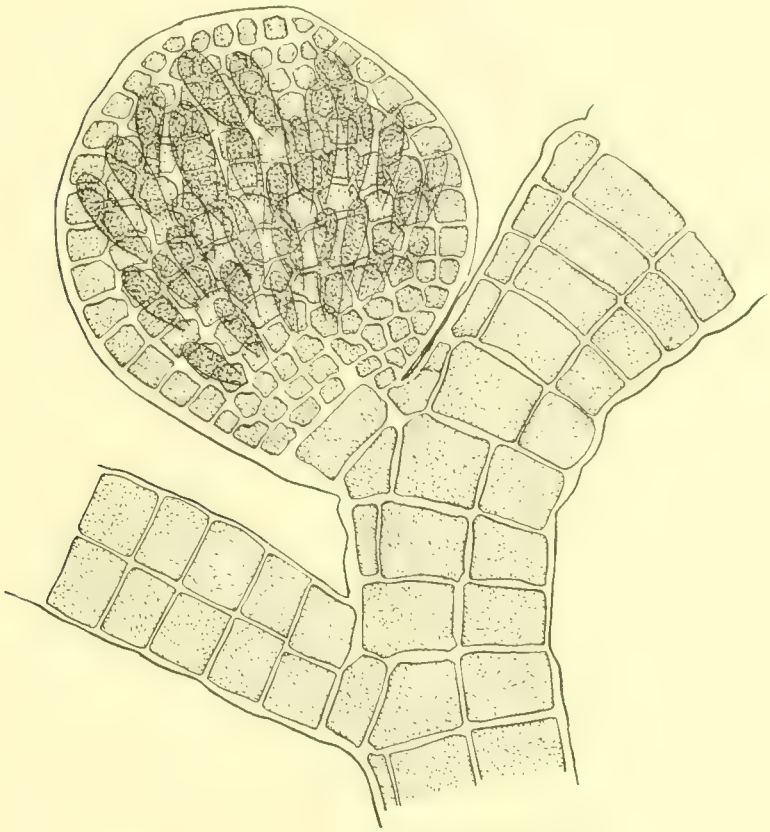


Figure 120. Strebdocladia camptoclada (Mont.) Falk.

Gelidium coulteri Harv.

Commonly forming colonies on the rocks of the middle tidal zone.

Gelidium cartilagineum L.

Frequent on rocks of middle tidal zone.

Gelidium australe J. Ag.

Also forming colonies on the rocks of the middle tidal zone.

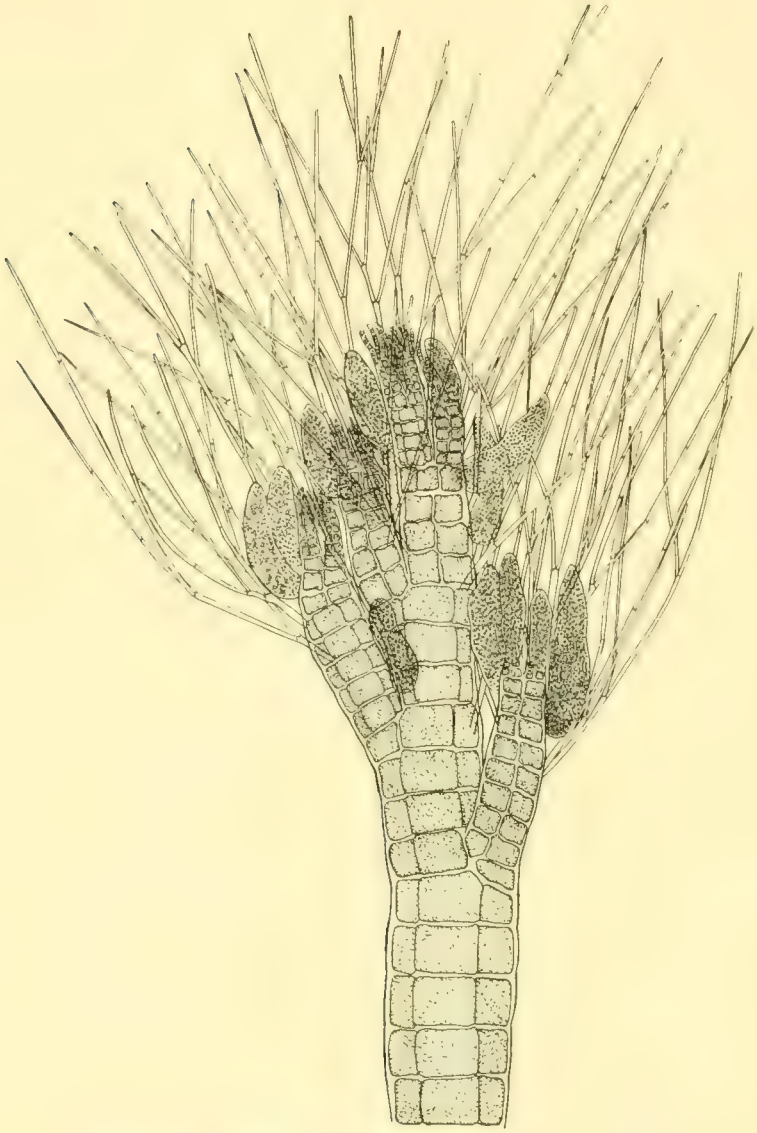


Figure 121. Strebdocladia camptoclada (Mont.) Falk.

GIGARTINACEAE

Endocladia muricata (P. and R.) J. Ag.
(Figure 115)

Common on rocks near high tide mark. Length of plant commonly 2 cm., diameter of stem .4 mm.

Chondrus canaliculatus (Ag.) Grev.

Common on the rocks of the middle tidal zone.

Gigartina canaliculata Harv.

With the above.

Gigartina spinosa (Kuetz) J. Ag.
Gigartina exasperata Harv. and Baill.
Gigartina horrida Farlow

The above three species are frequent on rocks of the lower tidal zone.

Gigartina microphylla Harv.

Specimens of this species frequent in the wrack along the beaches.

Stenogramma interruptum (Ag.) Mont.

Occasional in beach wrack. Dr. Setchell expresses doubt as to this determination.

SPHAEROCOCCACEAE

Hypnea sp.

Epiphytic on other algæ throughout the tidal zone.

RHODYMENIACEAE

Cordylecladia andersonii Grunow

Frequent on rocks between tides.

Chrysemenia pseudodichotoma Farlow

Occasional in beach wrack.

Plocamium coccineum (Huds.) Lyngb

Frequent on the rocks of the lower tidal zone, and abundant in the beach wrack. This is the common "red sea-moss" of the Southern California coast. Collectors will find it growing most abundantly and in finest specimens on the under side of rocky ledges of the lower tidal zone.

DELESSERIACEAE

Nitophyllum violaceum J. Ag. var. **crispulum.**

Epiphytic on other algæ of the lower tidal zone.

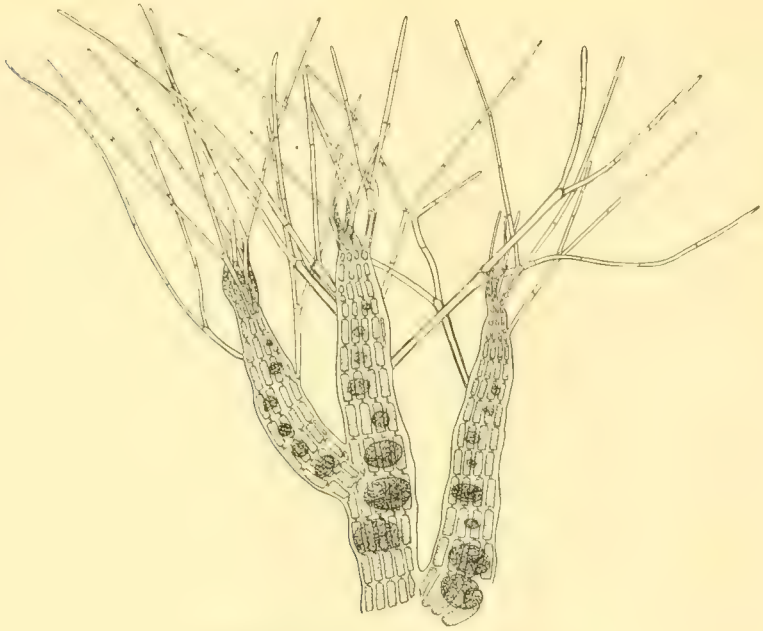


Figure 122. Strebdocladia sp.

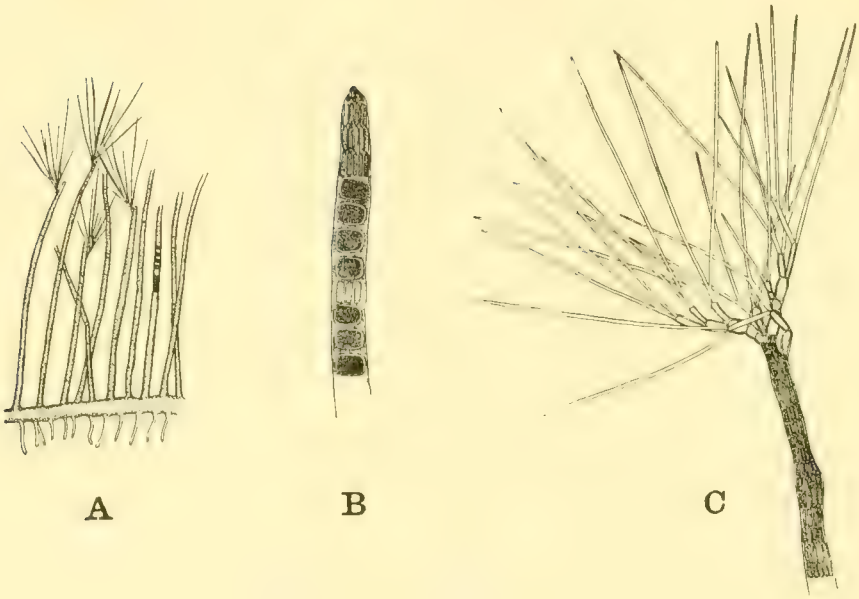


Figure 123. Herposiphonia sp.

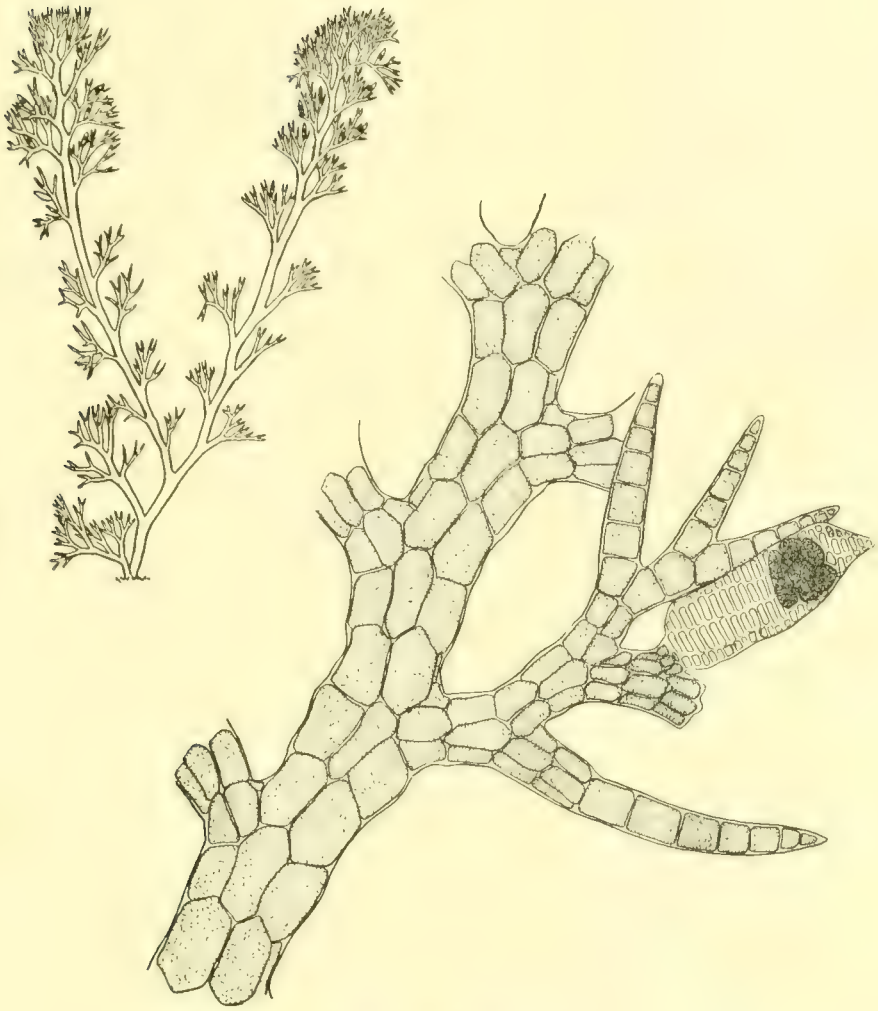


Figure 124. Heterosiphonia subsecunda (Suhr.) Falk.

BONNEMAISONIACEAE

Ricardia montagnei Durbes and Solier

Commonly epiphytic on *Laurencia virgata.*

RHODOMELACEAE

Laurencia virgata J. Ag.

(Figure 116)

This is a very variable species in both form and habits, growing either on rocks or on the basal portions of *Phyllospadix.* In the latter case the stems usually exhibit a remarkable tendril action. Diameter of the stems is commonly 1.5 mm.

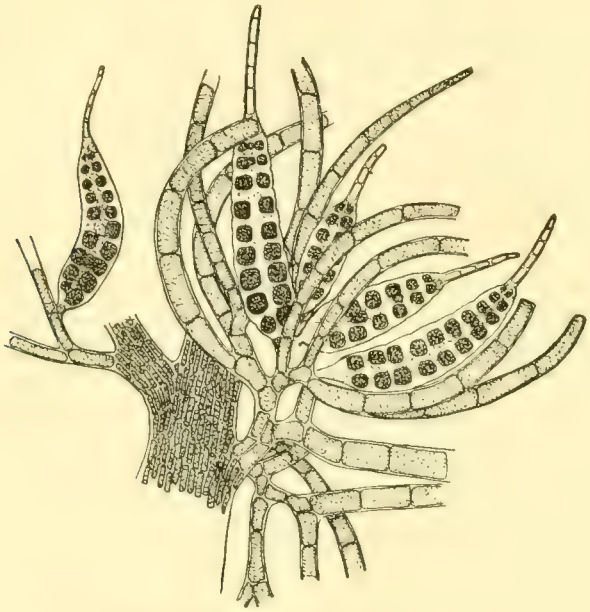


Figure 125. Dasya pacifica Harv.

Laurencia pinnatifida (Gmel.) Lamx.

On rocks of the lower tidal zone.

Polysiphonia verticillata Harv.

(Figure 117)

Epiphytic on other algæ of the lower tidal zone.

Pterosiphonia woodi (Harv.) Falk.

(Figures 118 and 119)

Commonly epiphytic on *Nereocystis.* Length of cells commonly 2 mm. Diameter of cystocarps, .4 mm.; tetraspores .12 in diameter.

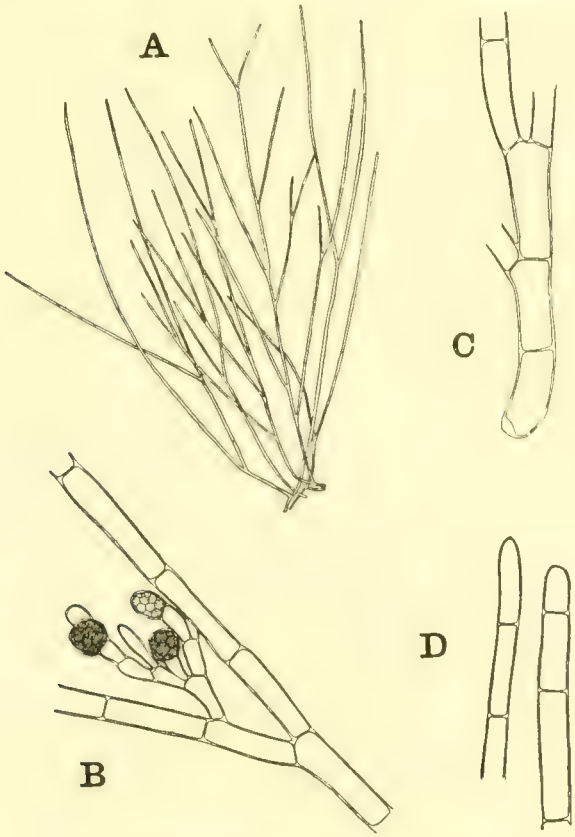


Figure 126. Spermothamnion snyderae Farlow.

Figure 127. Griffithsia sp.

Pterosiphonia bipinnata (P. and R.) Falk.

Epiphytic on *Nereocystis.*

Pterosiphonia baileyi (Harv.) Falk.

Occasional on rocks of low tidal zone.

Strebdocladia camptoclada (Mont.) Falk

(Figures 120 and 121)

Abundant as an epiphyte on other algæ of the whole tidal zone. Cystocarps .3 mm. in diameter.

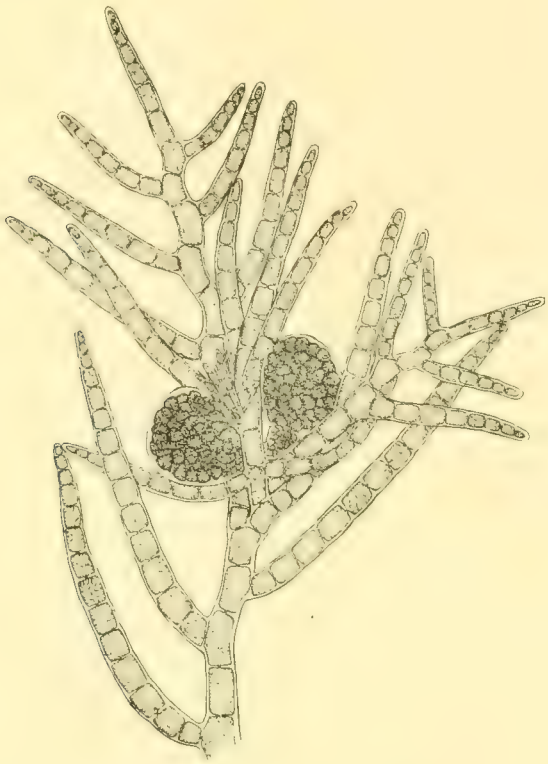


Figure 128. Callithamnion rupicolum f. pygmaeum Collins.

Strebdocladia sp.

(Figure 122)

Abundant on rocks and shells of the lower tidal zone. Of this plant, Dr. Setchell says: "Possibly a *Strebdocladia;* perhaps, however, a *Polysiphonia.* I have had it before, but as yet have not satisfactorily placed it."

Herposiphonia sp.

(Figure 123)

This was found in tow-stuff from the tide-pools, so that it is probably an epiphyte on other algæ growing in such situations.

Lophosiphonia obscura (Ag.) Falk.

Common on low rocks of higher tidal zone, growing in dense colonies and acting as a sand gatherer.

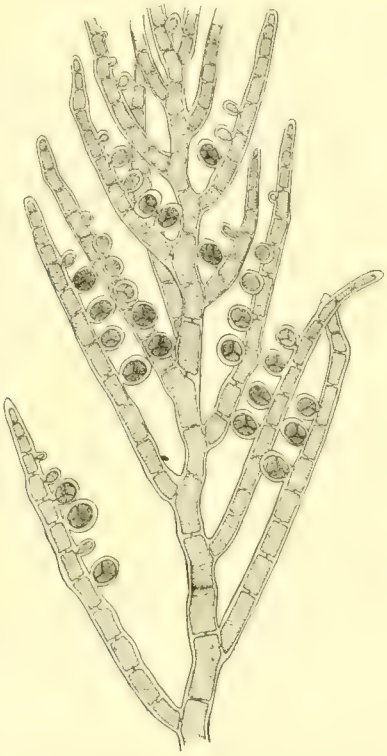


Figure 129. Callithamnion rupicolum f. pygmaeum Collins.

Lophosiphonia villum (J. Ag.) S. and G.

Occurs intermingled with *L. obscura.*

Heterosiphonia secunda (Suhr) Falk.

Frequent as an epiphyte on various algæ, especially corallines. Dr. Setchell remarks that "this is the plant which has passed in our lists under the name of *Dasya subsecunda.* The name given in the list is merely a synonym. There seems to be some reason for suspecting that our plant is not identical with the type of the species given, but belongs rather to *H. pulchra* of the Japanese coast."

Heterosiphonia subsecunda (Suhr) Falk.

(Figure 124)

Epiphytic on other algæ. Stichidia .8 mm. in length.

Dasya pacifica Harv.

(Figure 125)

Occasional in beach wrack. Stichidia .45 mm. in length.

CERAMIACEAE

Spermothamnion snyderae Farlow

(Figure 126)

Occasional in small colonies on the under side of ledges in the lower tidal zone. Sporangia .1 mm. in diameter.

Griffithsia sp.

(Figure 127)

A common epiphyte on the algæ of the lower tidal zone. Sporangia .08 mm. in diameter. Dr. Setchell says of this plant: "The specimens all have tetraspores. I wish very much that it might be found with *cystocarps*. Until then we shall be uncertain as to the genus. *Griffithsia* is perhaps hardly to be applied to this plant. In all probability it is more likely to belong to one of the related genera, but it is impossible to decide this with certainty until we have the cystocarpic fruit."

Callithamnion rupicolum forma **pygmaeum** Collins

(Figures 128 and 129)

An occasional epiphyte on other algæ of the lower tidal zone. Sporangia .07 mm. in diameter. Cystocarps .2 mm. in diameter.

Antithamnion floccosum (Muell.) Klein

An epiphyte on *Nereocystis*.

Spyridia filamentosa (Wulf.) Harv.

Rare in the beach wrack.

Ceramium codicola J. Ag.

(Figure 130)

Common on *Codium mucronatum*, length commonly 1 cm.

Centroceras clavulatum (Ag.) Mont.

Abundant on the rocks of the upper tidal zone.

Microcladia coulteri Harv.

Epiphytic on *Prionitis*.

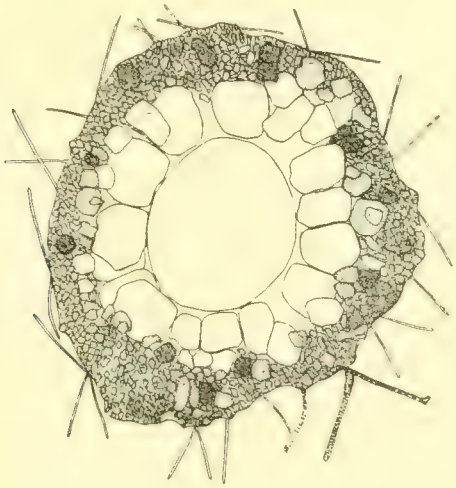
GRATELOUPIACEAE

Prionitis decipiens (Mont.) J. Ag.

Occasional on rocks between tides.

Grateloupia prolongata J. Ag.

Common on the rocks of the entire between tide zone.



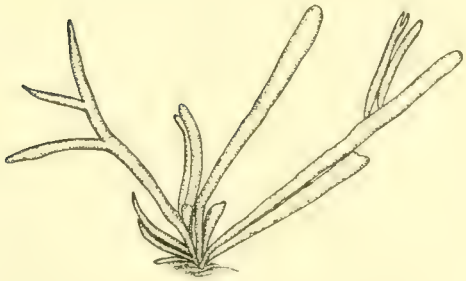


Figure 130. Ceramnium codicola J. Ag.

Polyopes bushiae Farlow

One specimen found in wrack on beach.

NEMASTOMACEAE

Schizymenia sp.

One specimen collected in wrack on beach.

CORALLINACEAE

Choreonema thuretii (Born.) Schmitz

Common in the middle tidal zone.

Lithothamnion sp.

Apparently several species of this genus form a common coating on rocks throughout the tidal zone. Dr. Setchell remarks of them, "No one knows the species of the crustaceous corallines."

Amphiroa tuberculosa forma **typica** S. and G.

Amphiroa tuberculosa f. **frondescens** (Kuetz) S. and G.

The above two forms are common on the rocks of the lower tidal zone.

Corallina officinalis L. var.

A common coralline among rocks of the middle tidal zone.

Corallina gracilis Lamx.

Frequent on rocks toward the lower tide mark.

Jania crassa Lamx.

Occasional on rocks about lower tide mark.

Jania rubens (L.) Lamx.

Occurs in middle tidal zone.

Lithothrix aspergillum J. E. Gray

Frequent on rocks of the middle tidal zone.