

REPORT
OF THE
NEW JERSEY STATE
MUSEUM
1911

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SENATOR ERNEST R. ACKERMAN,
President of Senate and Member of State Museum Commission.

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2006

ANNUAL REPORT

SMITHSONIAN
B. M.

OF THE

New Jersey State Museum

Including a list of the Specimens and Publications
received during the year

With a Report of the
CRUSTACEA OF NEW JERSEY

New Jersey State Museum.

FULLY ILLUSTRATED

1911



TRENTON, N. J.
MacCrellish & Quigley, State Printers, Opposite Post Office.

PART I.

(3)

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Commissioners of the New Jersey State Museum.

STATE COMMISSIONER OF EDUCATION, CALVIN N. KENDALL, *President.*

STATE GEOLOGIST, HENRY B. KUMMEL, *Secretary.*

PRESIDENT STATE BOARD OF AGRICULTURE, JOSEPH S. FRELINGHUYSEN.

PRESIDENT OF THE SENATE, ERNEST R. ACKERMAN.

SPEAKER OF THE HOUSE OF ASSEMBLY, EDWARD KENNY

SILAS R. MORSE, *Curator.*

Heads of the Several Departments of the New Jersey State Museum.

CALVIN N. KENDALL, STATE COMMISSIONER OF EDUCATION,
Educational.

JOSEPH S. FRELINGHUYSEN, RUTGERS COLLEGE,
Agriculture.

HENRY B. KUMMEL, STATE GEOLOGIST,
Geology.

JOHN C. SMOCK, EX-STATE GEOLOGIST,
Forestry.

WITMER STONE,
Birds and Botany.

JOHN B. SMITH, STATE ENTOMOLOGIST,
Entomology.

JAMES T. MORGAN, DEPUTY OF BUREAU OF LABOR STATISTICS,
Manufactures.

WILLIAM H. WERNER, *Taxidermist of Museum.*

HERBERT M. LLOYD, SECRETARY OF GEOLOGICAL SURVEY,
Archæology.

Letter of Transmittal.

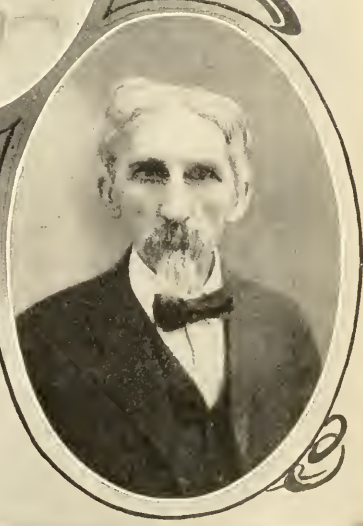
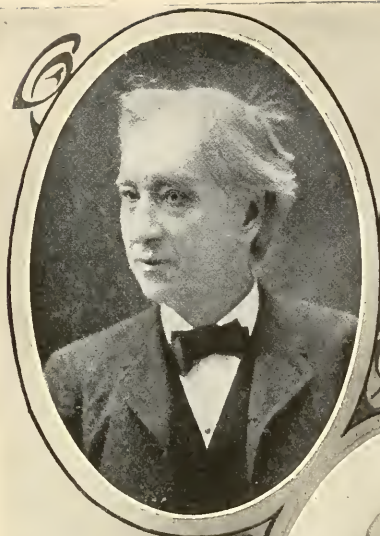
TRENTON, N. J., November 30th, 1911.

*To the Honorable Woodrow Wilson, Governor
of the State of New Jersey:*

SIR—I have the honor to present, for the Commissioners of the New Jersey State Museum, the Annual Report, including the Curator's Report, and a Report on the Crustacea of New Jersey.

SILAS R. MORSE,

Curator.



AUSTIN C. APGAR, *former Head of Biological Department.*
PROF. JOHN B. SMITH, *former State Entomologist.*
DR. E. B. VOORHEES, *former Commissioner.* WILLIAM H. WERNER, *former State Taxidermist.*

The Curator's Report.

The present report, "The Crustacea of New Jersey," is the seventh report on natural history subjects issued by the State Museum.

We think this subject will be both interesting and beneficial, as there seems to be no practical work on this subject suitable for the public schools and as reference books for the public libraries.

The subject matter of this part of the report has been collected and written by Henry W. Fowler, who has devoted much time to it, or for a number of years. He is also the author of "The Fishes of New Jersey" and "The Amphibians and Reptiles of New Jersey." We feel the present attempt will be a valuable addition to our Museum reports.

The demand for these works has been so very great that we have had to use much care in their distribution. The report on "The Insects of New Jersey," by the late Prof. John B. Smith, of Rutgers College, the State Entomologist, is especially valuable and in great demand. The editions of the Fish Report, and Mammal Report, have been exhausted. All of these volumes on natural history subjects are creditable to the work of the Museum, and the authors as well.

VISITORS.

The number of visitors to the Museum is continually increasing, a fact very gratifying to the Commissioner and the Curator.

We have as yet been unable to procure more room, which is so much needed, but then every department in the State House is in need of more room, as the business of the State increases. Soon something must be done to provide more rooms, and we trust the State Museum will soon be provided with the needed room.

The Ackerman Gift.

The collection of Continental paper money, presented to the State Museum by Acting Governor Ernest R. Ackerman, during the past year, is one of the most valuable that the Museum has acquired up to this time.

This gift is best described in the Trenton *Evening Times*, of June 5th, 1911, in the following:

ACTING GOVERNOR ACKERMAN GIVES CONTINENTAL MONEY COLLECTION
TO THE STATE.

New Jersey's Museum, Already the Depository of Wealth of Material of Historic Value, is Enriched by Generosity of the Senate President—Gift Highly Praised by Curator Morse and Others.

Through the generosity of Acting Governor Ernest R. Ackerman, the New Jersey State Museum, already the depository of a wealth of material of historic and economic value, is to be enriched by a splendid collection of Continental paper money. Acting Governor Ackerman has presented the collection to the Museum and Curator S. R. Morse has accepted it for the State.

The collection consists of 110 pieces and is one of the finest in the world, as it is complete in every detail as issued to the people, with one exception. It lacks the six dollar note of the tenth issue, dated Philadelphia, September 26th, 1778. This, Mr. Ackerman still hopes to obtain and place with the collection. The collection will be mounted in suitable frames for proper display in the Museum and will be known as the Ackerman Currency Collection.

This collection was formed by the late Harmon A. Chambers, of Philadelphia, a collector of notes, who gave a greater part of more than eighty odd years of his life to the collection of paper money, autograph letters and historical matters relating to Pennsylvania. This set, all in fine condition, was the one Mr. Chambers had selected as his best. Acting Governor Ackerman obtained the set some years ago when the Chambers collections were disposed of. Mr. Ackerman has added many choice notes to his collection from the Chambers sale.

Acting Governor Ackerman has long been known as one of the most noted living philatelists. His collection of postage stamps of the United States and various foreign countries is superb. While he has long been known as a famous collector of stamps, few of his friends knew that he was also a collector of coins and paper money.

Curator Morse said to-day that the value of this collection as an educational exhibit is beyond comprehension, and the State was indeed very fortunate in obtaining it. He declared the gift was another demonstration of the liberality of New Jersey citizens and their desire to make the State Museum one of the finest in the country.

Continuing Mr. Morse insisted that the State should no longer delay making provision for the increased museum accommodations that the great and

valuable collection may be properly safeguarded and displayed. He said that he was in touch with other citizens who would, doubtless, contribute collections to the Museum as the final resting place for them if the State provided adequate facilities for properly displaying them.

MR. STERLING'S DESCRIPTION.

E. B. Sterling, of this city, long a well-known collector, says the Ackerman collection is the finest he has ever seen of paper money of Continental issue, and the State is to be congratulated upon receiving it. He has written the following description of each piece in the set:

Paper money issued by the thirteen original Colonies of North America was first issued by Massachusetts in 1690 followed by Connecticut and New York, both in 1709.

Rhode Island,	1715	Pennsylvania,	1723
New Jersey,	1724	South Carolina,	1731
Delaware,	1735	New Hampshire,	1737
Maryland,	1740	South Carolina,	1748
Georgia,	1749	Virginia,	1755

Vermont issued State paper money in 1781.

The fight for American liberty began at Lexington, Mass., nineteenth of April, 1775, and on the tenth day of May the second Continental Congress assembled, one of the first acts being to issue paper money of various denominations.

DESCRIPTION OF THE NOTES.

These bills give abundant evidence of the haste with which they were prepared, being a combination of type with engraved borders and circular vignette, having a Latin motto above. The bill reads, The United Colonies (with value repeated) at top and bottom; Continental Currency (with value repeated) at each side; in body of note: "This bill entitles the bearer to receive Spanish milled dollars, or the value thereof, in gold or silver, according to the resolutions of the Congress, held at Philadelphia the 10th of May, 1775." Each note numbered in ink, signed by two of the committee, one signing in red and one in black ink. The reverse represents a crude imitation of leaves of various trees, different on each value, with the denomination above: "Philadelphia, Printed by Hall and Sellers, 1775"; below: the whole enclosed in a type border composed of pieces of various patterns evidently selected to add to the difficulty on counterfeiting. The engraved parts were cut on type by an English gun engraver named Smithers. This style of work was adopted so that the bills could be rapidly produced on the ordinary printing presses of the period.

The devices selected for the various values (which were retained for the same denominations throughout the series), were very odd and quaint and showed the spirit and earnestness of the committee who furnished the designs and fitted each with an appropriate Latin motto, supposed to cheer the patriots and depress the invaders and tories.

The designs are described as follows:

One Dollar.—Acanthus plant sprouting up around a basket which is held down by a heavy tile. The motto, *Depressa Resurgit*, "Though pressed down, it will rise again," meaning that although the country had been kept down by a foreign power it would eventually rise in strength and beauty.

Two Dollars.—A hand with flail about to thresh out a sheaf of wheat. The motto, *Tribulatio Detat*, "Affliction enriches." Showing the hard blows they must expect to receive will eventually rebound to their own good.

Three Dollars.—An aerial flight between a crane and an eagle in which the weaker bird has decidedly the best of it, for while each bird has clasped the other's claws and the eagle is uppermost, his neck is pierced by the long bill of the crane, making it difficult for him to strike his antagonist. The motto, *Exitus Indubioest*, "The end is certain."

Four Dollars.—A wild boar charging on a spear, motto, *Aut-Mors-Aut-Vita-Decora*, "Either death or an honorable life."

Five Dollars.—A thorny bush which has been grasped by an openhand from which the blood is dropping. The motto, *Sustine-Vel-Abstine*, "Sustain or abstain."

Six Dollars.—Beaver gnawing at a tree, the motto being *Perseverando*, the motto intending to show that the greatest obstacles can be overthrown by the smaller party.

Seven Dollars.—A storm, the rain coming down in thick streams over hill and valley while black clouds roll above. The motto, *Serenabit*, "It will clear up," meaning all cheer up.

Nine Dollars.—A thirteen-stringed harp with the motto, *Majora-Mil-Noribus-Constant*, "The greater and smaller ones all sound together." To give encouragement to the smaller States as well as the larger.

Twenty Dollars.—The ocean with mediæval device of a face blowing on it from out of the clouds. The motto, *Vi Concitata*, "Driven by force," the waves of course representing the people, the wind England, which is forcing them to rise up in self-defense. This bill differs from the rest of the series in every respect. The shape is narrower and longer; it has no engraved border, but has a chain linked around the four sides with "Continental Currency" in chain letters at top. It is printed on white paper, soft and porous, while all the other are printed on stiff paper, dull color, with mica and blue silk threads inserted. The left end is marbled in various colors. The reverse is also different, with a mixed border and having a circular vignette at left end, which motto reads, *Cessantevento Conquiescemus*, "The wind ceasing, we will be cheerful," representing the sun spreading its rays over the ocean upon which are sailing two ships; also the words "Continental Currency, Twenty Dollars." This is the rarest note of the series, only 11,800 bills having been printed, while 49,000 of all the other denominations were issued.

On the 24th of July, 1775, another million dollars of bills of the denomination of \$30.00 were printed, but the date on the note remained as before. The style is similar to the values on the obverse, while the reverse contains the vignettes of both sides of the \$20.00 last described. The design on the face of the \$30.00 bill is a small tomb with a large laurel wreath on it, with the motto, *Si-Recte-Facies*, "If thou shall do well." A wreath on an altar

which is supposed to represent Congress. This issue is signed by two of the following twenty-eight persons, one with red and the other with black ink: Thomas Barlow, Thomas Barclay, John Bayard, Andrew Bunker, Thomas Coombe, William Craig, Daniel Clymer, Judah Foulke, Isaac Hazellhurst, William Jackson, Robert S. Jones, Fred Kuhl, Thomas Lawrence, Ellis Lewis, Mordecai Lewis, John Mease, Samuel Meredith, George Mifflin, James Milligan, Anthony Morris, Luke Morris, Samuel Morris, John M. Nesbit, James Reed, Robert Roberts, John Shee, Joseph Sims, Robert Tuckniss.

The second series of notes is of the same design and values from one to eight dollars, the total issues being the same as the first series, or three million dollars, and are dated Philadelphia, November 29, 1775.

The third series, dated Philadelphia, Feb. 17, 1776, introduces four new values, which are confined to this issue only. The shape is upright instead of oblong, and the denominations $\frac{1}{6}$, $\frac{1}{3}$, $\frac{1}{2}$ and $\frac{2}{3}$ of a dollar. The design is the same on all, that of a sun dial with the word "*Fuglo*" in the half circle, and "Mind your business" below. The device is familiar to all coin collectors as that of the first American cent, while the reverse is equally well known from being found on the Continental pewter dollar. The thirteen-linked chain, bearing the name of a State, encircling a ring in glory inscribed "American Congress," in centre "We Are One." The designs of the fractional notes are far superior to those employed on the higher values. There are three designs of francs to each value, which are marked respectively, A, B, C. They were signed only once, and that in red ink. All this series contain the mica and silk threads in paper, a safeguard for all Continental bills.

The fourth, fifth and sixth series contain nothing noteworthy, other than the one dollar bill is omitted from the fifth and sixth and the \$30 take their place.

The dates are May 9, 1776; July 22, 1776; November 2, 1776, respectively.

The seventh series is noteworthy from the fact that they are dated at Baltimore, February 26, 1777, instead of Philadelphia. The values and designs remain the same.

The eighth series is the first on which the name is given as the United States, the old designation of United Colonies having been discontinued on the four series issued since the glorious Fourth, when it was officially adopted. This change in name was effected by a simple alteration of the border, except in the case of the \$30, where new top and bottom pieces were prepared. The set was issued at Philadelphia and dated May 20, 1777.

The ninth series, dated at Yorktown, April 11, 1778, are the most interesting of the entire series from the fact of their great rarity and for the substitution of the \$20, \$30 and \$40 bills (the latter value being the only one in the entire series with an English motto) in place of the regular \$1, \$2 and \$3 bills.

The borders have been replaced by new ones of less elaborate designs and the vignettes re-engraved in an inferior manner.

Counterfeits of this rare issue are met with, and from their frequency at the period and together with the eighth series, were withdrawn from circulation on this account.

The design on the \$40 bill is an altar with fire surrounded by thirteen stars, with the All-Seeing Eye above, with "Confederation" below on ribbon. This is the only instance where the motto is given in English.

The tenth series is dated Philadelphia, September 26, 1778, adding two new values, \$50 and \$60, this issue consisting of the following values: \$5, \$6, \$7, \$8, \$20, \$30, \$40, \$50 and \$60. The engraving is the same as used for the Yorktown set. \$50 represents an unfinished pyramid, consisting of thirteen layers of stone, representing the thirteen States. The motto, *Perennis*, means "Everlasting," a most appropriate device. Reverse, two arrows pointed upwards with one crossed.

Sixty Dollars.—The world floating in the firmament, with motto *Deus Regnat Exultat Terra*, "The Lord reigneth, let the earth rejoice." Reverse, a bow without arrows, representing all is spent.

The eleventh and last issue of Continental bills closed the series by giving the name of the government in full, "The United States of North America," omitting the name of the city where issued. The date is January 14, 1779.

As a safeguard against counterfeiting an oblong band in the left border and a section of the vignette is printed in red. No counterfeits of this series are found from the fact that the depreciation was so great that they were not imitated to any great extent, if any.

The values are as follows: 1, 2, 3, 4, 5, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70 and 80 dollars.

Thirty-five Dollars.—A field with a plow in the foreground, three trees and cloud above. The motto, *Hinc O Pcs*, "Hence Our Wealth," calling attention to the fact that agriculture is the sure source of wealth.

Forty-five Dollars.—Two beehives under a shed, bees at side and in front. The motto, *Sic Floret Respublica*, "Thus flourishes the Republic," teaching that if they would prosper they must follow the example of the bees.

Fifty-five Dollars.—The sun shining on a landscape and driving the black clouds away. The motto, *Post Nubila Phoebus*, "After the clouds comes the sun."

Sixty-five Dollars.—A hand from heaven holding a pair of scales over the earth. The motto, *Fiat Justitia*, "Let justice be done," calling attention of all to the fact that their cause is just and that they must place their reliance in God.

Seventy Dollars.—A single tree growing on a hilltop. The motto, *Tim Procellarum Quadrennium Sustinit*, "For four years it has sustained the force of the storm." The tree represents the United States, which, after four years of war, still remained strong and a sign of full encouragement for the future.

Eighty Dollars.—A large strong tree, firmly rooted and its branches filling all the space above. The motto, *Et In Secula Se Culorum Florescebit*, "It will flourish forever and ever." The last and highest denomination of the series. This prophetic announcement certainly has proven to be true.

While the first emission was dated May 10, 1775, the notes were not actually in circulation until August following.

Till the issue exceeded nine millions, the bills passed at their nominal value. The depreciation afterwards was very great.

The rate of exchange for hard money in Philadelphia from January, 1777, was $1\frac{1}{4}$ and in May, 1781, was 500. On the 31st of May, 1781, the Continental bills ceased to circulate as money, but were afterwards bought on speculation at various prices, from four hundred for one up to one thousand for one.

The value for Continental paper money was not the same in different parts of the country. The exchange was, for example, December 25, 1779, at thirty-five for one in New England, New York, the Carolinas and Georgia, and at forty for one in Pennsylvania, New Jersey, Delaware, Maryland and Virginia. As late as May, 1781, speculations were entered into at Philadelphia to purchase Continental money at two hundred and twenty-five for one and sell it at Boston at seventy-five for one.

It is worthy of remark that the depreciation of Continental money never stopped the circulation of it. As long as it retained any value at all it passed quick enough, and would purchase hard money or anything else as readily as ever when the exchange was two hundred for one and when every hope or even idea of its being ultimately redeemed at nominal value had entirely vanished. According to an estimate by the Register of the Treasury of 1790, the issues of the Continental money amounted to \$359,547,027.25 from 1775 to 1781, when the circulation ceased.

The Continental money was in its true character a simple evidence of debt due by the Government, when the Continental money was first issued. An expression of doubt as to its value involved suspicion of disaffection to the cause of the country. As the issue increased the prices of goods necessarily rose, but this was attributed to combination of the merchants to raise prices of their merchandise and to sink the value of Continental money. They were called Tories, speculators and many other hard names, and their stores were forcibly broken open and their goods sold at limited prices by committees of the neighbors.

On January 11, 1776, Congress resolved that whoever should refuse to receive in payment Continental bills, should be declared and treated as an enemy of his country and be precluded from intercourse with its inhabitants; in other words outlawed.

Other various acts were passed from time to time during the next five years to force the people to take Continental money. Many thousand families of full and easy fortunes were ruined by these fatal measures, and the loss mostly fell on the Whigs, as it was in their hands when the paper depreciated.

The Tories, who had no confidence in it from the beginning, made it a rule to part with it as soon as possible. Certain compulsory measures of the Executive Council of Pennsylvania designed to support the credit of the Continental money and of the State bills gave the fatal blow to the system in May, 1781.

C. J. Baxter, Ex-President of the Museum.

When Dr. A. B. Poland, now City Superintendent of Newark Public Schools, resigned as State Superintendent of New Jersey

to take a position in New York city, Dr. Charles J. Baxter was appointed to the position of State Superintendent by Governor Griggs on March 24th, 1896, and was at once confirmed by the Senate.

Dr. Baxter was elected President of the New Jersey State Museum Commission at its first meeting, and has held that office up to July 1st, 1911, when he went out of office as the State Superintendent by act of the Legislature, which act abolished the office of State Superintendent, and created a new department with a Commissioner of Education at the head, and a new State Board of Education of eight members instead of twenty, as before.

As President of the New Jersey State Museum Commission, Mr. Baxter took an active part in making the Museum a success, and he was always a very strong advocate of it. Mr. Baxter will be greatly missed. Dr. Calvin Kendall, the new Commissioner of Education, was elected President of the Museum Commission at its last meeting, and he is deeply interested in all matters that advance the cause of education.

List of Publications Received for the Museum Library.

We beg to acknowledge receipt of the following publications :

- Annual Report of the Smithsonian Institute for 1910.
- Ortmann on the Crawfishes of the State of Pennsylvania.
- University of California Bulletin, Third Series, Vol. 3, No. 8.
- The Oölogist, No. 286.
- American Museum Journal, Vol. 11, No. 5.
- Bulletin of the Charleston Museum, Vol. 7, No. 5.
- Zoölogical Society Bulletin, New York, No. 45.
- Camden Board of Trade Journal, Vol. 1, No. 5.
- New York Zoölogical Bulletin, No. 47.
- American Museum Journal, Vol. 11, No. 4.
- Zeitschrift für Hochschulpädagogik.
- The Oölogist, No. 285.
- Bulletin of the Detroit Museum of Art, Vol. 5, No. 2.
- Bulletin of the Charleston Museum, Vol. 7, No. 4.
- Bulletin of the Pennsylvania Museum for April.
- The Ecological Succession of Birds.
- The Wild Life Call.

- Bulletin of the New York Botanical Garden, Vol. 7, No. 25.
 The Oölogist, No. 284.
 American Museum of Natural History, Guide Leaflet, No. 31.
 Bulletin of the New York Zoölogical Society, No. 44.
 The American Museum Journal, Vol. 11, No. 3.
 American Museum of Natural History, Guide Leaflet, No. 33.
 Direct Election of Senators, Washington, 1911.
 Bulletin of the Charleston Museum, Vol. 7, No. 3.
 Bulletin of the Chicago Academy of Sciences.
 Chicago Academy of Sciences, special publication, No. 3.
 Bulletin of the Pennsylvania Museum for January, 1911.
 University of Illinois Bulletin, Vol. 8, No. 21.
 Field Museum of Natural History, Publication 150.
 Forty-second Annual Report of the American Museum of Natural History for 1910.
 Bulletin of the Charleston Museum, Vol. 7, No. 2.
 Annual Report of the Governor of Alaska of the Alaska Game Laws, 1910.
 The American Museum Journal, Vol. 11, No. 2.
 Speech of Hon. Henry Cabot Lodge, of Massachusetts, in the Senate of the United States.
 Bulletin of the Wisconsin Natural History Society, Vol. 8, No. 4.
 The American Museum Journal, Vol. 11, No. 6.
 University of Illinois, Annual Register, 1910-1911.
 Extinct and Existing Glaciers of Colorado.
 University of Illinois Bulletin, Vol. 8, No. 17.
 University of Illinois Bulletin, Vol. 8, No. 16.
 Bulletin of the New York Zoölogical Society, No. 48.
 Camden Board of Trade Journal, No. 6 and No. 12.
 American Museum of Natural History Journal, Vol. 11, No. 8.
 South Dakota Geological Survey Bulletin, No. 4.
 Bulletin of the New York Botanical Garden, Vol. 7, No. 26.
 Proceedings of the Portland Society of Natural History, Vol. 11, Part 9.
 Bulletin of the Charleston Museum, Vol. 7, No. 6.
 Bulletin of the Wisconsin Natural History, Vol. 9, No. 3.
 American Museum Journal, Vol. 11, No. 7.
 Camden Board of Trade Journal, Nos. 10 and 8.
 The Game Market of To-day.
 United States Department of Agriculture, Circular No. 83.
 Bulletin of the Buffalo Society of Natural Sciences.
 United States Department of Agriculture, Farmer's Bulletin 470.
 The Bulletin of the Detroit Museum of Art, Vol. 5, No. 3.
 Bulletin of the Pennsylvania Museum for July, 1911.
 Bulletin of the New York Zoölogical Society, No. 46.
 Bulletin of the Pennsylvania Museum for October, 1911.
 The Oölogist, No. 291.
 The Oölogist, No. 288.
 United States Department of Agriculture, Circular No. 81.
 United States Department of Agriculture, Circular No. 84.
 Bulletin of the Chicago Academy of Sciences, Vol. 3, No. 4.

- The Oölogist, No. 290.
 University of Michigan Bulletin, Vol. 12, No. 26.
 University of Illinois Bulletin, Vol. 8, No. 4.
 The Louisiana State Museum, Leguminosæ of Louisiana.
 Twenty-eighth Annual Report of the Public Museum of the City of Milwaukee.
 Proceedings of the American Association of Museums, Vol. 9.
 Report of the State Museum, Division of Education, Harrisburg, Pa.
 Pedigree Cultures and Museums.
 Annotations on Certain Isle Royale Invertebrates.
 Notes of Isle Royale Mammals and their Ecological Relations.
 Sur L'ontogenese De L'insects.
 Camden Board of Trade Journal, No. 7.
 Report of the Chief of the Bureau of Biological Survey for 1910, Washington.
 American Museum of Natural History, No. 32 of the Guide Leaflet Series.
 The Stone Age of North America.
 Textile Industries of Philadelphia, Pa.
 Fifty-fifth Annual Report of the Pennsylvania Museum and School of Industrial Art.
 Description and Details of Articles Recovered from the Sacred Lake of Guatavita.
 On the Identity of *Thecla Muri*.
 The First Grammar of the Languages Spoken by the Bonoc Igorot.
 Bollettino del Laboratorio di Zoölogia Generale e Agraria.
 Thirty-seventh Annual Report of the Newark Shade Tree Commission.

New Specimens In the Museum.

BIRDS.

- | | |
|---|---|
| Whistling Swan, male. | Black Rail. |
| Black Vulture, male and female. | Two Groups of Hungarian Partridges. |
| Glaucous Gull. | Heath Hens, male and female. |
| Razor-billed Auk, male and female. | Gull-billed Tern, male and female. |
| Cabot Tern. | Brant, female. |
| Corn Crane. | L.a. Heron, male and female. |
| Northern Parula Warbler, male and female. | Little Blue Heron, dark plumage, male and female. |
| Least Sandpiper, male and female. | Little Blue Heron, white plumage, female. |
| Baird's Sandpiper, male and female. | Purple Sandpiper, male and female. |
| Painted Bunting, male and female. | White-rumped Sandpiper, male and female. |
| Chestnut-sided Warbler, male and female. | Hudsonian Godwit, male and female. |
| Orange-crowned Warbler, male and female. | Seaside Sparrow, male and female. |
| Blackburnian Warbler, male and female. | Blue-headed Vireo, male and female. |
| Arctic Tern. | Warbling Vireo, male. |
| Vesper Sparrow, male and female. | Carolina Wren male. |
| Cærulean Warbler. | Group of Sandpipers. |

MAMMALS.

Porcupine.	Bat.
Deer Head.	Two Rabbits.
Four Moles.	White-footed Mouse.

Birds.

We have added many new specimens to the Museum collection. Several very rare ones, among them a pair of Heath Hens; Others are a pair of Philadelphia Vireos; Black Rail, male; Glaucous Gull, male; Whistling Swan, female; Corn Crake, female; a pair of Black Vutures.

We still need the following specimens to complete our list of New Jersey birds. We shall be glad to purchase them whenever possible.

38 Long-tailed Jaeger, male and female.	227 European Woodcock, male and female.
42 Glaucous Gull, female.	244 Curlew Sandpiper, male and female.
67 Cabot's Tern, female.	260 Ruff, male and female.
68 Trudeau's Tern, male and female.	272 Golden Plover, male.
71 Arctic Tern, female.	315 Wild Pigeon, male and female.
72 Roseate Tern, male and female.	327 Swallow-tailed Kite, male and female.
75 Sooty Tern, male and female.	395 Red-Cockaded Woodpecker, male and female.
86 Fulmar, male and female.	443 Scissor-tailed Flycatcher, male and female.
92 Audubon's Shearwater, male and female.	465 Arcadian Flycatcher, male and female.
104 Stormy Petrel, male and female.	466a Adler Flycatcher, male and female.
136 European Widgeon, male and female.	473 European Skylark, male and female.
138 European Teal, male and female.	467 Least Flycatcher, male.
156 Labrador Duck, male and female.	493 European Starling, male and female.
169.1 Blue Goose, male and female.	528b Greater Redpoll, male and female.
171a White-fronted Goose, male and female.	547 Henslow's Sparrow, male and female.
172a Hutchin's Goose, male and female.	549.1 Nelson's Sharp-tailed Sparrow, male and female.
174 Black Brant, male.	604 Dickcissel, male and female.
186 Glossy Ibis, male and female.	
217 Corn Crake, male.	

616	Bank Swallow, male and female.	658	Cerulean Warbler, female.
617	Rough-winged Swallow, male and female.	675e	Grinnell's Water Thrush, male and female.
627	Warbling Vireo, male and female.	672	Palm Warbler, male and female.
631	White-eyed Vireo, female.	678	Connecticut Warbler, male.
641	Blue-winged Warbler, male and female.	718	Carolina Wren, female.
	Brewster's Warbler, male and female.	722	Winter Wren, female.
646	Orange-crownd Warbler, male and female.	724	Short-billed Marsh Wren, male and female.
		751	Blue-gray Gnatcatcher, male and female.
		757	Grey-cheeked Thrush, female.

The Joseph B. Livezey Collection.

Mr. Joseph B. Livezey, of Mount Royal, N. J., who died February 23d, 1911, in his will bequeathed "to the New Jersey State Museum at Trenton his collection of minerals, fossils and other curios, as they think worth a place in this collection." This collection was accepted by the Commissioners and a letter of thanks sent to the heirs of Mr. Livezey. One of the attaches of the Museum was sent to Mount Royal to pack and ship the collection. It was placed in a cabinet until a proper location can be made in the Museum.

The collection consists of nearly 1,500 different specimens, mostly small ones, such as Indian relics, shells, petrified wood, minerals, etc., and is a valuable addition to the Museum.

The Gross Collection.

The botanical collection of C. A. Gross, which was presented to the Museum by his children two years ago, was another valuable gift to the State. It is a collection of the flora of southern New Jersey. It will soon be ready to be placed on exhibition in the Museum.

Memorial to Dr. E. B. Voorhees.

Former Commissioner of the New Jersey State Museum.

(Taken from Memorial by Dr. W. H. S. Demarest, President of Rutgers College, New Brunswick, N. J.)

Edward Burnett Voorhees was born June 22d, 1856; he died June 6th, 1911. He was graduated from Rutgers College with the degree of Bachelor of Arts in 1881, and in 1900 he received the degree of Doctor of Science from the University of Vermont. He became Professor of Agriculture in Rutgers College in 1890 and Director of the State and College Experiment Stations, respectively, in 1893 and 1896, which office he held until his death.

He was a classical student, as we have familiarly used the term through the years; he took the Arts degree, which demanded for its conferring Latin and Greek; and from such classical training he passed speedily into the research field of scientific agriculture and so to his eminent place in agricultural education; standing thus as one of the many high examples of great distinction in scientific and technical profession built from the broad foundation of a classical culture. As a graduate, through thirty years he gave to his college a loyal and energetic love. After but a single year's service elsewhere, in 1882 he came back to take up life and work within the walls where he studied, and there his home and his work remained to the end. It was inevitable that out of his marked ability and success in his chosen line of study and service he should become Professor of Agriculture in the college where his experiment, research and direction was maintained. Thus he entered the faculty in 1890, succeeding the lamented Dr. George H. Cook. For twenty years Dr. Voorhees, as Professor of Agriculture, fulfilled and advanced in Rutgers College this line of instruction with a power and aptness commanding wide recognition. And especially in the last half dozen years did he, as head of the department, with the administration of the college, successfully promote large things for this field of learning, chiefly perhaps in leading the State to the establishment of the Short Course in Agriculture.

Out from the College and Station Centre his work and his personality pervaded the State and even played their part in the life and progress of the nation. In the most material way the resources of the State were in far degree developed by that which came forth from his brain and hand.

It was his custom to go ceaselessly about the State, and his visits to communities and clubs were a vigorous campaign of scientific truth. Thus not only were great and continuous material results achieved, but, as well, a singular personal influence was created and wrought widely for good. Like Dr. Cook, he became widely known throughout the State, and throughout his wide acquaintance his character and work were a strong influence for the general good. It is difficult to measure the reach of such a life, but it is safe to say that there are few men in the life of the State who have been more warmly regarded, more surely trusted and more plainly followed than he. This singular hold upon the people and service of them was recognized in many appointments by the State itself and by organizations within its bounds. Such official places were not only the consequence of the unusual activities and acceptance, but the vantage point for still more effective work for the public good. Thus he was President of the State Board of Agriculture for many years, and frequently served on boards and commissions charged with the care of related interests. His counsel was always sought and respected; he it was who largely shaped policies, formulated plans and guided the movements of such enterprise.

It is plain that in all this distinguished relation to the State he was standing in high connection with general scientific movements and with the welfare of the world at large. He was a student, and the products of his scholarly thought and research were the enrichment of the worldwide field of learning. He was the author of books which became conspicuous promoters of the cause he represented and authorities in their special lines. In 1902 he received the Nichols Research Medal for the best paper containing results of chemical research submitted to the American Chemical Society Journal. He was a member of various learned societies, and read papers before them, both in this land

and abroad, where he was accorded the honors due an eminent scholar and scientist.

In the midst of engrossing work, surrounded by constant public demands, and challenged by the material problems of science, he found the time and had the spirit to enter steadily and strongly into the life and oversight of the church. He was a man of the fear of God and of faith. Born in a Christian home, trained in the nurture and admonition of the Lord, confessing his Lord in his maturity, he treasured through life the gospel of Christ and honored His church as the pillar and ground of the truth.

Dr. Voorhees was diligent in business, fervent in spirit. A supreme characteristic was his devotion to work, his incessantness in the affairs of his vocation. His interests were many and wide. His chosen calling brought him into manifold relations, many communities of men, many places of responsibility.

He was ambitious and confident and courageous. His heart, we say, was in his work; the joy of the pioneer and of the conqueror was his: the mastery of the earth beneath his feet, was a thing of the spirit as of the brain and hand. His was not a long life, but it was crowded full. He served his generation and his works do follow him.



Dr. Voorhees was a member of the Commission of the New Jersey State Museum from January 17th, 1901, to the time of his death, June 6th, 1911. His interest in the success of the State Museum was always shown by his work for it. For this success, we owe much to his interest and suggestions. No one could be associated with him in any way without profiting by the privilege of the association.

The Curator of the Museum feels that he has lost one of his best friends, and the State one whose place it will be hard to fill.

S. R. MORSE,

Curator.

Memorial to Mr. William H. Werner.

William H. Werner, a taxidermist of ability, has recently passed away in his seventieth year. His collection, all his own handiwork, valued at \$50,000, has been exhibited on the Atlantic City boardwalk, known as Wonderland. He was loved and respected by all who knew him. Fortunes may be made and lost. Fame may come upon the worthy and depart. There is but one thing that lives on through years, and that is character, the recollection of the kind sympathies, the loyalty, sincerity and integrity of the man who has gone. The thoughts of these good traits become enshrined in the minds of his fellowmen. The memory of these may sleep with one's consciousness, or may fade and be forgotten, but the mention of his name summons them back to life.

This sentiment is inspired by the sad demise of Mr. William H. Werner, of Atlantic City, N. J., which came as a distinctive shock to his relatives and friends, who were proud to call him friend. Mr. Werner, through a long life of usefulness, had endeared himself to a wide circle of friends, who deeply deplore his loss.

He was born in Nazareth, Pa., seventy years ago, and began the work and research of taxidermist at an early age. Being a naturalist, he combined the two talents, and built up the fine collection of birds, etc., which was for many years exhibited on the Boardwalk, Atlantic City, known as "Wonderland." This collection represented his life work, in which he had his whole interest. Experts of this country and abroad have pronounced the collection one of the finest of private collections in the world. Every animal and bird in the collection was hunted down, killed and stuffed by Mr. Werner himself.

No better evidence of the high regard in which Mr. Werner was held could be shown than upon the occasion of his funeral when the large concourse of mourners, coupled with the many beautiful floral offerings, was a striking testimonial to the memory of this estimable man.

With the death of Mr. Werner, the New Jersey State Museum loses another of its best friends and workers, the others being Prof. Apgar, in charge of the Department of Birds and Botany; Dr. E. B. Voorhees, one of the Commissioners, and Dr. John B. Smith, the head of the Department of Entomology.

Mr. Werner has been the State Taxidermist since the creation of the State Museum in 1895. He has mounted and arranged most of the birds and mammals in it. Before coming to our State he prepared the Pennsylvania State exhibits and those of the Lehigh University. At the St. Louis and Jamestown Exposition he arranged the birds and mammals for the exhibits. He has always been devoted to the success of the Museum, and was a friend who was true, honest and lovable.

The Museum and the Curator have lost a friend whose place cannot be filled. His work will be his monument when we shall all have passed away.

SILAS R. MORSE,
Curator.

Memorial to Dr. John B. Smith.

Dr. John B. Smith was born on November 21st, 1859, in New York City, of German parentage, and was educated in the public schools. He was admitted to the bar in 1880, and practiced law in Brooklyn between 1880 and 1884. He was greatly interested in insects, joined the Brooklyn Entomological Society of that time, and became editor of the bulletin of that society. This publication he afterwards developed into a periodical known as "Entomologica Americana," which became an important vehicle for the publication of smaller papers and notes. In 1884, he was made special agent of the Division of Entomology, U. S. Department of Agriculture, and for two years did field work, especially upon insects affecting hop and cranberry. This was his first introduction to economic entomology. In 1886 he was made aid in the Division of Insects of the U. S. National Museum, and held this position until he was appointed to his final position in New Jersey. During the four years he was con-

nected with the National Museum, it is true that his work was all of a systematic character and that he did no actual work in economic entomology, but he was a member of the Entomological Society of Washington and was constantly associated with the men of the Division of Entomology, U. S. Department of Agriculture, and followed their work intimately and discussed it with them; so that he really lived in an atmosphere of practical work.

With the founding of the Association of Economic Entomologists, an organization which has made a great impress on practical entomology, not only in this country but in other parts of the world, Dr. Smith was made secretary of the association and held this office for two years. He was made second vice-president in 1893, first vice-president in 1894, and president in 1895. His address as retiring president was entitled "Entomological Notes and Problems," and was delivered August 27th, 1895, at Springfield, Mass. It was a thoroughly practical address, dealing with all the phases of the work which the then new body of officials were engaged upon.

Dr. Smith's bibliography covers hundreds of titles. His industry was enormous. He not only made his office a noted one for its practical work, but he maintained all through his career an active interest in every phase of entomological research. He published, for example, two great catalogues of the insects in New Jersey, and very many systematic papers upon that Lepidopterous Family, Noctuidæ.

His latest work, and that which perhaps brought him the most fame, was that with the New Jersey mosquitoes. He was the first entomologist who realized and who proved that the banded-legged mosquitoes of the Atlantic coast must differ widely in habit and mode of life from the rain-barrel mosquitoes and the woodland mosquitoes of the interior; and he found that these salt-marsh mosquitoes breed in the salt marshes, and that their eggs are not laid in the water but on the mud, and that they fly a distance of from thirty to forty miles. These claims seemed revolutionary to earlier students of mosquitoes, but he proved his case beyond doubt and succeeded finally in securing a large

appropriation from this State, and in demonstrating that it is possible at a comparatively slight expense to control even these wild, salt-marsh forms.

Dr. Smith's death is a great loss to the State of New Jersey and the American economic entomology.*

Dr. Smith became associated in the work of the New Jersey State Museum at its creation by an act of the Legislature in March 26th, 1895. He was selected to have charge of the Entomological Department as soon as the commission was organized. The curator wrote to the Division of Entomology of the U. S. National Museum asking it to recommend a man to take charge of this department. This was the reply: "You have the best man for the work in your own State, Prof. John B. Smith, of Rutgers College. There is no better." This statement proved true.

My work with Dr. Smith has been one of the most delightful and profitable of my life. He has supervised all of the insect collections in the Museum, and the collection is among one of the best. The collection he prepared for the Museum "How to Exterminate Mosquitoes," shown at the St. Louis Exposition, was the first of its kind ever exhibited at an exposition. It was a wonderful exhibit and was studied by entomologists and others from all parts of the world. It is now a part of the New Jersey State Museum.

Dr. Smith wrote the part of the Museum Report on "The Insects of New Jersey," for 1910, which is one of the valued Museum reports.

We feel that the Museum, the State and the world has in his death lost one of their best friends and workers. The work he has done for the State, country and Museum will ever reflect his usefulness.

SILAS R. MORSE,
Curator.

* Taken from the Experimental Station Record, Vol. XXVI, No. 5.

PART II.

THE CRUSTACEA OF NEW JERSEY.

By HENRY W. FOWLER,

Of the Academy of Natural Sciences of Philadelphia.

PREFACE.

The animals known as the Crustacea, embracing the forms commonly called water-fleas, fish-lice, barnacles, beach-fleas, pill-bugs, wood-lice, shrimps, prawns, lobsters, crawfishes and crabs, are here treated with reference to those now known to inhabit the limits of the State of New Jersey. These creatures are in many ways of the greatest importance to man, not only as a number of them are valued for food, but their vast numbers, in many cases virtually myriads, form food in turn for other valued animals, and therein largely contribute to the maintenance of certain fisheries. Little is yet known of their habits, except in most casual or cursory ways, outside, perhaps, of the two most important economical species, *i. e.*, the lobster and the blue crab. When extensive researches into the animal behaviour and other studies are prosecuted, possibly better means may be discovered to allow human agencies to improve commercial possibilities. The great fecundity of many species is the only apparent offset to the murderous ravages of hosts of predatory enemies, to which the young appear ever subjected. While, therefore, the present account deals thus indirectly with the economic problems involved, such an attempt as is here outlined will at least assist, it is trusted, by defining and illustrating these interesting and valuable animals.

The faunal relations are such as would result from purely local conditions in the case of fresh-water forms, but in most instances, as the Crustacea are such wide-ranging animals, in fact many being world-wide in their distribution, but little can be said of their geographical features. However, among many of the species recorded, but little doubt attaches to most records. A species may be frequently known since from one end of its range along the Atlantic coast, at least within its faunal region,

to the other. In many cases I have been able to confirm old records by the examination of the original material, as well as add new collections not studied before.

In the method of sequence the lowest and most generalized groups are treated first, the more specialized following. The system of arrangement is largely that of Miss Mary J. Rathbun in the Crustacea of New England. In framing the higher groups as orders, suborders, families, tribes, genera, etc., all available information, from whatever source pertinent, has been utilized, and is, therefore, the work of various writers. This may be explained by the fact that in the Crustacea many writers have confined themselves to a single or but a few groups, a practice often followed by entomologists and others. Thus great differences in terminology as applied to really the same organs become evident. I have not attempted to eliminate this feature, but have tried to use such characteristic appellations as are in use for each group of animals.

It may also be well to note the various more important general works briefly which have been utilized in the present groupings. The Phyllopoda are treated in the exhaustive monograph by Dr. Packard in 1883. The Ostracoda will be found in the exhaustive account by Messrs. C. L. Herrick and C. H. Turner in 1895, though several important papers on special groups have appeared since. The parasitic Copepoda have recently been studied by Dr. C. B. Wilson, the fresh-water forms by Herrick and Forbes, and the free-swimming forms have been studied from the Gulf Stream by Professor W. M. Wheeler. The Cirripedia have been studied as early as 1851 by the masterly hand of Charles Darwin, and recently the stalked forms have been treated by Dr. Henry A. Pilsbry. The Amphipoda, in the discussion of the Wood's Hole region, have been studied by Dr. S. J. Holmes. The Isopoda have been monographed in the exhaustive and well illustrated work of Miss Harriet Richardson. The Decapoda have been studied and outlined in the article under the Synopses of North American Invertebrates in 1899 and 1903, by Miss Rathbun. It may also be stated that the Amphipoda and Isopoda, besides the Macrura, are included in similar fashion.

the first by Dr. Holmes, the second by Miss Richardson, and the latter by Dr. J. S. Kingsley. Further, the article on Crustacea in their text-book on Zoölogy, by Messrs. T. J. Parker and W. J. Haswell, and the handy little history of the Malacostraca, by the Rev. T. R. R. Stebbing, are largely drawn from. In drawing from these works the accounts have been freely modified to suit such purposes as appeared desirable.

The descriptions of species are drawn from New Jersey material, whenever possible, and if no specimens are available, the compiled description is credited to the particular author from which it is taken. Often I have followed the sequence of characters, etc., quite closely in cases where recent monographs treat of groups, but in every case most of the characters have been verified at the time of writing the description. The value of such models seems to be in that they afford room for the extent of variation noted.

Special mention of thanks is here given, collectively, for the works referred to above, besides numerous others, which, on account of the many titles, would be out of place if listed in this connection.

I am indebted to the Academy of Natural Sciences, of Philadelphia, for the use of the collections and books. The collection of this institution contains some of the most interesting historical specimens dealing with the carcinology of New Jersey, and safe to say many, if not all, of the indigenous crustacea. Within the past few years I have succeeded in adding a number of interesting specimens myself from various localities in the State, as well as from adjacent States.

To many friends and associates, who have been mentioned elsewhere, I am indebted for the acquisition of material, assistance in collecting, or notes, etc. Dr. Henry A. Pilsbry has kindly given me assistance with the barnacles. Mr. Witmer Stone has offered notes and records of his collections made at Point Pleasant. Dr. Richard J. Phillips has presented me with material and notes from Corson's Inlet. Dr. Benjamin Sharp, one time active in local, as well as general, carcinological work,

has kindly placed his entire card catalogue of the higher groups in my hands. To many others, whose favors I cannot definitely recall, expression of thanks is also cheerfully granted.

The writer is under obligations to Mr. Silas R. Morse, Curator of the State Museum of New Jersey, who has encouraged and assisted in every way towards making the present work possible.

The figures given are mostly my own, made in water-colors from fresh specimens, where possible, and, if not, with pen and ink sketches from preserved material. Where necessary, figures have been copied from other writers, and are duly credited as such. All the Entomostraca have been drawn by myself. Except in the case of the barnacles, and where necessary to copy from other writers, I have modified the figures to suit present purposes.

Finally, the work is offered not only as the first comprehensive attempt at describing and illustrating the Crustacea now known from the limits of New Jersey, but equally as a contribution to the knowledge of most of the Crustacea of the Middle Atlantic States, of which New Jersey is the integral unit in this respect. For this reason it has been necessary to consult the Crustacean fauna of the adjacent Atlantic States region. With this end in view, an appended list will follow the discussion of the New Jersey species, and thus united the two will form a complete check-list. It is, perhaps, scarcely necessary for me to state that the principle followed in nomenclature is priority, with actual type designation either originally or by the first reviser.

Though at best inevitably faulty, our work, it is thought, will be of great service in future studies. Therefore, should it arouse sufficient interest to produce other and more perfected accounts, then the writer believes his purpose will be accomplished.

HENRY W. FOWLER,
*Academy of Natural Sciences
of Philadelphia.*

October 29th, 1912.

Crustacea of New Jersey.

BY HENRY W. FOWLER.

HISTORY.

The history of the Crustacea of New Jersey, and in fact of North America generally, may be said to begin with the labors of that distinguished veteran naturalist Thomas Say. These are combined in the modest little paper, extending in several parts through the first volume of the Journal of the Academy of Natural Sciences of Philadelphia, published in 1818, and entitled "An Account of the Crustacea of the United States." This work is the very foundation of North American carcinology. While embracing but a few of the more conspicuous forms now known to occur, in the present instance the work is particularly pertinent, inasmuch as many, if not most, of the species were described from the Great Egg Harbor Bay region in the State of New Jersey. The figures accompanying were made with the characteristic daintiness of C. A. Le Sueur, another distinguished colleague of Say's. The region of Egg Harbor Bay was long famous as a point of interest to early local naturalists, and this has been increased by subsequent ones wishing to review the work of their predecessors. As most of these gentlemen were interested or connected in some way with the Academy of Natural Sciences of Philadelphia, most of their material found its way into the museum of this institution. Later they were also induced to visit other regions of the sea-coast, and thus more representative faunal collections were accumulated. As these are more or less complete from certain

localities, with respect to the more conspicuous or higher forms, they will be mentioned in sequence with the few published accounts. Of the latter only several short ones refer exclusively to the carcinological fauna of New Jersey.

Some of Say's specimens are still extant, though most of them in very poor or only fragmentary condition. This is largely due to the old method of preparation, when only dried specimens, mounted on cards, pins, or in trays, were in vogue. Other data than a general locality and the donor's name was exceptional. After being exposed to the light, dust and various temperatures, besides the wear and tear due to moving them about, not to speak of insect pests, it is remarkable that any have persisted to the present time. All recent collections are now fixed as wet or alcoholic preparations, and well housed from the ravages of light, dust and evaporation. The old habit of drying Crustacea likely grew out of the idea that while similar in many fundamental characters to insects, with which animals they were in fact considered, it was thus thought necessary to mount them on pins. Possibly it was also thought that they may be examined with greater facility, as well as save expense in the use of spirits.

Among other early collections made in New Jersey are those of Dr. R. E. Griffiths, Mr. Samuel Ashmead, and Dr. Joseph Leidy. Dr. Griffiths made a collection of the species found about Cape May, while Mr. Ashmead's specimens are mostly from Beesley's Point. Dr. Leidy's collections were perhaps the most important made since Say's time, and embraced material gathered from the early fifties till 1890. This was, fortunately, usually studied and the results published, first as a list in his memoir entitled "Contributions toward a knowledge of the marine invertebrate fauna of the coasts of Rhode Island and New Jersey," in 1855, and later by a few short abstracts, made mostly as verbal communications at the meetings of the Academy of Natural Sciences of Philadelphia. All these articles appear in the publications of this institution.

Professors A. E. Verrill, S. I. Smith and O. Harger, in their more or less combined accounts, in the "Catalogue of the marine

invertebrate animals of the southern coast of New England and adjacent waters," in the first volume of the Report of the United States Commissioner of Fish and Fisheries, give a list of the Crustacea studied, also including a number from New Jersey. This work is accompanied by good figures, which, in the case of the Crustacea are only at fault in that they are so few. Professor Harger published a detailed account of the Isopods, well illustrated, in a later volume of the same journal. This furnished, with the records scattered throughout, the first fairly representative account of the group as applied to New Jersey. The same may also be said as regards the earlier work, with respect to the other groups.

In 1888 Professor Angelo Heilprin published a semi-popular work, entitled "Animal Life of Our Seashore," intended to treat of the more conspicuous invertebrates along the southern coast of Long Island and the shores of New Jersey. But a few species of Crustacea are mentioned with reproduced figures, mostly from Smith and Harger. The work is unfortunate as an incomplete compilation.

The remaining contributions to New Jersey carcinology are largely in the form of collections from Mr. Witmer Stone, Mr. J. E. Ives, Dr. Benjamin Sharp, Dr. Henry C. Chapman, Dr. Henry A. Pilsbry, Mr. W. J. Fox, Mr. H. L. Viereck, Mr. J. A. G. Rehn, Mr. Bayard Long, the writer, and others. The most important was made by Mr. Stone, together with Prof. Amos Brown and Mr. Stewardson Brown, in the late eighties, at Point Pleasant. Mr. Ives secured material at Holly Beach, Dr. Sharp at Townsend's Inlet, Mr. Fox at Sea Isle City, Mr. Viereck at Cape May, Mr. Rehn at Atlantic City and Mr. Long at Spray Beach on Long Beach Island. Finally, my own material was secured at Cape May, in various parts of Cape May county, Anglesea, Stone Harbor, Sea Isle City, Corson's Inlet, Ocean City, Atlantic City, Great Bay, Seaside Park, Manasquan, and many other places within the State.

Descriptive Account of the Species and their Higher Groups.

RELATIONSHIPS.

The great group or phylum containing the Arthropoda embraces the greater number of known forms of life. They are characterized chiefly by the metameric segmentation, more or less perfected bilateral symmetry—the mouth and anus being placed at opposite ends of the elongated body—and a nervous system formed of a brain dorsally and a double ventral chain of ganglia. Each typical segment of the body carries a pair of appendages, which are divided into distinct limb-segments or podomeres, which are separated from one another by movable joints and acted upon by special muscles. These features will serve to distinguish them from the segmented worms. Arthropods have further characters in the almost universal absence of cilia, the muscles are nearly always of the striped form, their sperms mostly non-motile, and the body-cavity is largely represented by spaces (the blood-sinuses), in free communication with the circulatory system. The classes of this phylum usually admitted are five, as the Crustacea, Onychophora, Myriapoda, Insecta and Arachnida. The Crustacea include the crabs, lobsters, shrimps, wood-lice, barnacles, water-fleas, etc. The Onychophora are represented by only the curious *Peripatus*, caterpillar-like in form. The Myriapoda embrace the centipedes and millipedes. The Insecta include all true or six-legged arthropods, such as cockroaches, locusts, flies, beetles, moths, butterflies, bees, etc. The Arachnida include the spiders, scorpions, mites, etc.

Class CRUSTACEA.

The Crustaceans.

Body formed of segments, usually very distinct or well defined, motile, of considerable hardness, and without so-called internal skeleton. Five anterior segments joined or fused with

prostomium to form head, while others mostly forming two sections, as thorax and abdomen. Thoracic segments may be fused in greater or less number to form a cephalothorax. Head may have median eye, this often disappearing in adult life, and pair of compound eyes, both belonging to prostomial region. In case of latter jointed and elevated eye-stalks frequently developed. Head with appendages usually in five pairs. First, or antennules usually considered as of first metamere, more likely prostomial. Second, or antennæ, are postoral or metameric appendages moved forwards to præoral position. Third, are mandibles or crushing-jaws. Fourth are first maxillæ. Fifth are second maxillæ. Thoracic and abdominal appendages of variable modification, as jaws, legs, fins or accessory reproductive organs. Except antennules, appendages typically biramous, formed of a stem or protopodite which bears two branches, as endopodite and exopodite. External covering of body a chitinous cuticle, becoming thick and somewhat calcified in places where no movement is necessary, forms series of hard parts of sclerites, separated by flexible chitin, so that whole chitinous cuticle thus forms exoskeleton. Typically one sclerite to each metamere behind head and to each podomere in appendages, but concrescence of sclerites often obtains. Exoskeleton produced into setæ, which are hollow processes of cuticle containing prolongations of underlying epidermis. Respiration either by general surface of body or by gills, which are hollow offshoots of thoracic wall or of thoracic or abdominal limbs. Stomodæum and proctodæum form considerable portion of enteric canal, lined with chitin, and mesenteron gives rise to digestive glands. Body-cavity divided into compartments, most of which contain blood and are portions of vascular system, though true cœlome may be represented by compartments of body-cavity not containing blood and by cavities of reproductive organs. A vascular system formed of contractile heart, as muscular dilatation of dorsal vessel and communicating by valvular ostia with an enclosing pericardial sinus. Blood taken from heart to various organs by arteries, returned to pericardial sinus by sinuses and veins, and respiratory organs interposed in returning current. Renal organs pecu-

liarily modified nephridia, formed either like shell-glands opening on second maxilla or antennary (green) glands opening on antenna. Nervous system consists of brain united by œsophageal connectives with ventral nerve-cord, formed of double chain of ganglia joined together by commissures and connectives. First three pairs of embryonic ganglia commonly unite to form brain, which therefore syn-cerebrum. Sexes separate or united, sexual dimorphism common, and parthenogenesis frequent. Sperms usually non-motile, and eggs usually centrolecithal, sometimes telolecithal, or almost alecithal. Muscles striped, and no cilia. Segmentation of oöspem usually superficial, but may be complete or discoid. Embryo passes through nauplius stage, which may be free-swimming larva or may be passed through before hatching, and characterized by three pairs of appendages, which form into antennules, antennæ and mandibles of adult.

The crustacea are thus seen to form a very great assemblage of animals as here understood. The group *Xiphosura*, or king crabs as they are commonly known, are now usually admitted with the *Arachnida*. The crustacea agree with them, however, in that both typically breathe in water by means of gills joined to the appendages. The absence of antennæ will serve to distinguish the king crabs at once, and in this character they share alike with all the other *Arachnida*.

The ethology has been summed up very comprehensively by Messrs. Parker and Haswell, from which the following is largely extracted. Crustacea are remarkable for their very perfect adaptation to the most various conditions in life, occurring in the fresh waters, in the sea, in brine pools, in subterranean caves and on land, throughout the globe. Many of those living in the sea are littoral, others pelagic, and some abyssal, descending in the depths of the sea over three thousand fathoms. Certain copepods (as *Pontellina*) are said to be almost aerial, leaping out of the water or apparently flying in similar fashion to the flying fishes or exocœtids. Solitary forms are found in such types as the lobsters, crawfishes, etc., while the contrary is seen in the immense shoals of shrimps. Most crustacea prey on living animals or devour carrion. In the case of fixed forms, like the barnacles,

minute particles form the food in similar fashion to that of many of the lower animals. Members of more than one order are parasites, remarkable alike for their wide and often bizarre deviation from the typical structure of the class, and their adaptation to their peculiar mode of life. In size they present almost every gradation from microscopic water-fleas to crabs two feet across the carapace, or four feet from tip to tip of legs.

Geographically the distribution of all the chief groups are cosmopolitan, and only among the families, genera and species are points of interest from this view to be found. Fossils are known from very early time, though the oldest are usually referred to the Phyllocarida, ranging from the Cambrian to the Trias. Shells of Ostracoda are also known from the Cambrian upwards, and those of Cirripedia from the Silurian. Arthrostraca are known from palæozoic times, but are rare as fossils. The earliest Macruran is a shrimp-like form from the Devonian, while the highly differentiated Brachyura are not known with absolute certainty until Cretaceous time.

The recapitulation theory was first worked out in detail in the crustacea. Embryology shows that all crustacea may be traced back in individual development to the nauplius, upon which follows some kind of zœa-stage, many entomostraca progressing no further. But in malacostraca the zœa is followed by the mysis-stage, which is permanent in schizopods and transient in decapods. Though a tempting hypothesis it is only necessary to recall that all such free larvæ are subject to the action of the struggle for existence, and may likely have been modified in accordance with their own special needs and without reference either to their ancestors or to the adult species into which they finally change.

Many crustacea present instances of protective and aggressive characters, as modifications in form, color, etc., which serve to conceal them from their enemies or from their prey. Probably the most striking example is that of certain crabs (*Paramithrax*) which deliberately plant sea-weeds, sponges, alcyonarians, zoöphytes, etc., all over the carapace, and are thus perfectly concealed except when in motion. Another crab (*Dromia*) carries

a relatively immense ascidian or sea-squirt on its back, and in another species of the same genus the hinder legs are used to hold umbrella-wise over the back a single valve of a bivalve shell.

Several instances of commensalism occur. Certain sea-anemones (*Adamsia*) are always found on a univalve shell, such as that of a whelk, and the latter inhabited by a hermit-crab. The sea-anemone is carried about by the crab and in this way secures a more varied and abundant food-supply than would fall to its lot if it remained in one place. On the other hand the crab is protected from the attack of predaceous fishes by retreating into its shell and leaving exposed the sea-anemone, which, owing to its toughness, and to the pain caused by its poisonous stinging-capsules, is usually avoided as an article of food. Other interesting occurrences are the little oyster-crabs (*Pinnotheres*) living in the mantle-cavities of oysters and mussels. Other decapods are found in the intestines of sea-urchins and holothurians, and one genus of crab lives in the cavity in a coral, the aperture being only just sufficient to allow of a due supply of food and water.

The crustacea apparently exhibit certain characters with the object of attracting the opposite sex. The immensely enlarged and highly colored chelipeds of some male crabs (*Uca*) are said to be used for attracting the female as well as for fighting. The sound-producing organs of some decapods have probably also a sexual significance. The rock lobster (*Palinurus*) has a soft, chitinous pad on the antenna, which it rubs against a projecting keel on the sternal region of the head, producing a peculiar creaking sound, and another macruran (*Alpheus*) makes noises by clapping together the fixed and movable fingers of its large chelipeds. The fact that these sounds can be produced at the will of the animals seems to show that they undoubtedly possess a sense of hearing, and that the auditory sac is not merely an organ of the sense of direction.

Key to the sub-classes.

4. Size small, often microscopic; post-cephalic segments variable, and appendages comparatively little differentiated; large cephalic carapace often present; considerable portion of enteric canal derived from mesenteron, and no gastric mill; excretory organs shell-glands; metamorphosis present, larva usually leaves egg as free-swimming nauplius.

ENTOMOSTRACA

- aa. Size usually large; usually (except one order) thorax of eight and abdomen of seven segments, and appendages usually highly differentiated; usually mesenteron forms only small portion of adult enteric canal, and gastric mill present; excretory organs antennary glands; nauplius stage usually passed through in egg, though more or less complex metamorphosis.

MALACOSTRACA

Sub-Class ENTOMOSTRACA.

The Entomostracans.

Body often covered with a shell or carapace, this either leathery or horny in structure, composed of one or two pieces, sometimes with the appearance of a bivalve shell, in other forms like a buckler which largely or completely envelops the animal. Number of segments behind head varies. Considerable portion of the enteric canal derived from the mesenteron, and no gastric mill. The excretory organs are shell glands. Branchiæ attached either to feet or organs of mastication. Feet jointed, and all more or less ciliated, and usually of more or less similar appearance. Body regularly moulted or completely changing the shell with growth, this sometimes a form of metamorphosis.

These crustacea are of relatively simple organization, and mostly small, the vast majority in fact being microscopic.

Key to the orders.

- a. Body distinctly segmented, covered by cephalic carapace; post-cephalic appendages leaf-like.

PHYLLOPODA

- aa. Body unsegmented, with rudimentary abdomen, mostly enclosed in carapace or shell of bivalve form; appendages in seven pairs.

OSTRACODA

aaa. Body elongated, distinctly segmented except in certain parasitic forms; carapace may extend over first thoracic segment; thorax with four or five pairs of biramous appendages in free forms; abdomen limbless.

COPEPODA

aaaa. Body imperfectly segmented, often of considerable size, and either fixed or parasitic during adult life.

CIRRIPIEDIA

Order PHYLLOPODA.

The Phyllopods.

Body small or microscopic in size, distinctly segmented and covered by a cephalic carapace. The post-cephalic appendages leaf-like.

Key to the sub-orders.

a. Size moderate, with ten to sixty pairs of leaf-like swimming-feet.

BRANCHIOPODA

aa. Size minute, compressed body enclosed in bivalve carapace, swimming-feet in four or five pairs, and large biramous antennæ chief organs of locomotion.

CLADOCERA

Sub-Order BRANCHIOPODA.

The Fairy Shrimps.

Body usually, or in part, covered by large carapace. Mandibular segment greatly developed tergally, which in lower forms bent down, forms two valves, joined by a true hinge which opens and shuts by means of an adductor muscle, the shell thus resembling those of certain bivalve fresh-water mollusca, such as *Cyclas* and *Pisidium*. Antennæ as two pairs. Mandibles paired. Maxillæ in two pairs. Some forms with a pair of maxillipedes. Feet broad, leaf-like, with a series of six primary inner lobes or endites and two exites, the latter forming a gill and accessory gill or flabellum. Abdomen not clearly differentiated from thorax, and abdominal feet not different in shape from thoracic appendages. Body-segments vary in number from seventeen

(*Limnetis*) to sixty-nine (*Binoculus*), and often irrelatively repeated, this signifying inferiority. Eyes sessile and united into a single mass, or sometimes stalked (*Branchipodidæ*). Telson usually large and spiny, bearing in all genera pair of caudal appendages, probably homologous with the limbs. All hatch from the egg in a nauplius form, as in the copepods, and all have three pairs of appendages corresponding to the two pairs of antennæ and mandibles of the adult.

Crustacea living mostly in fresh-water pools or in brine lakes and ponds (*Artemia*), often where the water completely evaporates in summer. The eggs, after being fertilized and borne about for a time under the shell or in egg-sacs, finally are allowed to drop to the bottom of the pool. There they lie after the water disappears or evaporates, remaining in the dry mud in drought or hot weather until the rains of autumn refill the ponds, when the young hatch out and begin the life cycle anew.

Family BRANCHIPODIDÆ.

Body soft, long, delicate, slender, without carapace. Head small. Eyes stalked. A distinct median ocellus. First antennæ filiform. Second antennæ stout in males, formed as clasping organs. Frontal appendages often present. Eleven to nineteen pairs of branchial or respiratory feet, without gnathobase or coxal lobe. Other lobes (endites), especially fifth and sixth, broad and foliaceous, with a gill and simple rounded flabellum. First and second uromeres with a penis in male and egg-pouch in female. Specialized abdomen with eight or nine segments, not bearing appendages. Terminal segment bears pair of filamental not jointed setose appendages. Larva a nauplius.

Sub-Family BRANCHIPODINÆ.

Eleven pairs of natatory feet, nineteen in *Polyartemia*, with outer endites moderately broad. Abdomen slender, cylindrical. Terminal abdominal segment with two filamental setose caudal appendages.

Key to the genera.

- a. Frontal appendages present; ovisac short, broad.
 b. Frontal appendages ribbon-like or broadly triangular. EUBRANCHIPUS
 bb. Frontal appendages long and variously lobed or spinulose. INO
 aa. No frontal appendages; ovisac long and slender. STREPTOCEPHALUS

Genus EUBRANCHIPUS Verrill.*The Fairy Shrimps.*

Eubbranchipus Verrill, Proc. Amer. Assoc. Adv. Sci., XVIII, 1869, p. 241.
 Type *Branchipus vernalis* Verrill, first species.

Male.—Body large, very stout, robust. Head large, with elbowed claspers large, thick, stout, complex, form quite variable, two-jointed. First joint of clasper very stout, thick, nearly straight, with stout inward-pointing spine at base. Second joint varies in form, usually simple and straight, chitinous, bent a little at tip, stout at base. Head with pair of frontal appendages, hanging down between claspers, forming two broad, flat triangular lobes with crenulated edges, or very large and deeply and finely lobulated. Eleven pairs of natatory feet, usually fifth endites rather large and edge not very square but rather pointed. Penis large, broad, slightly cleft, cirrus long and slender. Caudal appendages long, slender, nearly twice as long as in *Branchinecta*.

Female.—Body long. Head large. Caudal appendages as in male. Egg-sac short, broad, bottle-shaped, opening transverse, at end of short neck.

This genus is perhaps the most familiar of all the phyllopod. Packard points out several distinctions between the European form, *Branchipus stagnalis* (Linnæus), and *Eubbranchipus vernalis* (Verrill) of our own country, which appears of general value. The former has simple, long, slender filiform frontal appendages and a deeply cleft penis. The latter species has broad, flat, triangular lobate frontal appendages with crenulated edges and a slightly cleft penis.

Eubbranchipus vernalis (Verrill).

PLATES I and 2.

Fairy Shrimp. Spring-time Shrimp.

- Branchipus vernalis* Verrill, Amer. Journ. Sci. Art., (2) XLVIII, 1869, p. 251. *New Haven, Connecticut; Salem and Cambridge, Massachusetts.*
- Packard, Twelfth Ann. Rep. U. S. Geol. Surv. Terr., Hayden, I, 1883, pp. 342, 352, Pl. 11, figs. 2-6, Pl. 22, figs. 3-6. Woodbury, New Jersey. Philadelphia, Penna.
- Underwood, Bull. Ill. Lab. N. Hist., II, Oct. 1888, p. 355. New York and Pennsylvania.
- Eubbranchipus vernalis* Gissler, Amer. Nat., XV, 1881, p. 136, figs. 1-3. Maspeth, Long Island.
- Gissler, l. c., p. 280. Maspeth, Long Island.
- Branchipus stagnalis* (nec Linnæus) De Kay, N. Y. Fauna, Crust., VI, 1844, p. 63, Pl. 9, fig. 36. "Most of our stagnant pools" [New York].
- Branchipus* sp. Leidy, Proc. Acad. Nat. Sci. Phila., 1880, p. 156. Near Woodbury, New Jersey.

Description.—Body stout. Head large. Claspers with very stout basal joint, a little curved, and thickness about one-half their length. Claspers retractile, and drawing in base of second joint. Latter firm, chitinous, long obtuse spur inside at base, directed inwards at right angles. Joint triangular as seen in transverse section beyond this spur and edges very pronounced. Inner edge of same joint hollowed basally and distally bent out somewhat. Frontal appendages broad, triangular, flattened at sloping down, length nearly twice width, acutely pointed, edges finely serrated. Serræ under a lens bottle-shaped, separated at base, with one, occasionally two, seldom three, cusps or ends distally. Penis stout and bulky, not cleft deeply in middle and cirrus filiform long and minute. In female body equally stout and of similar size to that of male. Egg-sac not long as broad, with conspicuous or full neck, and narrow transverse aperture to allow passage of eggs. Lower lip of this aperture smaller than upper. Length 23 mm.

According to Packard the color in life is a pale flesh color, the tips of the penis deep reddish-brown, and from them a narrow

line, widening to the hind half of the abdomen. The white setæ on the caudal appendages and the white tips of the endites contrast with the deep reddish-brown of the rest of the posterior half of the abdomen. The tips of the fifth endites are edged with reddish.

Remarks.—This most interesting little creature is given by Packard as ranging from Massachusetts to Philadelphia, and west to Ohio and Indiana. My description, as given above, is based on six examples obtained in March, 1891, by Mr. J. S. Witmer, Jr., at Paradise, in Lancaster county, Pennsylvania. There are but few places in New Jersey where it has been observed and recorded. The first was at Woodbury, and subsequently near Trenton, which latter will be mentioned below. Outside New Jersey it has several times been seen in the Delaware river valley in Pennsylvania. Mr. T. D. Keim found it in ditches above Bristol, in Bucks county, on April 12th, 1908, when it was fairly abundant. Several years previously Dr. J. DeB. Abbott found it in pools in woodland a mile or so still north of this place, where it was very common during March. I also found it in this region March 25th, 1913. Mr. F. M. Meyers found it very abundant in "dry-land pond" near Bethlehem, in Northampton county. He sent me a specimen in March, 1913. I have also examined a number of examples from Long Island, received from Gissler, though now very poorly preserved. Mr. W. T. Davis forwarded some examples he obtained at Staten Island, N. Y., in March and April of 1897.

Dr. Charles C. Abbott gives the following interesting account of this species from near Trenton. "Animal life, in April, must not be ignored. Many creatures that have been comparatively inactive during the winter are now gradually assuming their summer restlessness. Among the countless hundreds of objects worthy of the rambler's attention, perhaps none are so beautiful and full of interest as the fairy shrimps that throng the dark waters of an upland sink-hole. This hollow in the field has a foot or more of water in it from November to June, and during the past winter it was frozen to the bottom until the 1st of April. A hard time, therefore, thought I, have these fairy

shrimps had, with not a drop of water to move in; but they are not to be judged by the delicacy of their anatomy. There was a soft spot in the mud, somewhere, and when, later in the month, I waded between cakes of ice and looked long into the depths of this upland pool, finally I found the fairies in abundance, a few well grown, but mostly mere babies. They were earlier in '84. On the 22d of the month I gathered a great many, and all fully grown. To describe them is impracticable. They are lilliputian lobsters, pearly white, picked with crimson; and with eleven pairs of feathery legs that move with the perfection of grace. They swim upon their backs, and the movement of these legs or paddles is the very poetry of motion. While the water remains cool, they will dart, float and ramble among the dead twigs and leaves in the bottom of the pool, but disappear promptly, after a few hot days, or more gradually, as the waters soak away, if the weather is cool. Dr. Packard says of them: 'At Seekonk, Mass., they occurred abundantly May 2, in a large pond which completely dried up in summer; * * * when I visited the pond * * * May 13, none were to be found. It seems from this quite evident that the animal probably dies off at the approach of warm weather and does not reappear until after cool weather sets in late in the autumn, being represented in the summer by the eggs alone; and thus the appearance of this Phyllopod is apparently determined mainly by the temperature.' Bearing this in mind, I took several lumps of the dried mud, last summer, and placed them in ice-water, hoping to have the eggs, if there were any, hatch, and so puzzle the doctor with midsummer specimens, but the plan did not work. Either I got no eggs with the mud, or the water was too cold; at any rate, my plan was a failure, and, as it was intended to be a joke, deserved no better fate. Returning to pure science, I waded the waters of that upland pond faithfully until it froze. I could find no specimen. Even in March of '84 there were none to be seen; and this year, '85, they were apparently but a few days old, as late as April 1. In an aquarium they are very beautiful, but must be kept by themselves. A dozen were placed in a small tank containing mud-minnows and sunfish. The latter ate the

beautiful fairies as though they were an ordinary article of their diet; but the mud-minnows would not touch them. Later, I placed innumerable minute leeches in the same tank, and these the minnows greedily devoured, but the sunfish ignored them completely."¹

Genus INO Schrank.

Ino Schrank, Fauna Boica, III, 1803, pp. 179, 249. Type *Ino piscina* Schrank, monotypic.

Chirocephale Prevost, Journ. Phys. Chim. H. Nat. Paris, LVII, 1803, p. 37. Type *Chirocephale diaphane* Prevost, monotypic. (Name inadmissible as simply a vernacular.)

Chirocephalus J. V. Thompson, Zool. Research., III, 1834, Pl. 3, figs. 4-5, Pl. 4, fig. 1. Type *Branchipus prevostii* Fischer, monotypic. (Not consulted.)

Body slender. Head moderate in size. Second antennæ or male claspers with basal joint very large, thick, somewhat curved. Second joint very long, slender, curved inward, with sharp basal spur. Two remarkably long large frontal appendages arise between base of second antennæ, their length about twice that of second antennæ, much twisted and coiled, and variously lobed and spinulated. Eleven pairs of natatory feet. Basal lobe or endite long, with edge regularly curved, and second with an outer subdivision about one-fourth as broad as first. Each pair of feet paler, with rather long fringe of delicate hair-like setæ. Second to fourth endites small, each with three or four long minutely spinulated setæ. Fifth endite of usual size, but rather square, much as in *Eubbranchipus*, with tendency in lower outer angle to be somewhat produced so as to be subtriangular in outline. Sixth endite unusually long, narrow, almost lanceolate, with long setæ in third pair of feet, or small, narrow, and abruptly rounded in first pair. In tenth pair narrow and rounded at tip. Flabellum and gills much as in *Eubbranchipus*. Male genital apparatus short, small, deeply cleft, formed into two slender curved portions, each with its cirrus. Caudal appendages long and broad, much more so than in *Eubbranchipus*. Second antennæ in female with mucronate spur on tip larger and longer

¹ Upland and Meadow, 1886, pp. 71-72.

than usual. Egg-sac short, broad, end produced like neck of a bottle, much as in *Eubbranchipus*. Eggs few or about a dozen, and larger than in *Eubbranchipus* and *Streptocephalus*.

This genus differs from *Eubbranchipus* in its more slender body, very long coiled, twisted, lobulated and spinulose frontal appendages, and in the endites as noted above

The name *Chirocephalus*, as it was originally proposed in vernacular form, must evidently be replaced by *Ino*. Schrank identifies his *Ino piscina* with *Cancer stagnalis* Linnæus, but according to Baird it is a synonym of *Chirocephalus diaphanus*.

Ino holmanii (Ryder).

PLATE 3.

Green Fairy Shrimp.

Chirocephalus holmanii Ryder, Proc. Acad. Nat. Sci. Phila., 1879, p. 148, figs. Vicinity of Woodbury, New Jersey.

——— Leidy, Proc. Acad. Nat. Sci. Phila., 1880, p. 156. Near Woodbury, New Jersey.

Chirocephalus holmani Packard, Twelfth Ann. Rep. U. S. Geol. Surv. Terr., Hayden, I, 1883, p. 351, Pl. 13, figs. 1-5 (types). Also from Woodbury examples and Glendale, Long Island.

——— Underwood, Bull. Ill. Lab. N. Hist., II, Oct. 1888, p. 355. New York and Pennsylvania.

Ino holmani Fowler, Acad. Nat. Sci. Phila., 1913, p. 61. Chincoteague, Va.

Description.—Body somewhat slender, elongated. Second antennæ, or claspers of male, rather robust, second joint forked, much longer than first joint, large spur pointed. Slender longer branch with its end crossing its fellow of opposite side of body, when in repose. Shorter branch less curved, a little swollen, and inner surface of tip roughened, its length about half that of longer branch. Two frontal appendages very long, coiled, twisted, appearing as if jointed, gradually taper to long curved end, which latter slender, pointed, covered with minute short conically-pointed spinules. These proboscis-like appendages form at bases of claspers, coil between latter, finely and variously lobed with about seven finger-like spinulated processes, and medianly group of four or five setæ. When stretched or dis-

tended frontal appendages about three times length of male claspers. Sixth endites of all feet narrow and obtuse at end, gill variable in size. Color in life brilliant grass-green, with nearly hyaline tint, and almost uniform throughout, except the telson and last few abdominal segments, which are a deep rosy-maroon color, deeping on caudal spines. Length 17 mm.

Remarks.—This interesting species was first discovered by Mr. W. P. Seal in ditches near Woodbury, where it was found abundant. It was subsequently secured there, as late as March 27th, in company with *Eubbranchipus vernalis*, as reported by Packard.

My only acquaintance with it was at Chincoteague, in Accomac County, Virginia. On May 4th, 1912, I secured the example described above from a little pond of fresh-water. This pond was separated from a brackish-water inlet and glade by only several feet of dry soil. Several fresh-water mollusks were also found associated, besides *Gammarus fasciatus*, *Asellus communis*, water-striders, water-boatmen, very many larval dragonflies and a few *Rana pipiens*. The occurrence of this species in Virginia is quite interesting, not only on account of the physical location, but as indicating the most southern point at which it is so far known to occur.

According to Packard, the head of the female is simple and without frontal appendages. Her egg-sac is small, short and contains about a dozen very large eggs. He also gives her size as slightly exceeding the male.

The types of this species, embracing perhaps seven or more individuals, are now in the Academy, but in such fragmentary or imperfect condition that they cannot be used in the present connection. They are labeled from Woodbury, and bear the names of J. H. Holman and W. P. Seal.

Genus STREPTOCEPHALUS Baird.

Streptocephalus Baird, Ann. Mag. Nat. Hist., London, (2) XIV, 1854, p. 219. Type *Branchipus torvicornis* Waga, first species.

Heterobbranchipus Verrill, Amer. Journ. Sci. Art., (2) XLVIII, 1869, p. 250. Type *Branchipus cafer* Loven, monotypic.

Body rather slender, much more so than in *Eubbranchipus*. Second antennæ of male three-jointed, remarkably long and large, tortuous and twisted, basal joint stout, armed externally at end with very long slender spur, about as long as joint itself. Second joint thick, very long, but upward and inward near end on inside row of small papillæ. At end it enlarges into short, thick, hand-like portion, the third joint, which divides into two long, unequally forked chitinous appendages. Second antennæ of female as usual, broad, suddenly mucronate at tip. Eleven pairs of feet, much as in *Eubbranchipus*. First endite as usual, but fringe rather long, as also that of other endites. Fifth endite square, outer edge hollowed out, spines on lower edge few and unusually blunt. Sixth endite more acute than in *Eubbranchipus*. Flabellum large and rounded, fuller than in *Eubbranchipus*. Gills rather large. Penis consists of two separate very long, curved, filiform processes. Egg-sac of female long and slender. Caudal appendages longer and broader than in *Eubbranchipus*.

This genus differs from *Eubbranchipus* in the absence of frontal appendages, and may easily be known by the long three-jointed, twisted and elbowed claspers, and by the two long, slender, filamental processes forming the male genital armature.

***Streptocephalus sealii* Ryder.**

PLATES 4 AND 5.

Streptocephalus sealii Ryder, Proc. Acad. Nat. Sci. Phila., 1879, p. 200, fig. (head). *Near Woodbury, New Jersey.*

——— Leidy, Proc. Acad. Nat. Sci. Phila., 1880, p. 156. Woodbury, N. J.

——— Packard, Twelfth Ann. Rep., U. S. Geo. Surv. Terr., Hayden, I. 1883, p. 348, fig. 21 (copies Ryder). Note on Woodbury examples, also others from Glendale, on Long Island.

——— Underwood, Bull. Ill. Lab. N. Hist., II, Oct. 1886, p. 355. New York and New Jersey.

Description.—Body elongate, rather slender, moderately thick. Inner branch of terminal joint of male claspers shortest. At interior front edge of short branch two unequal lobes extend forwards and lie flat against laminar posterior border of front branch. At lower posterior angle of this lamina, or blade of for-

ward branch, a well-marked and somewhat falcate process which fits between lower lobular process of posterior branch and its scythe-shaped lower extremity. Anterior branch then crosses posterior at nearly right angles, for about a third of its length maintains nearly uniform thickness, straight, when suddenly swelling and bending forward, then as suddenly contracts and tapers for its remaining two-thirds, ending in slender, slightly curved, pointed end. First joint long, robust, and from apex externally cylindrical curved antenniform organ arises, which about long as filiform first antennæ. Second joint tortuous, very strongly bent, twisted upon itself. Third joint bearing complex terminal appendages wide. Appendages close against each other, like blades of a scissors, and processes of their opposing edges interlock as already described. Front of head prolonged into a straight beak hanging down nearly vertically between first joints of claspers, flattened anteriorly behind and emarginate at its tip. Antenniform appendage rather long. Male organs very feebly armed with a few short spines and nearly straight. Cephalic horns of female twisted upon themselves, slightly bent and flattened at their extremities which fringed with short hairs. Large lateral ovoid pedunculate and apparently glandular organs behind eyes similar in size and shape in both sexes. Egg-sacs large, nearly half length of abdomen, conical in form, and contain a great number of ochraceous eggs, more numerous and much smaller than those of *Ino* from the same locality. Male a beautiful green, deeper about head, as though saturated with acetate of copper. Female yellow, with a tinge of green, verging to brownish in parts, and very nearly of same size as male, if not a little larger. Two rather long plumose tapering branches of tail red in both sexes, but much brighter red in female, more slender in male. Length 27 mm.

Remarks—This species was first secured near Woodbury, by Mr. W. P. Seal. It does not appear to have been rediscovered since originally described, and, if so, is not on record so far as I can find. The types now before me number five males and nineteen females, and were collected September 7th, 1879, by Mr.

Seal. These specimens are still in fair preservation. Packard is rather ambiguous in his quotation from Gissler, and from the paragraphs quoted it is not clear that the latter ever secured *Streptocephalus sealii* in Long Island.

Sub-Order CLADOCERA.

The Water Fleas.

Feet more or less leaf-like. Body enclosed in lamina of thin chitine more or less, or at least latter forming sac for protection of eggs. This so-called shell springs as a fold from maxillary segment and conspicuously and variously formed. Young with single median eye, and this sometimes lost in later life, or sometimes remaining as the only visual organ. Outer covering of body mostly changed by frequent moults.

Besides the single group or super-family embraced in this work, members of the other group, or *Gymnomera*, will likely be added with future studies.

Super-Family CALYPTOMERA.

Body enclosed in a bivalve shell. Mandibles truncated below. Maxillæ distinct, spiny. Thoracic ganglia discrete.

Key to the tribes.

- a.* Five (or six) pairs of feet, anterior pair more or less prehensile and destitute of branchiæ. ANOMOPODA
aa. Six pairs of feet, similar, foliaceous, all distinctly branchiate.

CTENOPODA

Tribe ANOMOPODA.

Five (or six) pairs of feet, anterior pair more or less prehensile and without branchiæ.

Two families known from New Jersey limits.

Key to the families.

- a. Rami of both antennæ three-jointed; intestine convolute, with abdominal but no anterior cæca. LYNCEIDÆ
- aa. Rami of antennæ three and four-jointed; five pairs of feet, last with curved appendage guarding branchial sac; antennules of female short, one-jointed. DAPHNIDÆ

Family LYNCEIDÆ.

Head covered with an arched shield, this often passing without an indentation into the shell of body. Head covering generally extending forward and downward to form more or less of sharp angle in front, or simply rounded. In either case it arches over more fleshy lower side of head, from which hang two short antennules and labrum, while strong two-branched antennæ spring from well up under its posterior expansion. Rounded sides of shield, which protect insertion of antennæ known as fornices. Above insertion of antennæ a dark fleck lying near or on lower angle of brain, which is the larval or nauplius eye. This black spot often large as eye itself, even larger, and sometimes the only visual organ. Antennules small, with several sensory filaments, and a lateral flagellum at end. Antennules in male differing little from those of female. Labrum with triangular or semicircular process, and usually larger than terminal portion. Mandibles similar to, though usually shorter, than in *Daphnidæ*. Maxillæ often conspicuous, and first pair of feet serving by slight alteration at base same purpose. Rarely an indication of sixth pair of feet, and antennæ with both rami three-jointed. End of body, or post-abdomen, usually enlarged, anal opening near its base, and armature usually considerable.

Genera numerous, comprising very small species, and but few exceed one millimeter in length. The shell is various in form, often beautifully sculptured. A limited number of eggs is produced at one time and the winter eggs are very often laid in the brood-cavity with no preparation of the shell previously, in which case the ephippium is said to be absent. Negatively, the shell may be considerably modified, generally with a deposit of

dark pigment in its upper part. The males are very rare and have been seen but seldom.

Key to the sub-families.

- a. Digestive tract not coiled, with two cæca in front, and anus at end of post-abdomen. EURYCERCINÆ
 aa. Digestive tract coiled, and anus near end of post-abdomen. LYNCEINÆ

Sub-Family EURYCERCINÆ.

Intestine not coiled, with two cæca in front and vent at end of post-abdomen. Many eggs produced at once. Male opening at base of abdomen. Males appearing in autumn.

Genus EURYCERCUS Baird.

Eurycercus Baird, Ann. Mag. Nat. Hist., London, II, 1843, p. 88. Type *Lynceus lamellatus* Müller, monotypic.

Characters contained in the sub-family.

Eurycercus lamellatus (Müller).

PLATE 6.

Lynceus lamellatus Müller, Zoöl. Dan. Prodröm., 1776, p. 199. Denmark.

Eurycercus lamellatus Turner, Geol. N. Hist. Surv. Minn., Zoöl. Ser., II, 1895, p. 274. Kent County, Delaware.

Description.—Shell large, mostly of very slight ovoid contour, lower edge but little curved or scarcely so much as back, and ends in a small point or spine behind. Posterior and lower edge of shell sometimes with a series of fine hairs. Most of entire surface of shell with fine or more or less obsolete transverse wavy striæ. Back depressed, with indention at root of neck. Head rather triangular, large, rounded before and above eye. Eye large, conspicuous, high. Beak rounded, obtuse. Antennules rather short. Antennæ moderate, filaments slightly plumose. Fornices short, rounded, joined with beak by line suddenly de-

flected downward. Sometimes second line seen to emerge just above end of fornices and pass over eye in wide curve. Post-abdomen truncate behind, with long terminal simple claw, four others graduated down follow close behind. Color in life largely transparent, though with rather brownish or russet tints. Length 3 mm.

Remarks.—The above description is from examples I obtained in a small rain-pool of fresh-water on the brackish tidal marsh of Dennis Creek, at South Dennis, in Cape May County, April 5th, 1912. No other animal life was discovered associated, nor were any of *Eurycercus* in the similar but larger numerous pools all about. The pool in question was merely a depression in an unfrequented path on the meadow, and in size was scarcely larger than a good-sized wash basin. In a few hours it had dried up entirely, all of *Eurycercus* having disappeared or perished. During life these small animals appeared like small seeds moving about the bottom from place to place, swimming more or less direct. They were easily located with the naked eye. Diligent search in many pools about the flooded adjacent marshy region failed to reveal any other examples.

The species is said to range all over Europe and the eastern United States, though it has never before been recorded from New Jersey. Turner reports it from Kent County, in Delaware.

Sub-Family LYNCEINÆ.

Intestine coiled. Vent near end of post-abdomen. Opening of vas deferens nearly terminal. No anterior cæca, but usually a single anal diverticle of intestine. Rarely or never more than two embryos produced at once.

Genus CHYDORUS Leach.

Chydorus Leach, Encyclop. Brit. Suppl. (Annulosa) 1816, p. 406. Type *Lynceus Sphæricus* Müller, monotypic.

Form globose, not obviously truncate behind. Head ends in sharp, long curved beak, which lies close upon anterior margins

of valves. Antennæ short. Eye larger than pigment fleck. Abdomen flattened, excavated in male. Intestine with no anterior cæca, doubly convoluted, with an anal cæcum.

These animals are minute round creatures appearing like moving pin-heads as they wander about with a wavering or rolling motion. They usually live on vegetation, or slime, which occurs in the bottoms of small, quiet pools. In bright sunlight, which they seem to prefer, they sometimes occur in immense numbers near the surface. The males have been found but rarely. These animals are, in fact, among the most minute of all our Entomostraca.

Key to the species.

- | | |
|---|------------|
| a. Post-abdomen armed with eight or nine teeth. | SPHÆRICUS |
| aa. Post-abdomen armed with a double row of twelve teeth. | BICORNUTUS |

***Chydorus sphaericus* (Müller).**

PLATE 7.

Lynceus sphaericus Müller, Zoöl. Dan. Prodröm., 1776, p. 199. *Denmark.*

—— Herrick and Turner, Geol. N. Hist. Surv., Zoöl. Ser., II, 1895, p. 261, Pl. 64, figs. 4, 7, 8, 10. "Whole circumpolar land area."

Chydorus sphaericus, Fellows, Proc. Amer. Soc. Micros., IX, 1885, p. 176. Lake Chautauqua, N. Y.; l. c., X, 1887, p. 249 (same material).

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 113. "Common."

Description.—Body in profile nearly spherical, and as viewed from above broadly oval, though young rather squared or truncate behind. Head not distinct from rest of body. Eye small, inconspicuous. Beak moderately long, blunt in male. Antennules moderate, very large in male, with nearly median curved flagellum on anterior edge. Pigment spot nearly large as eye. Shell reticulate, each one polygonal in form. Post-abdomen broad, short, end rounded and furnished with eight or nine sharp teeth. Color of body dull or pale brownish, generally. Length 0.5 mm.

Remarks.—I first discovered this species in New Jersey in pools of fresh water about South Dennis, in Cape May County, on

April 5th, 1912. It was very abundant, frequently occurring with other small entomostracans. I next found it in May of 1912 in a small tributary of the Delaware below Florence, where it was quite abundant with species of *Scapholeberis*, and in July and August it was abundant about Trenton. It likely occurs throughout the State.

***Chydorus bicornutus* Doolittle.**

PLATE 8.

Chydorus bicornutus Doolittle, Proc. Biol. Soc. Wash., XXII, 1909, p. 154.
Sebago Lake, Songo River, Panther Pond, Maine; Umbagog Lake, New Hampshire.

——— Doolittle, Proc. U. S. Nat. Mus., XLI, 1911, p. 165, Pls. 17-19. (Maine and New Hampshire.) Grover Mill Pond, Princeton, New Jersey.

Female.—Body rounded in lateral view, ventral margin sharply ventricose. Body as seen from above broadly oval, front same, and sides concave dorsally. From each valve body a great horizontal horn stands out, curving slightly posteriorly, often half width of body proper. From this horn two high ridges run forward, and also two over back from horn to horn. An area on back immediately anterior to interspinal ridges bounded laterally by two other ridges. Near front limit of area, these ridges, after giving off on each side high lateral branch, sharply converge and unite in median line, forming a short crest where head and body meet, then diverging on head they bound or enclose large area in front and continue down to tip of rostrum. On lower half of each valve four more high ridges, taking their origin near each other at upper end of ascending anterior margin of valve, and running more or less parallel to margin, but second and fourth from margin not running whole length of valve. First and third, however, unite at dorso-posterior angle, run forward on back to interspinal ridges, flaring outward, thus united ridges of opposite sides bound a dorsal area posterior to interspinal ridges. Between parallel ridges, except those arising from lateral horns, there pass partitions forming deep large rectangular cells. Within areas as described similar cells of various sizes and shapes. Laterally above marginal ridges other

deep hexagonal cells of various sizes. Eyes large, with few facets, ocellus adjacent. Rostrum long, acute, covered with ridges and cells similar to those of valves. Labrum from side view with anterior lobe blunt, posterior lobe digitates and ciliated distally. Maxillæ with two heavily ciliated teeth. Feet, five. Post-abdomen broad, rounded distally, with twelve spines on dorsal or anal border. Claw strong, basal teeth two, proximal smaller. Length about 0.55 mm.

Male.—Unknown. (Doolittle.)

Remarks.—This species was originally found in lakes in Maine, and is recorded from Princeton, in 1911, by its describer. In color it is said to be yellowish. The eggs are two. The New Jersey examples are found to belong to the short-horned type.

Family DAPHNIDÆ.

Rami of antennæ three and four-jointed. Five pairs of feet, last with curved appendage guarding branchial sac. Antennules of female short, one-jointed.

The members of this family are among the best known, and some among the largest of the *Cladocera*.

Key to the genera.

- a. Head beaked below; shell extending in sharp spine at upper posterior angle. DAPHNE
- aa. Head somewhat beaked below; shell angled below or extending in long spines from lower angle. SCAPHOLEBERIS

Genus DAPHNE Müller.

Daphne Müller, Zoöl. Dan. Prodrom., 1776, p. 199. Type *Monoculus pulex* Linnæus, second species.

Daphnia Müller, Entomost Dan. Norweg., 1785, p. 79. Type *Daphnia pennata* Müller, first species, designated as example by Latreille, Hist. Nat. Crust., III, 1802, p. 17.

Head beaked below. Shell extending in sharp spine at upper posterior angle. Pigment fleck small.

This genus is the most conspicuous, and the one frequently seen. Young hatched with a pendant appendage attached to upper posterior angle of shell, and this soon becoming the rigid spine characteristic of the younger stages and males of the genus. Females almost immediately after birth begin production of eggs by an asexual process. Groups of epithelial cells containing four each are formed and one of the cells of each group develops at the expense of the others, forming the egg. Many such eggs are laid simultaneously and deposited in the cavity between the shell and the dorsal part of the animal.

Daphne pulex (Linnæus).

PLATE 9.

Daphnia. Red Daphnia.

Monoculus pulex Linnæus, Syst. Nat., Ed. 10, 1758, p. 634. "*In aquis dulcibus*" (Europe).

Daphnia reticulata (nec *Monoculus reticulatus* Jurine) Haldeman, Proc. Acad. Nat. Sci. Phila., 1843, p. 196. *A little pond on the Susquehanna above Columbia, Pa.*

—— Underwood, Bull. Ill. Lab. N. Hist., II, Oct. 1886, p. 342. Pennsylvania.

Description.—Body stout, thick, usually large. Shell thin, transparent, nearly broadly ellipsoid in contour, and ending superiorly behind in a slender attenuated spine, this often about one-fourth rest length of body. Edges of spine and of shell adjacent with fine small spinules. Head depressed, broad, not crested, and protuberant in front, ventral edge deeply concave. Beak on head below rather attenuated and curved back a little. Fornix high. Eye high, small. Antennules short, conic, reach but little beyond beak. Antennæ slender, short. In mature females shell not separated from head by a depression. Pigment spot present. Cæca present, dorsal in position on abdomen behind. Abdominal processes approximate, first twice length of second and third small. Post-abdomen long, somewhat tapering towards end, where rounded. About a dozen subequal post-abdominal teeth, curved, forming two combs. Color transparent to pink or dull red. Length 2.15 mm.

Remarks.—This little crustacean is very valuable as food for many of our fresh-water fishes. It is also in demand by breeders of aquarium fishes, as forming food for the fry, especially those of the gold fish with its ornamental varieties. It appears to be common only periodically, and especially during the spring of the year or in the month of May. At this time it may be seen in great abundance in the ditches about Camden and Philadelphia, the myriads of individuals often imparting to the water a bloody appearance. The color varies from perfectly transparent to the deepest dull red, though the former condition is the most usual in which individuals are found most of the year. It is widely distributed, occurring in many parts of the United States and Europe.

Genus SCAPHOLEBERIS Schöedler.

Scapholeberis Schöedler, Die Branchipod, Berlin, 1858, p. 23. Type *Daphne mucronata* Müller. (Not consulted.)

Body robust, continuation of fornices extending toward apex of incurved beak, which usually lies within valves of shell. Lower posterior angle of shell angled or spined. Lower anterior angle of shell with a prominence and a basin-shaped area encloses base of antennæ, latter partly lying on shell and part on head. This area more strongly lined or reticulated than rest of shell. Lower margin straight and ends usually in a long scythe-shaped spine which directs backward. Shell usually indistinctly reticulated or unmarked, and usually deeply colored. Post-abdomen similar to that of *Ceriodaphnia* or *Simos*, with anal spines few and older specimens having more than young, and place where additional spines are to appear marked by prominences. Eye moderate in size, pigment fleck rather small and short antennules hidden by beak. Antennæ of small size and generally dark colored. Ephippium containing but one egg. Males without altered antennæ or feet.

Key to the species.

- a. Shell with short spine at lower posterior corner.
 aa. Shell with a long spine at lower posterior corner.

mucronata
armata

Scapholeberis mucronata (Müller).

PLATE 10.

Daphne mucronata Müller, Zoöl. Dan. Prodröm., 1776, p. 200. Denmark.

Scapaoleberis mucronata Underwood, Bull. Ill. Lab. N. Hist., II, Oct. 1888, p. 340. Eastern United States.

Scapholeberis mucronata Herrick and Turner, Geol. N. Hist. Surv. Minn., Zoöl. Ser., II, 1895, p. 174, Pl. 43, figs. 4-7, Pl. 45, fig. 5. Eastern United States.

—M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 110. All Europe and eastern United States.

Description.—Body of rather irregular semi-circular contour, that of back convex and of ventral region nearly straight, ending behind in short spine at each posterior angle of shell. These spines quite short and barely equal head or one-fourth length of shell. Lower straight edge of shell with a series of moderate fine spines. Head rather large, round in front of large eye. A short rounded beak on lower surface of head. Antennules short, behind and below beak. Fornices very short, rounded, connected by a line with beak by a sudden downward deflection, this offsetting area forming part of basin of antennæ. Second line springs from just above end of fornices and passes over eye by broad curve. Post-abdomen truncate, has beside terminal claws four or more spines rapidly decreasing in size. Claws minutely spined. Color usually dark brownish. Length 0.6 to 0.8 mm.

Remarks.—I first met with this species in pools about South Dennis on April 5th, 1912, when a few were found in company with *Eurycercus* and *Chydorus*. In May it was found in a little tributary of the Delaware just below Florence, also associated with *Chydorus*. On July 4th, 1912, it was found fairly common in a tributary of Crosswicks creek near Trenton, where it was associated with *Scapholeberis armata*, *Cyclops serrulatus* and other species of *Cyclops*. Likely it is common in many places throughout the State. It is widely distributed in Europe and North America.

Scapholeberis armata Herrick.

PLATE II.

Scapholeberis armata Herrick, Mem. Den. Sci. Assoc., I, Oct. 1887, No. 1, p. 37. *Mobile, Alabama. Minnesota.*

Description.—Body rather oblong, back scarcely more convex in profile than ventral surface or edge, and latter ending behind in long spine, often equaling entire lower margin of shell in length. Lower edge of shell with a series of fine hairs, each moderately long. Head rather large, rounded in front. On lower surface of head a short rounded beak. Eye large. Antennules short, below beak. Fornix rather broad, somewhat square, basin of antennæ small, upper lines meeting behind eye. Post-abdomen truncate, with four terminal claws. Color dark brownish. Length 0.8 mm.

Remarks.—First found with the preceding in the tributary of the Delaware below Florence, in May of 1912. It was very abundant in a tributary of Crosswicks creek near Trenton on July 4th, 1912. About Philadelphia, in Pennsylvania, I have also found it at Holmesburg, in pools, and in a pond near Elkins Park. It is evidently a species of wide distribution in the United States.

Although Herrick refers in the above-quoted work to this species in the American Naturalist for 1883, as *Scapholeberis mucronata* var. *armata*, I cannot find it in the volume before me.

Tribe CTENOPODA.

Feet in six pairs, alike, foliaceous and all branchiate.

A single family in our region.

Family SIDIDÆ.

Head separated from body by a depression, without prominent fornices (or spreading shields) over base of antennæ. First pair of antennæ, or antennules, one-jointed, usually rather small

in female, but extending into very strong flagellum in male. Antennæ long, biramose, with unequal branches. Mandibles truncate at end. Maxillæ armed with large spines. Form of body usually elongate, and abdomen often extends beyond edge of shell behind. Male openings usually in end of long appendages which depend from base of post-abdomen.

Several genera in America, though only one known from New Jersey. These animals are usually to be found in the clear and colder waters of large lakes. They produce winter eggs, laid in October, which differ from the summer eggs, which hatch in the brood cavity, by a brown color and fatty spheres being present. These eggs are produced in large numbers, in distinction to most other Cladocera, in which the winter eggs are very few. The eggs fall to the bottom and there develop at the proper time. Some forms occur abundantly in areas of plant growth. As the size and reproductive energies are dependent on environment, but little success may be expected if their preservation in aquaria is attempted. As some forms are nocturnal they should be sought at the surface of the water on quiet evenings.

Genus SIDA Milne-Edwards.

Sida (Straus) Milne-Edwards, Hist. Nat. Crust., III, 1840, p. 385. Type *Daphne crystallina* Müller, monotypic.

Body long, transparent. Head quadrate, rather small. For-nices absent. Antennules of female small, truncate. Antennules of male with long flagellum. Second antennæ with rami two and three-jointed. Male with sexual openings just behind last pair of feet.

Species few. The reference to Straus, in Mém. Mus. Hist. Nat. Paris, V, 1819, pp. 380-425, which I consulted, shows that the generic name is not proposed there. The earliest I can find is by Milne-Edwards in 1844, though it may have been used previously.

Sida crystallina (Müller).

PLATE 12.

Daphne crystallina Müller, Zoöl. Dan. Prodröm., 1776, p. 200. *Denmark*.

Sida crystallina Herrick, Geol. N. Hist. Surv. Minn., Zoöl. Ser., II, 1895, p. 147, Pl. 35, figs. 13-15, Pl. 37, figs. 1-2 "ubiquitous."

Description.—Body elongate, somewhat ovate, transparent, and truncate posteriorly. Head large. Eye large, round. Body as seen in shell narrow and nearly straight. Abdomen at posterior angle with knob, from which two long setæ protrude. Edges of carapace without any setæ. End of abdomen with two long curved pointed claws, shorter than setæ mentioned. Between latter and terminal claws a series of about twenty short spines along lower edge of abdomen. Also another superiorly. Superior antennæ rather large, long, armed at end with four short stout spines. Inferior antennæ large, with stout basal joint, more than third length of whole limb, and with three short spines on anterior extremity. External branch of three articulations, first very short and with small spine at outer angle, other two subequal. Inner branch of two joints, first much larger. Feet in six pairs, each of three articulations, and with several strong setæ. Transparent. Length 3 mm.

Remarks.—Known to me only from several examples I secured in July of 1912 in a tributary of Crosswicks Creek near Trenton, in Mercer County. The species was not common and but few were found among the multitudes of *Cyclops*, *Scapholeberis* and other minute crustaceans gathered. I was, however, enabled to make the above notes and thus include the species in our list.

According to Baird "the motion of *Sida* through the water is a sort of rapid running movement. They are generally inactive, and adhere in a peculiar manner by the back of their head to the side of the vessel in which they are contained, remaining there for hours. They adhere most probably in the same way to the weeds in the water where they are found, as it is by skinning the stems of the weeds that they are detached and

caught. They do not appear to be numerous in the localities in which I have found them, and indeed are of rare occurrence."¹

This species is widely distributed in both Europe and North America.

Order OSTRACODA.

Body enclosed in a bivalve shell. Body always with seven pairs of articulated appendages. Of these first five are appendages to head, though in different groups one or all of last three pairs may be modified for locomotion. Last two pairs belong to the body and usually known as feet. Sometimes (*Cypris*) last pair of feet not used for locomotion. Usually abdomen ends in a pair of appendages which resemble legs.

These little crustaceans so closely resemble certain molluca, like *Sphærium*, that they are frequently mistaken for them by the novice. The animal however is quite crustacean in structure, though primitive. As a rule they are poor swimmers, though some like *Cypria*, *Cypridopsis* and *Cyclocypris* swim quite well. Others move along the stems of plants, burrow in the sand or mud, or creep along the bottom, not swimming at all. The ostracoda usually occur in shallow waters, as ponds, pools, marshes, etc., and when occurring in lakes or rivers are usually to be found near or at the bottom, seldom venturing to the surface of the deeper waters. In our region the spring and fall are the best seasons for collecting.

Tribe PODOCOPA.

Second antennæ simple, subpediform, geniculate, clawed at apex, not very unlike upper antennæ. Both pairs of antennæ bear long setæ and adapted for swimming, or shortly setose and not used for swimming. Mandibles distinct, mostly strongly toothed at lower extremity, with palp of moderate size, and bearing more or less developed branchial appendage. First pair of maxillæ bearing large branchial plate.

¹ Nat. Hist. Brit. Entomotr., 1850, p. 109.

These characters, chiefly indicated by the simple second antennæ, clearly distinguish the present tribe from the others. The *Podocopa* are mostly fresh-water, while the other tribes are marine. These latter show the second antennæ biramous, one immobile branch rudimentary and the other flexibly elongate with long natatory setæ as the *Mydocopa*, both movable natatory branches well developed in the *Cladocopa*, and both branches flattened as in the *Platycopa*.

Family CYPRIDIDÆ.

Last pair of legs bent backwards within shell and not used for locomotion.

This character at once separates the members of this family from the others found in the Middle States region. In all of them the last pair of legs are directed downwards and used for locomotion.

Key to the sub-families.

- a.* Natatory setæ entirely lacking or little developed; second antennæ of female five-segmented, and of male mostly six-segmented, and with two sense clubs; terminal segment of second foot with three unlike setæ, two of which backwardly directed. CANDONINÆ
- aa.* Natatory setæ reaching beyond end claws, or approximately to tips of end claws; second foot with beak-like end-segment and a claw. CYPRIDINÆ
- aaa.* Natatory setæ very long, usually twice as long as distance from their origin to tips of end claws; second feet with three setæ, one long, other two short and backwardly directed; furca usually normal. CYCLOCYPRIDINÆ

Sub-family CANDONINÆ.

Natatory setæ entirely lacking or little developed. Second antennæ of female five-segmented, in male mostly six-segmented, and with two sense clubs. Terminal segment of second foot with three unlike setæ, two of which are backwardly directed.

Genus **PARACANDONA** Hartwig.

Paracandona Hartwig, Zoöl. Anzeiger, XXII, 1899, p. 309. Type *Candona euplectella* Brady and Norman, monotypic.

Terminal claws of second antennæ very long, and penultimate segment at least as long as united second and third segments. Terminal segment of mandibular palp with two very strong claws, of which one united by fusion to segment. Second feet with an extra long seta on each of third and fourth segments. Appendages otherwise as in *Candona*, but small and slender. Shell tumid, reticulate pitted, as a honey-comb. Branchial plate of two setæ. Second antennæ of both sexes five-segmented. Small beautiful forms, not more than 0.8 mm. long.

Paracandona euplectella (Brady and Norman).

PLATE 13.

Candona euplectella Robertson, Fresh and Brackish Water Ostracoda of Clydesdale, etc., 1880, p. 23 (no description).

— (Robertson) Brady and Norman, Trans. Roy. Dublin Soc., (2) IV, 1889, p. 105, Pl. 9, figs. 7-8. *Isle of Bute, Little Cumbrae, Lochmaben, Black Loch, Port Glasgow.*

Paracandona euplectella Sharpe, Proc. U. S. Nat. Mus., XXXV, 1909, p. 402, Pl. 52, figs. 1-5. Small branch of the Elizabeth River, northwest of Roselle Park, New Jersey.

Description.—Shell as seen laterally, about twice as long as high, dorsal margin nearly straight, ventral margin weakly sinuate, nearly same width throughout, and both extremities evenly and very similarly rounded. Shell, as seen from above, appears very plump, and widest just posterior to middle. Anterior end rather more pointed than posterior, and both quite gently rounded. Both shells similar in appearance and size. Shell covered with profuse ornamentation of polygonal areas or reticulations, causing net-like appearance, and also with number of conspicuous papillar elevations, which show more thickly and conspicuously anteriorly when seen in profile from above. Terminal claws of second antennæ plain and unusually long, larger than last three segments. Terminal segment of mandibular palp with

two strong toothed claws, one of which fused to segment. Terminal claw of first foot long as rest of foot. Second foot five-segmented, and terminal segment being but slightly longer than broad, or one-half length of preceding segment, which slightly longer than antepenultimate segment. Shorter terminal claw about length of terminal segment, or about one-fifth length of other similarly directed claw. Third and fourth segments each armed with unusually long setæ. Furca thick and stout, nearly straight, average width one-sixth length as measured along dorsal edge. Terminal setæ weak, scarcely evident, with stout, slightly curved, plain terminal claw one-half length of furca, and subterminal claw but slightly shorter, though both faintly toothed near tip. Dorsal seta less than width of ramus from subterminal claw and about same length as subterminal claw. Second maxillary palp of male unusually long and slender. Length of female, 0.56 to 0.65 mm.; breadth, 0.32 to 0.34 mm.; height, 0.32 to 0.36 mm. Male somewhat larger. Found rather sparsely in the shallower parts of a swamp near a small branch of the Elizabeth River, northwest of Roselle Park, New Jersey.

(Sharpe.)

Remarks.—The above account, the first American record, shows the species to be widely distributed, having been known previously only from Europe.

Sub-Family CYPRIDINÆ.

Natatory setæ reaching beyond end claws, or approximately to tips of end claws. Second foot with a beak-like end segment and a claw.

Key to the genera.

- a. Caudal rami rudimentary. CYPRIDOPSIS
 aa. Caudal rami cylindrical, with two terminal claws.
 b. Testes, if present, originating in anterior part of shell, and anteriorly in form of concentric circles; shell tumid, excessively hairy.
SPIROCYPRIS
 bb. Testes, if present, not originating in anterior part of shell, and usually not in form of circles or half-circles; shell comparatively smooth. CYPRIS

Genus *CYPRIDOPSIS* Brady.

Cypridopsis Brady, Tr. Linn. Soc. London, XXVI, 1868, p. 375. Type *Cypris vidua* Müller, monotypic.

Second pair of antennæ five-segmented. Natatory setæ at end of third segment long and plumose. Branchia of second maxilla consists of a plate bearing five plumose setæ or else of two setæ which are inserted directly on the blade. Second foot five-segmented, with strong chitinous claw at its end. Caudal rami rudimentary, flagelliform, base turgid, a short cilium on dorsal edge.

Males unknown. Species about eleven.

Cypridopsis vidua (Müller).

PLATE 14.

Cypris vidua Müller, Zool. Dan. Prodröm., 1776, p. 200. *Denmark*.

Cypridopsis vidua Sharpe, Bull. Ill. Lab. N. Hist., IV, 1897, p. 469 "ubiquitous."

—— Sharpe, Proc. U. S. Nat. Mus., XXXV, 1909, p. 400. "Common everywhere."

?*Cypris hispida* (nec Baird 1835) De Kay, N. Y. Fauna, Crust., VI, 1844, p. 64. Pl. 10, figs. 48-49. *Neighborhood of Lake Champlain and Hoboken, New Jersey*.

—— Underwood, Bull. Ill. Lab. N. Hist., II, Oct. 1886, p. 337. *New York and New Jersey*.

Description.—Seen from side shell partly kidney-shaped, widest medianly, ventral edge straight except slight median concavity, and other edges well convex. Seen from above shell broadly ovoid, widest behind middle, ends rounded, and hinge-line straight. Seen from below like upper view, slightly depressed in center and contact line sinuous. Antennæ five-jointed and last or terminal joint small. Two terminal claws stout, and blunt teeth on inner edge of one. Natatory setæ plumose, reach a little beyond tips of terminal claws. Mandible stout, and claws of palp reach to ends of mandibular teeth. Antepenultimate joint of palp with short pectinate dagger-shaped seta. Abdominal rami rudimentary, long slender terminal claw longer than ramus.

Also shorter and more slender claw in addition to terminal claw. Color of shell yellowish-green, and marked with three broad characteristic dark, or dusky, to dark greenish transverse bands extending over dorsal surface. Shell also covered with short sparse hairs. Length 0.54 to 0.70 mm.

Remarks.—Found at South Dennis, near Florence and at Trenton, during the past year. It does not appear to have ever been recorded from New Jersey before, though likely is to be found everywhere during proper seasons.

Several times in the spring I have found thousands above Bristol, in Pennsylvania, in temporary pools, and as some of them were stained somewhat dark, owing to the infusion of old leaves, suspect that possibly De Kay's *Cypris hispida* may have been colored from a similar cause? This species was also found in examination of the stomach contents of young sturgeons (*Acipenser brevirostrum*) secured in the fall of 1911 at Torresdale, Pennsylvania.

Sharpe says of it: "This species is ubiquitous, and I have yet to know of a pond or stream in which it has not made its home. It is seemingly always present in aquaria, and appears to play the rôle of scavenger, thriving in situations to which other Ostracoda seem to be totally unadapted. Viewed with a low power these creatures present a very pretty appearance as they rapidly swim about, the banded shell at once attracting attention."

I have allowed De Kay's *Cypris hispida* to fall provisionally with this species, as it was likely a discolored specimen. De Kay's description is as follows: "Valves when viewed together, resemble a minute Modiola. Epidermis uniform jet-black, and covered with numerous whitish rigid hairs. Length, .09 to .1 mm." De Kay appears to never have examined living examples. Possibly the jet-black coloration may be due to preservation, or the condition of the water in which it was found. No writer since De Kay's time appears to have met with it. In any case De Kay's specific name cannot be used as it is preoccupied for a species of *Candona*.

Genus *SPIROCYPRIS* Sharpe.

Spirocypris Sharpe, Proc. U. S. Nat. Mus., XXVI, 1903, p. 981. Type *Spirocypris passaica* Sharpe, monotypic.

Shell excessively hairy, plump. Natatory setæ simple, reaching barely beyond terminal claws. Feet as in *Cypris*. Caudal rami normal, slender, not more than one-half length of shell. Propagation sexual. Testes of male originating in anterior half of shell and arranged in form of concentric circles.

Spirocypris passaica Sharpe.

PLATE 15.

Spirocypris passaica Sharpe, Proc. U. S. Nat. Mus., XXVI, 1903, pp. 9, 82, Pl. 66, figs. 1-3. *Passaic, New Jersey*.

Description.—Color brownish, with dark blue patches laterally, which connect dorsally with a dorsal band. Another patch with a greenish tinge anteriorly, and still another in posterior region. These both connect with dorsal band which runs longitudinally on either side of hinge. Shell excessively hairy, hairs coarse and backwardly directed. Seen from side anterior end of shell wider than posterior, evenly rounded and dorsal margin almost straight, sloping slightly more rapidly posteriorly. Ventral margin slightly sinuate. Seen from above, shell appears a perfect elongate oval, widest just in front of dorsal transverse dark band, which midway. Testes in male arranged in form of concentric circles in anterior half of shell. Natatory setæ simple, reaching slightly beyond terminal claws. Latter moderately curved, long as penultimate segment. Sense club long and slender, three-fifths long as width of segment at its point of attachment. Terminal claw of first foot moderately curved, faintly toothed, and two terminal setæ about same length. Terminal claw of second foot one and one-half times length of terminal segment. Furca slightly sigmoid in shape, twenty-three times long as wide, and dorsal margin very weakly pectinate. Terminal claw nearly straight, faintly toothed, one-half long as furca. Terminal setæ little more than one-half length of ter-

terminal claw, which one and three-eighths times length of sub-terminal one. Dorsal setæ one-half length of terminal one and width of furca from sub-terminal claw. Length 1.60 mm.; height 0.80 mm.; breadth 0.82 mm. Passaic, New Jersey.
(Sharpe.)

Known only from the above account.

Genus CYPRIS Müller.

- Cypris* Müller, Zoöl. Dan. Prodröm., 1776, p. 198. Type *Cypris pubera* Müller, second species, designated by Norman and Brady, Trans. Roy. Dublin Soc., (2) IV, 1889, p. 125.
Cyprinotus Brady, Journ. Linn. Soc. London, XIX, 1885 (1886), p. 301. Type *Cyprinotus cingoalensis* Brady, monotypic.
Heterocypris Claus, Arb. Z. Inst. Wien, X, 1893, p. (7) 153. Type *Cypris incongruens* Ramdohr, monotypic.
Amphicypris G. O. Sars, Arch. Math. Naturvid., XXIV, No. 1, 1901, p. 29. (Not consulted.)

Natatory setæ reaching tips of terminal claws or somewhat beyond. Second antennæ five-jointed in both male and female. Branchial plate of six plumose setæ. Terminal segment of second foot beak-shaped, with toothed hooked-shaped claw. Furca normal, with two claws and two setæ. Propagation sexual or asexual. Ductus, when present, of numerous chitinous spines thickly crowded over entire surface of cylinder and usually not in wreaths.

Though many species have been described, as now restricted, this genus embraces but one from our limits.

***Cypris reticulata* Zaddach.**

PLATE 16.

- Cypris reticulata* Zaddach, Synop. Crust. Pruss. Prodröm., 1844, p. 34. (Prussia) "*prope Regimiontum*."
 — Sharpe, Proc. U. S. Nat. Mus., XXXV, 1909, p. 400. Catskill Mts., New York. New Jersey.

Description.—Viewed from side shell much broadest in front, highest at anterior third where a small gibbous elevation and below which the eye-spot. Dorsal edge slopes rapidly back to

quite narrow posterior extremity. Ventral edge nearly straight, slightly sinuate just posterior to middle. Viewed from above shell tumid, oval, widest in middle, tapers somewhat more rapidly anteriorly. Dark dorsal coloration appearing in form of rough cross. Longest of natatory setæ reach but slightly beyond terminal claws. First pair of maxillæ slender, weakly developed, and spines in its first process toothed. Second foot long, slender, terminal claws covered, slender, twice as long as terminal segment. Caudal rami straight, weakly bent near end, from ten to twelve times long as wide, and very faintly toothed on dorsal edge. Terminal claw slender, straight, finely toothed at extremity, nearly three-fifths long as ramus. Sub-terminal claw five-sevenths long as terminal claw, straight. Terminal seta slender, short, of same length as dorsal one, which one-third length of sub-terminal claw and distant from it width of ramus. Color clear yellowish to translucent, with dark blue patch dorsally and just posterior to eye-spot. Strikingly sculptured form of shell especially noticeable in young stages. This sculpturing resembles striations at center of shell, changing to radially arranged patterns, resembling filagree work. Occasionally in old specimens this absent. Length 1.25 mm. (Sharpe.)

Remarks.—Known from New Jersey by Sharpe's record. It occurs mostly in northern Europe and lives in small grassy pools.

Sub-Family CYCLOCYPRIDINÆ.

Natatory setæ very long, usually twice as long as distance from their origin to tips of end claws. Second feet with three setæ, one long, the other two rather short and backwardly directed. Furca usually normal.

Key to the genera.

- | | |
|---|-------------|
| a. Terminal segment of second pair of feet two-thirds long as fourth segment. | CYCLOCYPRIS |
| aa. Terminal segment of second pair of feet one-fourth as long as fourth segment. | CYPRIA |

Genus **CYCLOCYPRIS** Brady and Norman.

Cyclocypris Brady and Norman, Trans. Roy. Dublin Soc., (2) IV, 1889, p. 70.
Type *Cypris globosa* G. O. Sars, monotypic.

First antennæ seven-jointed. Second antennæ five-jointed in female, six-jointed in male. Fourth segment of second antenna of male with no sense organ on its distal end. Natatory setæ of second antennæ reach far beyond tips of terminal claws. Palp of both mandible and first maxilla normally developed. Second maxilla bears a branchial palp and a plate. This branchial palp in female unjointed, in male forming hooked prehensile organ. Terminal segment of second foot long and narrow, three times long as broad. Ductus of numerous long filaments and no distinct central axis. Vas deferens long and convoluted, copulatory organ quadrangular. Males numerous.

Cyclocypris lævis (Müller).

PLATE 17.

Cypris lævis Müller, Entomotr. Dan. Norweg., 1785, p. 52, pl. 3, figs. 7-9.
(Marshes and pools.) *Denmark and Norway.*

Cyclocypris ævis Turner, Geol. N. Hist. Surv. Minn., Zoöl. Ser., II, 1895, p. 310, Pl. 70, figs. 9-10. Jones Creek, Delaware.

——— Turner, Bull. Sci. Lab. Den. Univ., VIII, pt. 2, 1887, p. 14, Pl. 7, figs. 9-11. Jones Creek, Delaware.

——— Sharpe, Proc. U. S. Nat. Mus., XXXV, 1909, p. 400. New Jersey.
Also Catskill Mountains, N. Y.

Description.—Shell lemon-yellow to chestnut-red. Seen from side highest point of shell almost exactly in middle, approximately seven-ninths as high as long. Dorsal margin rather plainly humped in middle, posterior margin evenly rounded, ventral margin nearly straight or weakly convex. Seen from above shell egg-shaped, pointed anteriorly, left shell slightly overlapping right anteriorly, and greatest width in middle, width slightly more than one-half or about three-fifths of length. Terminal segment of second foot about three times long as wide. Terminal claw about long as width of terminal segment, shorter setæ about four times long as claw, penultimate segment about

twice as long as terminal one and armed with two setæ in its inner edge and outer margin of segment with three combs of minute teeth. Sometimes terminal claw weakly sigmoid, likely of younger stages of growth. Furca stout, nearly straight, one-sixth wide as long measured along anterior edge, and terminal seta varying from one-half to two-thirds length of terminal claw. Terminal claw stout, slightly curved near tip, toothed near tip and about one-half length of ramus measured along anterior margin. Subterminal claw also slightly curved near tip, toothed, but little shorter than terminal claw. Dorsal seta hardly distinguishable and usually wanting. Length 0.45 to 0.48 mm.; breadth 0.24 to 0.28 mm.; height 0.3 to 0.34 mm. Rather common in ponds and swamps southeast of Chicago, Illinois, and at Clarke Junction, Indiana. (Sharpe.)

Remarks.—This species is world-wide in its distribution, and is said to be somewhat variable. It has been once recorded from New Jersey. Fossils are also known from the English Tertiary.

Genus CYPRIA Zenker.

- Cypria* Zenker, Arch. Naturg., XX, 1854, p. 77. Type *Cypris punctata* (nec. Jurine) Zenker, first species (= *Cypris insculpta* Rischer), designated by Norman and Brady, Tr. Roy. Dublin Soc., (2) IV, 1889, p. 68.
- Physocypria* Sharpe, Proc. U. S. Nat. Mus., XXVI, 1903, pp. 993, 994. Type *Cypria pustulosa* Sharpe, first species.

Second antennæ of female five-jointed, of male six-jointed. Distal end of fourth joint of second antennæ bears two olfactory setæ. Natatory setæ of second antennæ extend far beyond tips of terminal claws. Mandibular palp much elongated. Palp of first maxilla strongly developed. Second maxilla bears well-developed branchial plate. Palp of second maxilla unjointed and ends in three setæ in female. In male it forms hooked prehensile organ, and right and left palp dissimilar. Caudal rami robust, and dorsal setæ situated about midway of outer border. Eye large. Muscle impressions four. Center of Zenker's organ surrounded by seven whorls of chitinous setæ. Upper part of organ forms blind sac, and lower ends in funnel-shaped origin of vas deferens. Copulatory organ triangular. Males numerous.

Cypria dentifera Sharpe.

PLATE 18.

Cypria dentifera Sharpe, Bull. Ill. Lab. Nat. Hist., IV, 1897, p. 463, Pl. 47, figs. 6-11. *Cincinnati, Ohio*.

— Sharpe, Proc. U. S. Nat. Mus., XXXV, 1909, p. 410. Pond near Westfield, New Jersey. Also Long Island, N. Y.

Description.—Shell seen from side highest just posterior to middle, quickly sloping posteriorly, more gradually anteriorly. Anterior edge of right valve projects as by a line flange, receives as in a pocket anterior margin of left valve, which armed with row of eighteen to twenty tuberculiform teeth. Ventral edge slightly sinuate at middle, anterior and posterior parts sparsely hairy. Seen from side shell widest back of middle, blunt and evenly rounded, sides nearly parallel, then quickly narrowing anteriorly to rather pointed end. Natatory setæ of second antennæ long, slightly plumose, three of them reaching entire length of antennæ beyond terminal claws. Terminal and penultimate segment in female three times long as wide. Mandibles and maxillæ not especially marked. First pair of feet rather stout. Terminal claw smooth, much bent, long as last three segments. Terminal segment subconic, one-third long as penultimate, which of same length as antepenultimate. Latter with few scattered setæ dorsally, and short slender seta at inner apical angle, two-thirds long as segment. Two terminal setæ of second feet approximately equal, long as last segment, faintly toothed. Terminal segment sinuate on its inner edge, two-thirds wide as long. Penultimate segment three and three-fourths times long as terminal one, four times long as wide, dorso-basal edge somewhat crenulate, inner finely ciliate, plumose seta at its middle point and comb cilia at inner apical angle. Antepenultimate segment long as penultimate, finely setose on its inner edge and with rather stout plumose seta at its inner apical angle, long as seta on penultimate segment. Long seta of terminal segment long as last three segments. Caudal rami rather stout, about ten times long as wide. Terminal claw stout, nearly smooth, curved beyond middle, and three-fifths long as ramus. Subterminal claw

two-thirds long as terminal one, with comb of remarkably long teeth near tip. These teeth longest distally, decrease in length towards base of claw. Terminal caudal seta half as long as subterminal claw. Dorsal seta very slender, nearly four times width of ramus from subterminal claw, upwardly curved, not larger than ramus width, situated slightly above center of ramus. Entire shell smooth, sparsely hairy except at end. Color brownish-yellow, with dark brown markings as follows: An anterior, a ventral and a dorso-ventral patch, and a vertical stripe dorsally just posterior to eye-spot. Muscle impressions in form of rosette, closely clustered, six or seven in number. Length 0.69 mm. (Sharpe.)

Remarks.—Originally described from Cincinnati in Ohio, it has since been recorded by its describer from Westfield, in New Jersey.

Order COPEPODA.

The Copepods.

Crustacea of small size, with distinctly segmented elongated body, except in degenerate parasitic forms. Body never enclosed in a bivalve shell, but usually elongated cylindrically in form, and composed of two subdivisions. A few forms resemble shelled crustacea, in prolonged and expanded dorsal shields. Cephalothorax, or anterior portion of body composed of ten somites, and these often more or less united, or fused. Five of these segments form the head and appendages as follows. First as pair of several-jointed to many-jointed antennæ, never primarily sensory in function, though often provided with sense-hairs or other like organs. Second as pair of two-branched antennules, sometimes almost simple or prehensile. Third a pair of mandibles in form of masticatory or piercing organs, and these usually furnished with a palp. Fourth as pair of maxillæ of various form and function. Fifth as pair of maxillipeds, which not infrequently subdivide in later life to form what appear to be two distinct pairs. Five thoracic segments each

with pair of swimming-feet, consisting typically of two-jointed base and two like three-jointed rami. The symmetry frequently broken by retardation of development of inner ramus, while fifth pair of feet may become rudimentary and in various ways subserve organs of sex. Five abdominal segments nearly devoid of appendages and continued posteriorly by two caudal stylets which bear strong setæ constituting, in many forms, a tail-fin or spring.

These minute and mostly predaceous animals are not only useful as scavengers but supply the food of most fish fry, as well as of other animals. They are distributed in both salt and fresh water, and while the latter forms are perhaps few in species they make up in the numerous individuals.

Though the scheme of divisions into suborders as adopted by Giesbrecht is used here, very likely the more recent views of G. O. Sars, who admits seven, as the Lernæoidea, Caligoida, Monstrilloidea, Notodelphyoidea, Cyclopoida, Harpacticoida and Calanoida, will be found necessary.

Key to the sub-orders.

- a. Free-swimming, or ectoparasitic; body mostly elongated; eggs developed in brood-pouches attached to base of abdomen. EUCOPEPODA
 aa. Ectoparasitic; whole body strongly depressed, broad; eggs not developed in brood-pouches. BRANCHIURA

Sub-Order EUCOPEPODA.

Free-swimming or ectoparasitic animals. Swimming-feet biramous. Biting-jaws developed, or when parasitic degenerate and jaws often adapted for sucking. Eggs developed in brood-pouches attached to base of abdomen.

Key to the tribes.

- a. Mouth not furnished with organs adapted to mastication, but with an apparatus fitted for sucking; feet partly formed for walking or prehension, partly branchiferous and fitted for swimming; body usually enclosed in buckler of one or two pieces; parasitic. GYMNOPLEA
 aa. Mouth furnished with organs adapted to mastication; feet mostly adapted for swimming; body enclosed in buckler, articulations mostly cylindrical and serve in locomotion; free-swimming. PODOPLEA

Tribe GYMNOPLA.

Mouth without organs developed for mastication, though modified as an apparatus for the purpose of sucking. Feet various, developed for walking or prehension, partly with branchiæ, and modified for swimming. Body mostly enclosed, usually almost entirely, in a buckler, consisting generally of one piece, though occasionally of two.

Besides the families represented in New Jersey limits, so far as known at present, a number of others from the Middle Atlantic and adjacent faunas will doubtless be added with future researches. All but one of the New Jersey families treated below are parasitic, for the most part on fishes, etc. The following interesting remarks concerning these animals are from Dr. C. B. Wilson.¹

The problems of parasitism and its attendant degeneration are among the most interesting in the whole realm of ecology, and nowhere can they be studied to any better advantage than among the parasitic copepods.

We can find here every grade of parasitism and can easily follow the resultant effects in the habits and morphology of the parasites themselves. There are forms like *Argulus* which not only move about all over the body of their host, but also change frequently from one species of fish to another, and can even leave their host at will and swim about freely, sometimes for several days, before returning.

Retaining thus completely their powers of locomotion we should not expect, nor do we find in them, any degeneration, but rather such a modification of the various organs especially used in parasitism—*e. g.*, organs for clinging to their host, for piercing after blood, etc., as will the better adapt them to their specific use.

Then we find forms like *Caligus* which roam about freely over their host's body but do not apparently leave it voluntarily, though they can swim well enough when compelled to do so.

¹ Proc. U. S. Nat. Mus., XXV, 1903, pp. 641-642.

Here also we should not expect any marked degeneration, but rather a more complete adaptation of the various organs.

The first evidence of degeneration in this genus lies apparently in the inclination toward free swimming and not so much in the ability to perform it. In these two genera, *Argulus* and *Caligus*, the males and females differ but slightly, and in some species of *Argulus* they may even be approximately of the same size. The fact that the *Argulidæ* do not carry their eggs about with them tends still farther to eliminate the sexual differences, while in the *Caligidæ* the presence or absence of the long egg pouches with the attendant modifications of structure constitute the chief sexual distinctions.

Not so, however, in forms like *Pandarus*, for here both sexes usually fasten themselves in one place and remain there for a long time. They are also so dissimilar in habits and structure that the males have been hitherto placed in an entirely separate genus (*Nogagus*), and the two sexes have been proved to belong to the same species only by being repeatedly found in actual coition. As is usual in such cases, the female is the more degenerate and can only crawl about slowly; she is so heavy and clumsy that she cannot swim at all.

Here then is evidence of structural degeneration, not very marked as yet, since fully developed swimming organs are retained though they cannot be used in the adult state.

The male *Pandarus*, on the contrary, not only retains the locomotor structures, but can use them, being able to swim about freely whenever occasion demands.

Again there are forms like *Philicthys* in which both the male and female have become practically incapable of locomotion, but are still found free in the mucous canals and sinuses of fishes. In them the locomotor organs are markedly degenerate, having dwindled to mere stumps without joints or setæ.

And, finally, we have forms like *Chondracanthus*, *Anchorella* and *Lerneæ*, in which the female is absolutely incapable of motion, being fixed in one position for life, while the male has dwindled to a mere pigmy, adherent to some part of the female's body.

The male can still move about somewhat, but the female has lost all trace of every appendage except those which serve to fasten her to her host.

Key to the families.

- a.* Mouth suctorial, without or only with rudimentary foot-jaws.
b. External ovaries as dilated sacs. LERNÆOPODIDÆ
bb. External ovaries filiform. LERNÆIDÆ
aa. Mouth siphonal, with styliform mandibles and well-developed foot-jaws.
c. Head formed as a buckler, furnished anteriorly with frontal plates; short antennæ consist of two flattened points; thoracic segments uncovered, or series of one or more pairs of elytraform lamellar appendages on dorsal surface. CALIGIDÆ
cc. Head not formed as a buckler or shield-shaped, and not furnished anteriorly with frontal plates; antennæ long, of five or more articulations; body ovoid or pyriform.
d. Antennæ of five or six articulations; parasitic. ERGASILIDÆ
dd. Antennæ of six to eighteen articulations; free-swimming. CYCLOPIDÆ

Family LERNÆOPODIDÆ.

Adult female.—Body robust, incompletely or not segmented at all. First antennæ small, arise from inside posterior, which latter usually biramous. Mouth conic, margin ciliated and dentate slender mandible seen within. Maxillæ curved, toothed, free. First maxillipeds large, developed as strong hook-like limbs. Second maxillipeds converted into organs for attachment, sometimes long and slender, at others united throughout, or short and dilated, ending in fixed apparatus. Thoracic limbs often entirely absent. External ovaries as dilated sacs. Habit that of a fixed parasite.

Male.—Pigmy in form. Found clinging or attached to some part of the female, as the head, arms or body. While strikingly different, it is also proportionately very small. The articulated limbs often represented, but varying in the different genera, are of value in the arrangement of the groups.

A single genus in our limits.

Genus *NAOBRANCHIA* Hesse.

Naobranhia Hesse, Ann. Sci. Nat. Paris, (4) XX, 1863, p. 122. Type *Naobranhia cygniformis* Hesse, monotypic.
Cestopoda Kurz, Zeitschrift. Wiss. Zoöl., XXIX, 1877, p. 407. Type *Cestopoda amplexens* Kurz, first species.

Female with elongated cylindrical cephalothorax, enlarged squarish genital segments, and minute abdomen. Ovaries lateral, enclosed in muscular bands united together down center by a membrane. Second pair of maxillipeds short, double, muscular, and functional as an organ for attachment to the host.

At present only the females of this genus are known.

I allow the name *Naobranhia* Hesse precedence over *Cestopoda* Kurz, on account of priority.

Naobranhia pomolobi new species.

PLATE 19.

Description of female.—Cephalothorax one and one-half times longer than rest of body, mostly cylindrical, and acuminate at end. Genital segments large, bulky, their combined width comprising greatest body width and nearly equals in length the most bulky portion of body. Second pair of maxillipeds quite short, double, and forming attachment to host. Color, milk-white. Length of entire animal about 8 mm.

Male.—Unknown.

Remarks.—I first discovered this interesting parasite attached to the gills of *Pomolobus pseudoharengus* taken in the Delaware River (at Tullytown, Pennsylvania) opposite or a little below Florence, in Burlington County, on May 17th, 1912. At the same time I also found a few in the branchial cavities of *Pomolobus astivalis*. On May 28th, 1912, I again visited this locality and examined hundreds of individuals of both species of *Pomolobus*, and secured about ten more specimens. It is not a common parasite, and often dozens of the herring must be examined before one is located. They are easily seen, however, their white sac-like bodies strongly contrasting against the dark and red color of the gills. Often the parasites were found

attached to the inner side of the opercular arch or just above the pseudobranchiæ. Such a location was apparently a favorite place. Others were taken from the isthmus, sometimes well anterior, and still others were less numerous about the gill filaments.

Type No. 2000, Academy of Natural Sciences of Philadelphia. Tullytown, Pennsylvania. From gills of *Pomolobus astivalis* (Mitchill), May 28th, 1912. H. W. Fowler. Also several paratypes, besides others (No. 2001) with same data, except taken on May 17th, 1912.

(*Pomolobus*, the alewife, the host from which this species was secured.)

Family LERNÆIDÆ.

PLATE 20.

Anterior antennæ short, slender, carrying small bristles. Posterior antennæ uncinatè, generally project beyond front border of cephalothorax. Maxillipeds very small, weak. Mouth suctorial. Thorax not articulated. Feet and other organs belonging to thoracic segment absent or rudimentary. No eyes. Genital segment of female much elongated. Abdomen rudimentary. Egg-sacs double.

In the young the body of sexually mature forms is very similar to those in the following related families. The larvæ vary from a cyclops-like form to those having a twisted frontal filament. In the older and fixed parasitic stage the females are long and worm-like, usually without limbs, and for this reason the present group has been allowed as a distinct family from the *Pennellidæ* by some writers. Some old females also show irregular excrescences from the anterior portion, others with elongated appendages from the genital segment or abdomen.

Key to the genera.

- a. No appendages on neck below those radiating from head.
- b. No vestiges of feet on under surface of body, nor any appendages representing them.

- bb.* Several vestigial pairs of feet on under surface of body near head, though these always very small and rudimentary. PENNELLA
- aa.* A pair of well-developed appendages on neck rather close below those radiating from head. LERNEOCEROPSIS

Genus **LERNEÆNICUS** Le Sueur.

- Lerneænicus* Le Sueur, Journ. Acad. Nat. Sci. Phila., III, 1824, p. 289. Type *Lerneocera radiata* Le Sueur, second species.
- Lerneænicus*, auct.
- Foroculum* (Thompson) Bassett-Smith, Proc. Zool. Soc. London, 1899, p. 484. Type *Lernæa spratta* Sowerby, monotypic. (Nom. in syn.)

Head rounded or obliquely pointed, with short, simple, horn-like excrescences projecting backwards. Neck non-segmented, long, passes gradually into genital segment, which latter in same straight line. Abdomen without penniform processes. Thoracic limbs placed close together just behind head, first two biramose, third and fourth uniramous, and all with two joints.

One species frequently found on the menhaden of our coast.

Lerneænicus radiatus (Le Sueur).

PLATE 21.

- Lerneocera radiata* Le Sueur, Journ. Acad. Nat. Sci. Phila., III, 1824, p. 288, Pl. II, fig. 1. No locality (though eastern coast of United States doubtless intended; on *Clupea tyrannus* Latrobe).
- Lernæa radiata* De Kay, N. Y. Fauna, Crust., VI, 1844, p. 60. No locality (evidently New York intended: "found on the Alewife").
- Lerneonema radiata* S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 578 (284), Pl. 7, fig. 30. Great Egg Harbor, N. J. (on *Brevoortia tyrannus*).
- Lerneonema radiata* R. Rathbun, Proc. U. S. Nat. Mus., V, 1884, p. 491 (Smith's material).
- Lerneænicus radiatus* Fowler, Proc. Acad. Nat. Sci. Phila., 1913, p. 62. Chincoteague, Virginia.

Description.—Body elongate, filamentous, for greater part anteriorly or at least two-thirds, very slender and evenly filiform. Posterior portion of body dilated cylindrically, though at first this rather gradual. These two regions include the thorax proper. Head terminal, furnished with five slender filamentous radiating appendages, all simple, similar, attenuated at their ends and

rather short. Abdomen small, rather robust, somewhat attenuated. Egg-strings long, filamentous, of equal width or calibre and equal about one-third the entire length. Color of thorax when distended usually darker red than rest of body, which is very pale or translucent. Egg-strings pale reddish. Total length 80 mm.

Remarks.—I have seen this species in New Jersey menhaden (*Brevoortia tyrannus*), but have no examples from the State's limits at present. It is, however, very common at times, and then almost every fish one meets with is infested with at least one parasite, often several or more. It is quite conspicuous, the distended posterior portion of the thorax usually being depressed parallel with the axis of its host and trailing along. The parasites are often found protruding most anywhere from their host's body, usually somewhere along the back, often from the dorsal fin, and sometimes they hang out from the region under the tongue, trailing along like a barbel. The head of the parasite is deeply imbedded, usually with its flexural cephalic tentacles wrapped about some portion of the skeleton of its host and thus well under the muscular tissue. The long anterior filamentous thorax moves freely within a well-drilled aperture through the fish's flesh so that usually only the distended portions and egg-strings are pendant. That sometimes these apertures are either distressing or serious to the host cannot be doubted, especially when they occur in numbers and the parasites are numerous. Then, according to the fishermen, fish will be found swimming about in a weakened condition and sometimes have dozens of their tormentors hanging from them. Such fish are usually easily secured, though too sickly to be valued. So deeply imbedded are these creatures that it is only by careful operation in cutting into their host that they may be secured intact, and then the head is usually removed unimpaired only with difficulty. Even small or young fish are frequently parasitized. According to many fishermen, and most of them are entirely ignorant as to what the lernean really is, the infested fish are sometimes said to be "shedding their bones"!

Other material, and I have examples in great number from the region of Chincoteague in Accomac County, Virginia, were secured during May of 1912. Numbers of menhaden examined there were found to be greatly infested. I also have one of these parasites taken from a small menhaden, though the parasite itself is quite adult, from Fort Macon, in North Carolina, many years ago by Dr. H. C. Yarrow.

On July 3d, 1912, I examined a menhaden (*Brevoortia tyrannus*) which had several examples of this lernean punctured through its back. The fish was caught in Great Bay in Ocean County.

Genus PENNELLA Oken.

Pennella Oken, Lehrb. Zoölog., I, 1815, p. 358. Type *Pennella diodontis* Oken, monotypic.

Penella, *Penellus*, auct.

Lerneopenna Blainville, Journ. Phys. Chim. Hist. Nat. Paris, XCV, 1822, p. 378. Type *Lerneopenna bocconi* Blainville, first species.

Lerneopinna, auct.

Baculus Lubbock, Trans. Linn. Soc. London, XXIII, 1860, p. 190. Type *Baculus elongatus* Lubbock, monotypic.

Hessella Brady, Rep. Voy. Challenger, Copepod., VIII, 1883, p. 136. Type *Hessella cylindrica* Brady, monotypic.

Female.—Head large, globose, tuberculate, with arm-like projections directed backwards. Neck long, straight, not distinctly segmented, united with elongated genital segment in same line. No antennæ. Only one pair of foot-jaws, which simple and hooked. Four pairs of limbs present, placed close behind head or under surface of body and together, first two biramose, and third and fourth uniramous, each branch with two joints. Feet always quite small or entirely rudimentary. Abdomen penniform.

Male.—Of very small size. Body globular, and more imperfect than in most of related genera, without distinct thorax and no rudiments of feet behind appendages representing foot-jaws.

Remarks.—The females are attached to their hosts by only their anterior extremity of the body, forcing the entire head into the tissues of the animal to which they adhere, and remain

there by the variously developed processes springing from the back portion of the head.

Key to the species.

- a. Head carries posteriorly two short obtuse horns; abdominal appendages slender and united as clusters at base. *filosa*
 aa. Head carries posteriorly two very long branchiform appendages; abdominal appendages simple. *sagitta*

Pennella filosa (Linnæus).

PLATE 22.

Pennatula filosa Linnæus, Syst. Nat., Ed. 10, 1758, p. 819. *Mediterranean Sea* (on *Xiphias gladius*).

Pennella filosa Leidy, Proc. Acad. Nat. Sci. Phila., 1890, p. 281. Beach Haven, New Jersey (on *Mola mola*).

Penella plumosa De Kay, N. Y. Fauna, Crust. VI, 1844, p. 60, New York.

Description.—Head rather large, globular, or compressed spheroid, lower anterior surface thickly papillate, and dorsally with a median and lateral pair of obtuse, robust horn-like processes, which median not more than half length of others. These processes all posterior on upper surface of head, median directed backward and lateral outwards. Tubercles near buccal aperture small, these representing foot-jaws. Several tubercles at lateral lower anterior faces of head. Neck long, mostly straight, slender, without distinct segments, and in same line with thorax. On neck ventrally, just below head, four pairs of minute hooks, these rudimentary, so that no distinct segmentation is evident. Thorax thicker, cylindrical, segmented or annulated, and about equal or a little shorter than neck. Abdomen short, about two-fifths length of thorax, also narrower than thorax, annulated and with crowded lateral filaments issuing from base in regular bunches on each side. Filaments moderate in length, though somewhat variable, and last ones extend downward and back beyond end of abdomen their length, which equal to that of any others. Ovaries long, slender, filiform. Color brownish, head and neck paler. Filaments and ovaries pale. In life thorax, abdomen and appendages black, and head, neck and

ovaries straw-colored. Length 130 mm., measured from end of head to tip of abdomen.

Remarks.—Known from our coast only on the record given by Leidy in 1890. His examples were taken during the same summer, hanging in great clusters from the root of the dorsal and other fins on the *Mola mola*, captured at Beach Haven. His specimens varied from 124 to 176 mm. in length, and the neck was buried in the flesh of their host from 32 to 76 mm. Many were also parasitized with the barnacle *Conchoderma virgata* and the hydroid *Eucope parasitica*.

I have two examples, also taken from a *Mola mola*, and obtained by Captain John L. Howard. Though labeled "Port Richmond, Philadelphia," they were possibly secured from a host captured somewhere off the coast. One example shows a large barnacle, *Conchoderma virgata*, attached to the lower surface of the abdomen.

De Kay's *Penella plumosa* appears to be this species. It is described as having a body capable of great contraction and dilatation. The enlarged head has numerous foramina at its end, and there is a rudiment of a third elongated process on the nape. The caudal extremity has a series of processes on each side, eighteen to twenty in number, and appear bulbous under a lens. In color all the free portion of the animal is dark red or purple. Its length is two to three inches. De Kay gives two hosts, which he apparently credits to his work on the fishes of New York, but neither occur there under the name *Rhombus ferrugineus* and *Diodon plumosus*. The former of these is likely his *Platessa ferruginea* (= *Limanda ferruginca*) and the latter his *Diodon fuliginosus* (= *Chilomycterus schæpfi*).

***Pennella sagitta* (Linnæus).**

PLATE 23.

Pennatula sagitta Linnæus, Syst. Nat., Ed. 10, 1758, p. 819. "In Pelago" (on *Lophius histrio*).

Pennella sagitta De Kay, N. Y. Fauna, III, 1842, p. 333. Lower bay within Sandy Hook, New Jersey (on *Mola mola*).

Description.—Head rounded, with two small horns, and carries at its base a pair of very long branchiform appendages. Abdominal penniform appendices simple. Length about four inches. (Milne-Edwards.)

Remarks.—Only known from our limits by De Kay's record for *Mola mola* taken in the lower bay within Sandy Hook. He further says that various parasitic animals, such as *Pennella sagitta* and *Tristopus coccineum*, are found frequently adhering to its body. It seems hardly likely De Kay could have confused this species with *Pennella filosa*, and for this reason his record is allowed to remain distinct provisionally.

Genus **LERNEOCEROPSIS** new genus.

Type *Lerneoceropsis septemramosus* new species.

This genus resembles the preceding in most respects, but differs at once in the presence of a pair of horn-like excrescences projecting outward from each side of the neck.

A single species, parasitic on several small fishes along our coast.

(*Lernæa*, the name of the typical genus; *ceros*, horn; *opsis*, appearance.)

Lerneoceropsis septemramosus new species.

PLATE 24.

Description of female.—Body elongate, filamentous, at least for greater portion anteriorly, so that nearly two-thirds of this region quite filiform and evenly slender. Hind part of body swollen cylindrically, rather gradually so at first. Head terminal, hardly distinct, and with five slender radiating filamentous branches or appendages, all alike, simple, rather short and ends not swollen, at least conspicuously. On neck, close below head, though distinctly separate, a branched appendage extends out each side from axis of neck. Left branch smaller in the type, though subequal to right in some examples, and sometimes less than half as long. Sometimes right branch with small sub-

basal knob or process. These branches both of similar structure to those in radiating series of head. Abdomen small, rather short, robust and a little pointed. Egg-strings long, filamentous, of equal calibre and about as long as rest of body. Color with head and anterior constricted thoracic region very pale or pellucid. Distended thoracic region deep maroon-red, and long egg-strings pale. Total length about 83 mm.

Male.—Unknown.

Remarks.—I first discovered this species on an alewife, *Pomolobus pseudoharengus* obtained in the open Delaware River and brought into the fishery of my friends, Messrs. R. and H. H. Burton, at Tullytown, in Bucks County, Pennsylvania. This specimen was captured on May 28th, 1912. About several hundred alewives were examined, but no more parasites were found in any of them, and they are not noticed by the fishermen. The method the latter employ of scaling the fish, by dumping them in a compartment and throwing sand over them, then several men in rubber boots tramping them about, of course, renders it impossible to examine fish for any of the protruding lerneans. I had the opportunity of examining the above example before it was so treated, and thus secured it intact.

On July 1st, 1912, Mr. W. B. Davis and the writer secured several examples from the mummichog (*Fundulus heteroclitus macrolepidotus*) along the shores of Great Bay in Ocean County.

Two other hosts may be mentioned, as I secured it on the silversides (*Menidia menidia notata*) and the may fish (*Fundulus majalis*) at Assateague, in Virginia, on May 5th, 1912. It was not abundant, however, and only several specimens were obtained from several hundred fishes.

Type No. 2002, Academy of Natural Sciences of Philadelphia. Tullytown, Pennsylvania. From *Pomolobus pseudoharengus* (Wilson). May 28th, 1912. H. W. Fowler. Others, paratypes, Nos. 2003 and 2004, same collection, are mentioned in the above remarks.

(*Septus*, seven; *ramus*, branch; with reference to the appendages of the head and neck.)

Family CALIGIDÆ.

Carapace broad and usually depressed. Cephalothorax incompletely segmented, free thoracic segments often partially overlapped or hidden by dorsal plates. Anterior antennæ short, club-shaped, with two or three free joints, their basal segments anchylosed with anterior border of carapace. Posterior antennæ in form of simple hooked claw, not extending beyond carapace. Mouth in form of more or less elongated suctorial beak, formed out of upper and under lips and inclosing toothed mandibles. Maxillæ free, both pairs rudimentary, and first pair sometimes wanting. Maxillipeds also free, in form of hooked claws, first pair weak, second much stronger and used for prehension. First four pairs of thoracic legs usually biramose, but first and fourth pairs frequently uniramose, and fifth pair rudimentary, often invisible dorsally or entirely wanting. Two simple eyes fused on median line often wanting. Generative organs paired in both sexes. Females with two cord-like egg tubes, usually quite long. Eggs in a single row. Male usually smaller than female, and both sexes permanent parasites on fishes.

Key to the sub-families.

- a.* First thoracic segment only fused with head, others free; one or more of them with paired dorsal plates; all four pairs of legs biramose.
b. Frontal plates fused with carapace; egg-cases convoluted, entirely hidden. CECROPINÆ
bb. Frontal plates distinct; egg-cases visible their entire length. PANDARINÆ
- aa.* Three anterior segments of thorax fused with head; fourth and genital segments free, and former without dorsal plates or any appendages except fourth legs. CALIGINÆ

Sub-Family CECROPINÆ.

First thorax segment fused with head, and second and third segments more or less fused inter se. Fourth segment with pair of dorsal plates in both sexes, overlapping genital segment. Sexes very similar.

Female.—Carapace orbicular, strongly arched, frontal plates more or less completely fused with carapace and not distinct, and grooving similar to that in *Pandarina*. Three free thorax segments, first two usually fused and furnished with a single pair each of dorsal plates and lateral lobes. Third segment carries pair of enlarged dorsal plates which cover front portion of genital segment. Latter large as, or larger, than carapace and with pair of dorsal plates which entirely cover this segment as well as abdomen. Abdomen one-jointed, with large anal laminae armed with spines instead of setæ. Abdomen sometimes with broad wings extending to lateral margins of genital segment, when egg-strings are concealed below genital segment, or sometimes without wings, when egg-strings long, straight and visible as in *Pandarina*. First antennæ usually two-jointed, rarely three-jointed. Second maxillipeds with terminal claws. All legs biramose, rami of first three pairs two-jointed, of fourth pair one-jointed and usually enlarged into broad lamellæ, armed only with spines.

Male.—A fixed form incapable of locomotion like female. Carapace and thorax segments similar to female, dorsal plates of fourth segment being reduced in size. Genital segment also much smaller, with abdomen partially visible beyond its hind margin. Abdomen without wings in all genera. Second antennæ and second maxillipeds with stout prehensile claws. All feet biramose, rami as in female, except those of fourth pair rarely much enlarged. Rami of first three pairs with plumose setæ in a few genera, fourth pair and all rami in other genera without them.

Chalinius.—Attached by two broad ribbon-like frontal filaments very short and parallel.

Remarks.—The parasites of this sub-family are found largely on the Ocean sun-fishes (*Molida*), though they also sometimes occur on tunnies, porcupine-fishes, flat-fish, sharks, etc. The following, compiled from Dr. C. B. Wilson, discusses their ecology: These parasites are more gregarious than the *Pandarina* and are found in bunches of fifteen to thirty or more, attached to the outside skin and gills of fish. The combined laceration of their

claws often produces a large pit or sore, in the bottom of which they cling tightly. Nothing of this sort is found among the *Pandarinae*, as they do not collect in such numbers and cling partly, if not chiefly, by means of their adhesion pads. Hence when several of them get together, as often happens on a shark's fin, there is very little laceration and no bunch or sore is formed. The abrupt transition and the consequent degenerate character of the male forms one of the chief characteristics of the group. The only locomotion possible to either sex is such as can be accomplished by loosening one set of prehensile organs and obtaining a new hold by stretching the body, while still keeping a second set securely fastened. When once placed, with the second antennæ buried in the flesh of the host, it is probable that the female does not subsequently change her position. The male is usually found attached to the female, the front margin of its carapace burrowed beneath the apron of her third swimming-legs, and its second antennæ clasped around her fourth thorax segment. When he has once gained this position the male probably does not change it during life. The organs of prehension are similar to those in the *Pandarinae*. The chief hold is maintained by the second antennæ, which are buried for their entire length in the skin and underlying flesh of their host. During life the body of the copepod frequently trails off in the water, with no attachment to the host except these antennæ, which gives it the appearance of being fastened by a frontal filament. Usually, however, the antennæ are reënforced by the second maxillipeds and adhesion pads. The latter are similar to those in the *Pandarinae*, but there are two of them behind each first antenna, while there is none on the base of the second pair. These parasites certainly never drop off into the boat or anywhere else, as claimed for the genera in the *Pandarinae*. Both the antennæ and maxillipeds are set so firmly in position that they cannot be loosened without breaking them. Even after the death of the parasite it is usually necessary to cut around these appendages if one would remove the entire animal. When placed alive in the aquarium they are more helpless than the *Pandarinae*, and both sexes can only lie in the place they are put, with an occasional weak and spasmodic

movement of the swimming-legs. Hence they can be kept alive but a very short time. As they are gregarious and gather together in colonies, whose combined lacerations form a deep pit extending through the skin and into the flesh of their host, they are kept alive after the skin of their host may have dried. Such a pit does not dry as quickly as other portions of the surface of the host's body, and the parasites, being fastened in its very bottom, are not only protected from abrasion, but are also kept moist long after the fish's skin has become dry and parched.

Key to the genera.

- a.* FEMALES. Third dorsal plates of medium size, covering quite a portion of genital segment; latter large as or larger than carapace.
- b.* Abdomen without wings; egg-strings long and entirely visible; genital segment a little smaller than carapace; margins of carapace and dorsal plates finally toothed; third dorsal plates covering three-fifths of genital segment; rami of first swimming-legs normally developed.
- PHILORTRAGORISCUS
- bb.* Abdomen with broad wings between which and genital segment long egg-strings are entirely concealed; genital segment much larger than carapace.
- c.* First antennæ three-jointed, prominent; second pair projecting beyond carapace margin; posterior border of carapace slightly concave; margin of carapace and dorsal plates coarsely toothed.
- ORTHAGORISCICOLA
- cc.* First antennæ two-jointed, not prominent; second antennæ hidden; posterior border of carapace deeply concave; margin of carapace and dorsal plates smooth.
- CECROPS
- aa.* MALES. Third dorsal plates small, overlapping genital segment but little; latter much smaller than carapace.
- d.* Third dorsal plates very much reduced; grooving of carapace distinct; abdomen largely visible; second antennæ much enlarged, projects beyond carapace; first dorsal plates large; genital segment with large spines at posterior corners; first swimming-legs normally developed.
- PHILORTRAGORISCUS
- dd.* Third dorsal plates relatively large as in female; grooving of carapace nearly invisible; abdomen almost or quite concealed.
- e.* First antennæ three-jointed; second and third thorax segments distinct and entirely visible, without plates; abdomen partly visible; margins of plates on fourth and genital segments coarsely toothed.
- ORTHAGORISCICOLA
- ee.* First antennæ two-jointed; second and third thorax segments fused inter se and furnished with pair of broad lateral plates, concealed beneath carapace; abdomen also entirely concealed.
- CECROPS

Genus *PHILORTHRAGORISCUS* Horst.

Philorthragoriscus Horst, Notes Leyd. Mus., XIX, 1897, p. 137. Type *Dinematura serrata* Kröyer, monotypic.

Female.—Carapace well rounded, a little wider than long. First thorax segment only fused with head, second and third segments fused inter se and furnished with pair of small lateral plates, and fourth segment with pair of large dorsal plates fully wide as carapace and overlapping three-fifths of genital segment. Latter nearly size of carapace, covered by pair of large dorsal plates with finely serrated edges. Abdomen small, wider than long, one-jointed, attached to genital segment so far forward as almost entirely concealed in dorsal view. Anal laminæ large, foliaceous, divergent, each armed with four short spines. Frontal plates well fused with carapace. First antennæ long, two-jointed. Second pair three-jointed, uncinatè. Mouth-tube long, pointed. Mandibles with very wide blunt teeth. Second maxillæ short, jointed, simple. Second maxillipeds large, with stout terminal claw. All swimming-legs biramose. Rami of first three pairs two-jointed, armed with both spines and plumose setæ, rami of fourth pair one-jointed and bearing short spines only. Fifth pair of swimming-legs entirely lacking. Egg-tubes straight or coiled outside body, several times body length. Eggs as in *Pandarina*.

Male.—Carapace much larger than rest of body, wider than long, its dorsal surface grooved as in *Pandarina*. No eyes visible. Second and third thorax segments fused inter se, furnished with pair of small lateral plates. Fourth segment with pair of very small and rudimentary dorsal plates which scarcely overlap genital segment at all. Genital segment subquadrangular, with slightly rounded sides, covered with two dorsal plates thoroughly fused along mid-line, with posterior margin and sinus exactly as in *Perissopus*. Abdomen shaped as in female but more of it visible behind genital segment. Anal laminæ narrower and smaller than in other sex, each armed with three good-sized setæ. First antennæ relatively longer than in female. Second pair also enlarged, their terminal claws projecting well

in front of carapace. Other appendages like in female, except on all claws and spines longer and sharper.

***Philorthroriscus serratus* (Kröyer).**

PLATE 25.

Dinematura serrata Kröyer, Naturh. Tidssk., (3) II, 1863, p. 250, Pl. 8, figs. 4a-i. *Locality?* (*host?*).

— Leidy, Proc. Acad. Nat. Sci. Phila., 1890, p. 282. Beach Haven, New Jersey (on *Mola mola*).

Philorthroriscus serratus Wilson, Proc. U. S. Nat. Mus., XXXIII, 1908, p. 479, Pls. 42-43. About 120 miles off Wood's Holl, Mass.

Description of female.—Carapace well rounded, about one-sixth wider than long, with large acuminate teeth along lateral and posterior edges. Frontal plates wide, fairly distinct, but still fused with carapace, and smooth, slightly curved frontal margin with small incision at center. Dorsal surface of carapace with well-defined grooves marking it off into similar areas as in *Pandarina*. Two longitudinal grooves strongly concave toward each other, like parenthesis marks, space between being nearly two-thirds of entire width. Lateral areas outside these grooves wider posteriorly, prolonged backward on either side in large lobe extending nearly to anterior margin of dorsal plates of fourth thorax segment. Each of these lateral areas divided by transverse groove which starts from deep sinus in lateral margin curving inward and backward to longitudinal groove. Posterior or thoracic portion of area thus shorter but wider than anterior portion, with somewhat appearance of lateral plate attached to hind portion of carapace. Second and third thorax segments fused together and with single pair of lateral plates, one on either side beneath posterior carapace lobe and nearly concealed by it. Fourth thorax segment considerably narrower than second and third, carries pair of large dorsal plates extending outward on either side to level with lateral margins of carapace and backward until overlapping half genital segment. Two plates entirely fused anteriorly for about one-fourth their length, and combined anterior margin nearly perfect arc of large circle which terminates at either end in short sharp spine. Each plate

nearly circular in outline and bordered by acuminate spines similar to those on carapace, but not quite as large. Sinus between plates wide, well rounded at base, but farther back its sides approach until in actual contact. Combined plates of fourth and genital segments about same size as carapace and inversely same shape. As abdomen is hidden this produces a regular elliptical outline, broken across short diameter by waist between carapace and fourth segment. Joint between third and fourth segments seems to be only one really flexible, and anterior half of body frequently folded over ventrally against posterior half. Dorsal surface of genital segment covered by pair of plates similar to those on fourth segment and finely serrate around edges. Posterior sinus between these plates deeply cut, similar to that between fourth segment plates. Abdomen of medium size, considerably wider than long, unsegmented, attached to ventral surface of genital segment just in front of base of sinus, between dorsal plates of latter. Its own hind margin slightly reentrant on either side where lamina is attached, and these laminae small, foliaceous, and furnished with four short spines. Laminae vary in length, but usually project somewhat behind genital segment. Egg-strings narrow, two and one-half to three times long as whole body. Eggs small, similar to those in *Pandarinae*.

First antennae large, appressed close to edge of carapace, two joints subequal, basal twice diameter of terminal, and both well armed with setae. Second antennae large, three-jointed, end in stout curved claw with an accessory spine on its inner edge. When antennae turn forward these claws project beyond outer carapace edge, prehensile and with second maxillipeds are driven deeply into the flesh of the host. No first maxillae. Second pair close beside mouth-tube, about one-third its length, simple and end in short blunt spine directed outward. Mouth-tube very long, conical, base wide, but about level of tips of second maxillae narrows rapidly to slender tip. Mouth-opening terminal, fringed with long hairs, through which mandible tips may be seen. Latter slender, toothed some distance along inner edges at tip, and wide blunt teeth different from those in *Pandarinae*. First

maxillipeds small, weak, terminal and basal joints subequal, end in two claws same size covered with stiff hairs. Second maxillipeds considerably larger and stouter, terminal claw about three-fourths length of basal joint. On inner surface of latter, opposite tip of claw, pair of long blunt spines, some distance apart and so situated that when claw closes down on basal joint it shuts in between them and is locked securely in place. All four joints of legs biramose, rami of first three pairs two-jointed, of fourth pair one-jointed. In first pair exopod considerably larger than endopod, basal joint three times length of terminal and nearly twice as wide, and endopod joints about equal. In second and third legs basal joints enlarged and connected across mid-line by wide lamina, larger in third pair than in second. Rami of second pair about same size, joints unequal, in exopod basal joint twice size of terminal and in endopod terminal joint more than twice size of basal. Rami of third legs equal and four joints nearly same size. Fourth legs and basal joints well separated, without connection across mid-line, rami one-jointed and rudimentary, exopod three times size of endopod, both armed with short spines and without plumose setæ. Color variegated yellow and gray. Total length 7 mm.

Description of male.—Carapace much larger in proportion, more than twice width of rest of body and about same length. Grooves and divisions as in female. Lateral plates on fused second and third segments plainly visible just inside posterior lobes of carapace. Dorsal plates of fourth segment very rudimentary, no larger than lateral plates just mentioned, barely overlapping base of genital segment. Latter subquadrangular, with slightly rounded sides, hind angles armed with sharp spines, and hind edge with wide central sinus with divergent sides showing most of dorsal surface of abdomen. Margin on either side of sinous sigmoid, almost exactly as in *Perissopus*. Abdomen as in female, also anal laminae. First antennæ longer than in female, more densely armed with setæ. Second antennæ much enlarged, and terminal claw projects well in front of carapace. Other appendages as in female, except that in all spines and claws longer and sharper. Basal joint of exopod of first legs some-

what swollen, armed along outer edge and adjacent ventral surface with stout curved spines pointing backward. Claw at outer corner of this joint and those on terminal joint enlarged and furnished along their margins with row of stout teeth. Color as in female. Length 5 mm. (C. B. Wilson.)

Remarks.—This species was secured at Beach Haven in 1890 by Leidy. It was taken from the ocean sunfish (*Mola mola*) in company with *Orthagoriscicola* and *Cecrops*. Leidy states that his three examples, which were females, were 6 to 7 mm. long.

Genus ORTHAGORISCICOLA Poche.

Orthagoriscicola Poche, Zoöl. Anzeiger, XXVI, 1902, p. 13. Type *Cecrops* (*Lamargus*) *muricatus* Kröyer, monotypic.

Lamargus (nec Müller and Henle, July, 1837) Kröyer, Naturh. Tidssk., I, 1837 (September), p. 487. Type *Cecrops* (*Lamargus*) *muricatus* Kröyer, monotypic.

Female.—Carapace trapezoidal or wedge-shaped, one-fourth wider than long, much narrowed anteriorly, posterior edge scarcely reentrant. Posterior carapace lobes very broad and evenly rounded. Eyes invisible. Groovings on dorsal surface indistinct. Lateral carapace edges coarsely toothed, dorsal surface sparsely covered with spines. Frontal plates fused with carapace, their outlines indicated by well-defined grooves. Second and third thorax segments distinct, free, without dorsal plates, forming narrow waist joining carapace and genital segment. Fourth segment with pair of dorsal plates covering half of genital segment, margins serrate. Abdomen on ventral surface of genital segment, entirely concealed, lateral margins prolonged into broad laminae similar to those of *Cecrops*. Egg-tubes carried between these laminae and dorsal plates of genital segment as in *Cecrops*, irregularly coiled and many times body length. First antennae three-jointed. Second pair stout, uncinatè. Maxillae much smaller than in *Cecrops* and mouth-tube about same. Second maxillipeds stout, with large terminal claw. All swimming-legs biramose, rudimentary and destitute of plumose setae. Rami of first two pairs two-jointed, of third and fourth pairs one-jointed and enlarged into huge flattened laminae.

Male.—Carapace similar to female, relatively shorter and wider. Thorax segments similar. Genital segment much smaller, only two-thirds size of carapace, its dorsal plate fused along mid-line with wide and shallow posterior sinus through which abdomen shows. Latter small and subquadrangular. Anal laminae narrow and oblong. Appendages like in female. Second antennae and second maxillipeds longer and stouter than in female. Third legs like first two pairs, with two-jointed rami, and fourth pair one-jointed and enlarged as much as in female.

***Orthogoriscicola muricata* (Kröyer).**

PLATE 26.

Cecrops (Lamargus) muricatus Kröyer, Naturh. Tidssk., I, 1837, p. 487, Pl. 5, figs. a-e. Denmark (on *Mola mola*).

Lamargus muricatus Leidy, Proc. Acad. Nat. Sci. Phila., 1830, p. 282. Beach Haven, New Jersey (on *Mola mola*).

Orthogoriscicola muricata Wilson, Proc. U. S. Nat. Mus., XXXIII, 1908, p. 473, Pls. 40-41. About 120 miles off Wood's Holl, Mass.

Description of female.—Carapace trapezoidal or wedge-shaped, much narrowed anteriorly, with well rounded posterior lobes and very shallow sinus. Frontal plates fused with carapace. Eyes invisible in adults. Lateral carapace margins set with fine conical teeth, and grooves on dorsal surface indistinct but separating lateral area on either side, which again divided into very small cephalic and much larger thoracic portion. Entire dorsal surface sparsely covered with spines, which coarser and more prominent on ridges alongside grooves. Second, third and fourth thorax segments free, first two with pair of narrow spine-like projections in place of lateral lobes, all three of same width. Third segment without dorsal plates. Fourth pair, whose combined area greater than that of carapace, and separated by deep posterior sinus, often trifle enlarged at its base. Genital segment transversely elliptical, large as carapace, one-half wider than long, covered with pair of huge dorsal plates which overlap each other along mid-line and extend back beyond tip of abdomen. Posterior and postero-lateral borders

of these plates and of those on fourth segment toothed, teeth on genital segment plates being considerably larger and coarser. Genital plates not routing over ventrally in scroll as in *Cecrops*, but flattened to very edge. Abdomen similar to *Cecrops*, lateral lobes prolonged sidewise and backward so their edges coincide nearly with those of genital segment plates. Abdomen length plus these plates about twice that of genital segment in front of abdomen. Lobes also set with fine teeth along their edges, and not rolled at margins, but flat. This space between them and genital segment, in which egg-strings are coiled, not as thick dorso-ventrally but wider than in *Cecrops*, thus accommodates about same length of egg-strings, twenty or thirty times body length. Strings about same diameter and eggs fully as numerous.

First antennæ three-jointed, joints diminishing regularly in diameter and in length from base outward, also very sparsely armed with setæ. Second antennæ large, three-jointed, projects well in front of carapace, terminal joint very powerful, strongly curved claw buried its entire length in flesh of host. Mouth-tube broadly conical, similar to that in *Cecrops*, mandibles projecting through opening at its tip, armed with square teeth on their inner margins only. Second maxillæ in form of short conical knobs, apparently without joints, spines or rudimentary exopods, in size less than one-fourth length of mouth-tube. First maxillipeds two-jointed, both joints exceptionally stout and terminal slightly longer. Terminal claw short, wide, heavily fringed with stout spines, and accessory claw in form of large spine. On ventral surface of joint opposite accessory claw a raised knob covered with small spines. Second maxillipeds swollen, basal joint much longer than terminal claw, on its inner surface two pairs of knobs, one near base of terminal claw and other near its own base. Claw when closed lies between two knobs of each pair. Legs all biramose, rami transformed into flattened laminae without plumose setæ, and those of first two pairs two-jointed, while third and fourth pairs with but single joint. Color uniform light yellow without any pigment markings. Claws and chitin ribs which strengthen carapace darkened to brownish hue. Total length 20 mm.

Description of male.—Carapace similar to that of female, relatively little shorter and wider, grooving on dorsal surface indistinct. Eyes invisible in adult. No teeth along carapace margins laterally. Fourth segment plates nearly circular, their combined area well less than carapace, but covering more than half of genital segment plates, and posterior margins thickly set with teeth. They project forward at anterior corners in broad rounded shoulder on either side. Genital segment small, two-thirds size of carapace, orbicular in outline, strongly flattened dorso-ventrally, and dorsal plates fused along mid-line their anterior half, but separated for their posterior half, hind margins thickly set with teeth. Abdomen very small, weak, subquad-rangular, fastened to ventral surface of genital segment so that its hind margin coincides with that of latter. Anal laminae narrow, oblong, nearly three times long as wide, each armed with four small setae. Dorsal surface of abdomen and anal laminae visible through posterior sinus between dorsal plates of genital segment. Appendages as in female, except second antennae and second maxillipeds larger, and more spines on swimming-legs. Fourth legs fully degenerate as in female, being enlarged into broad laminae with no signs of segmentation. Third legs like second pair, not enlarged, and each ramus two-jointed, joints about same size, but those of exopod nearly three times size of those of endopod. Terminal joint of endopod in third legs armed with long single spine or claw, curved strongly outward. No plumose setae on swimming-legs. Color as in female, spermatophore receptacles deep purple, and ducts leading to them lighter purple. Length 10 to 15 mm. (C. B. Wilson.)

Remarks.—Known from New Jersey limits by Leidy's record of four females taken from a large sunfish (*Mola mola*) captured at Beach Haven in 1890. These, like his examples of *Philorthratoriscus serratus* (Kröyer), were found attached to ulcerated surfaces at the root of the caudal fin.

The following notes are taken from Dr. Wilson's exhaustive account: "It is found almost exclusively on the ocean sunfish (*Mola mola*), but lives on the outer surfaces of the body, often frequenting the anal fin or its adjacent regions. It occurs often

in bunches of from ten to twenty individuals, so that even the thick skin of the host is quickly penetrated by the combined laceration of the sharp claws and probosces of the parasites. Thus groups of parasites are found lying in the bottoms of depressions or pits, which have been eaten through the host's skin and into the raw flesh below. The edges of these pits are often raised above the surrounding surface and calloused. Thus while themselves free from some dangers due to their fixed habit, their chitinous plates covering the dorsal surface often invite different vegetable and animal forms of the sea to a good anchorage. Thus the back of an *Orthagoriscicola* may be found covered with algæ, infusoria, hydrozoa or barnacles. Sometimes a huge *Lepas* may be found attached, and while not in sense a parasite, its heavy weight upon the copepod's back is likely a sore burden."

Genus CECROPS Leach.

Cerops Leach, Encyclop. Britan. Suppl. (Annulosa), 1816, p. 405. Type *Cerops latreillii* Leach, monotypic.

Female.—Carapace oval, stout, strongly arched, deeply notched behind. Frontal plates fused with carapace. Cephalic and thoracic portions of lateral areas separated by transverse groove. Second thorax segment with large lateral lobes. Third segment with pair of small dorsal plates. Fourth segment with pair of larger plates. Genital segment small, carries pair of dorsal plates larger than carapace extending back beyond tips of anal laminae and forms dorsal half of bag in which eggs are carried. Abdomen ventral, large as genital segment in front of its base, strongly flattened dorso-ventrally. Ventral surface of abdomen produced laterally and anteriorly into large lobes, forming ventral surface of egg-bag. Egg-strings very narrow, twenty or thirty times body length, irregularly convoluted and entirely hidden by above-mentioned bag. First antennæ two-jointed, second pair and second maxillipeds stout and furnished with strong curved claws for prehension. Maxillæ huge, club-shaped, two-jointed, terminal joint covered with small spines. Legs all

biramose, rami of first three pairs two-jointed, of fourth pair one-jointed and enlarged into flattened laminæ with large fold of skin on ventral surface.

Malc.—Fixed and degenerate, similar to female except genital segment without dorsal plates but covered by those of fourth segment, which also reach nearly to end of abdomen. Latter plump, not flattened, twice wide as long, without lateral lobes. Anal laminæ close together, armed with good sized setæ. Fourth legs but little enlarged, rami one-jointed, without ventral fold of skin. Plumose setæ on first three pairs of legs less rudimentary than in female.

***Cecrops latreillii* Leach.**

PLATE 27.

Cecrops latreillii Leach, Encyclop. Britan. Suppl. (Annulosa) 1816, p. 405, Pl. 20, figs, 1-5. *No locality.*

—— Leidy, Proc. Acad. Nat. Sci. Phila., 1890, p. 282. Beach Haven, New Jersey (on *Mola mola*).

Female.—Carapace oval, long as wide, with prominent frontal margin and deep triangular posterior sinus. Frontal plates almost entirely fused with carapace, separated by wide deep median sinus. On lateral edges just behind frontal plates a well-defined notch on either side in base of which first antennæ are attached. Another notch a little posterior on lateral margins formed by transverse groove separating cephalic from thoracic portion of lateral areas. This groove far forward, thus cephalic portion in front of it small and triangular, while thoracic portion behind it nearly four times as large and trapezoidal. Second and third thorax segments fused, with single pair of lobes and single pair of dorsal plates. Broad lateral lobes apparently belong to second segment, reach well out beneath hind lobes of carapace. Small dorsal plates belong to third segment and overlap following segment a little. Fourth segment with pair of medium-sized plates which reach about to center of those on genital segment. Each small dorsal plate triangular with well-rounded corners. Genital segment with dorsal plates en-

larged nearly twice length of carapace, elliptical, about one-fourth longer than wide and sides very evenly curved. Genital segment covered by pair of dorsal plates with softened edges which project far beyond lateral and posterior edges of segment. These soft edges rolled over ventrally into large scrolls which completely cover sides and hind end of segment and lap quite a distance on to ventral surface, completely concealing abdomen, anal laminae and egg-strings in dorsal view. Posterior sinus between these plates sharply triangular, about one-fourth entire length of plates. Abdomen semi-elliptical, fully as large or larger than that portion of genital segment preceding. Its ventral surface produced into large lobe or lamina on either side, which extends outward laterally beneath turned-over edge of dorsal plates of genital segment. When egg-strings absent lateral and anterior edges of these laminae turned upward into scrolls, similar to those formed by dorsal plates of genital segment and inside of them. Lateral margin also caught inward in large fold on either side about one-fourth distance from its anterior end. This gives ventral aspect of abdomen peculiar T-shape, upright portion more than twice width of arms. When egg-strings extrude these folds and scrolls along lateral edges are straightened out and each lamina rests flatly upon ventral surface of coiled egg-strings, completely concealing them in ventral view. Scrolls along anterior edge never entirely straightened, but lamina on either side curls up over eggs at that point and holds them securely in place. Anal laminae small, orbicular, attached close to anus either side, and armed with short stout spines, without plumose setae.

First antennae two-jointed, basal joint much longer, and each joint armed with a few short spines. Second antennae large, powerful, principal organs of prehension, three-jointed, terminal joint strong sickle-shaped claw, which is buried in the host's flesh. Terminal joint of first maxillipeds much shorter and more slender than basal, terminal claw nearly long as joint itself and only slightly curved, accessory claw much shorter, while both claws with serrate edges. Second maxillipeds stout, not swollen as in *Pandarinae*, curved terminal claw nearly long as basal joint and

shutting down between two large corrugated knobs on ventral surface of latter. Mouth-tube and maxillate peculiar, former conical with swollen base, tapering rapidly to fairly sharp tip, from which ends of mandibles protrude. Latter straight, coarsely toothed along inner edges, teeth more or less rectangular. Maxillæ enormous, club-shaped, each one large as whole mouth-tube and two-jointed, its hemispherical terminal joint covered with small curved spines. On ventral surface of each maxilla, at base of terminal joint, a small knob represents rudiments of exopod. Swimming-legs biramose, rami two-jointed except of fourth pair, which modified into large laminae with indistinguishable joints. Basal joints of exopods of first two pairs much larger than terminal joints and armed with stout spine at outer distal corners, one on legs exceptionally large. Segments of third legs all same size, while in fourth legs rudimentary endopod several times larger than exopod. In latter legs also large fold of skin caught up on ventral surface of each basal joint. When legs are in place this fold fits into groove between abdomen and genital segment, doubtless assisting materially in holding egg-masses in place. Coils of oviducts in front part of genital segment, estimated about twenty-five times length of body. Strings narrow, and eggs thin, so that several thousand to a string. They are held securely between dorsal plates of genital segment and lateral lobes of abdomen until hatched, the nauplii escaping at the hind end of the egg-bag.

Color uniform yellowish-white, turning orange-brown in alcohol in center of different carapace areas and dorsal surface of genital segment. Anterior ventral surface of abdomen and edges of dorsal plates of genital segment with a few spots of light brown. Egg-masses deep orange-brown. Total length 30 mm.

Male.—Carapace as in female, with same grooving on dorsal surface. Cephalic and thoracic portions of lateral areas not differing as much in size as in other sex, and posterior sinus rather deeper. Lateral lobes on second segment and dorsal plates on third and fourth segments correspond closely with female, last

covering whole of genital segment and most of abdomen. Genital segment transversely elliptical, nearly twice wide as long, narrowed into neck where it joins fourth segment. Abdomen transversely elliptical, terminal, little more than half diameter, but much less than half length of genital segment. Anal laminae terminal, small, close to anus on either side and with rudimentary plumose setae. Appendages similar to those of female, with usual sex distinctions in larger size of second antennae, maxillae and second maxillipeds, and in an increase in number and length of plumose setae on swimming-legs. Fourth legs have large laminate basal joints and one-jointed rami, but no fold of skin in basal joints, and rami not as large and rudimentary as in female. Testes large, very apparent in well-preserved specimens. Color as in female, but rather lighter and more transparent, without pigment spots on ventral surface. Total length 17 mm.

(C. B. Wilson.)

Remarks.—This species is known from New Jersey waters by Leidy's record. It was taken from the gills of *Mola mola* secured at Beach Haven in 1890. Leidy secured six mature females about an inch in length, of which three had the male appended. The males were about half the length of the females. He also secured three other young females.

So far as known the *Mola* seems to be the only host on which this species has been found.

Sub-Family PANDARINÆ.

First thorax segment only fused with head, others free. Sexes quite dissimilar.

Female.—Carapace short, well rounded, frontal plates distinct. Eyes three in number, fused on median line, lenses arranged in form of triangle. One or more of free thorax segments furnished with paired dorsal plates. Genital segment enlarged, often covered with similar dorsal plates. Body stiff in consequence of these plates and not capable of much motion. Abdomen elongate, often with lateral processes. Anal laminae large

and broad, with stout plumose setæ. Eggs numerous, uniseriate, and borne in straight cases, visible for their entire length and usually much longer than body. Mouth-tube elongate and tapering to sharp point. First maxillæ lacking, second pair simple flattened laminae, tipped with short claws. Second maxillipeds massive and nodose. All four pairs of legs biramose, and some or all of them lamellar and destitute of plumose setæ.

Male.—A typical *Nogaus* form. Carapace more elongate than that of female, and produced posteriorly into better defined lateral lobes. Free segments all well separated, of about same length, but diminishing regularly in width, and none furnished with dorsal plates. Genital segment also without dorsal plates and little enlarged. Abdomen two-jointed. Anal laminae large and foliaceous, furnished with long and stout plumose setæ. Adult males are as free swimmers as any of the *Caligina* and move about with as much ease over their host's body, thus affording a marked contrast to the fixed females. The young are attached by two broad and ribbon-like filaments, placed side by side and very short.

Key to the genera.

- a.* FEMALES. All four pairs of legs biramose; one, three or four, but never two pairs of dorsal plates; abdomen one-jointed and entirely concealed from view.
- b.* Rami of first three pairs of legs two-jointed, with plumose setæ, of fourth pair one-jointed and setæ nonplumose; four pairs of dorsal plates, fourth on genital segment. PANDARUS
- bb.* Rami of first and second legs two-jointed, of third and fourth pairs one-jointed and very rudimentary; three pairs of dorsal plates. PERISSOPUS
- aa.* MALES. All four pairs of legs biramose and armed with long plumose setæ; abdomen one or two-jointed, entirely visible.
- c.* Both fifth and sixth legs visible on genital segment; abdomen two-jointed, joints equal. PANDARUS
- cc.* No legs on genital segment, or but one pair; abdomen two-jointed, terminal joint larger. PERISSOPUS

Genus **PANDARUS** Leach.

Pandarus Leach, Encyclop. Brit. Suppl. (Annulosa) 1816, p. 405. Type
Pandarus bicolor Leach, first species.

Nogaus Leach, Dict. Sci. Nat., XIV. 1819, p. 535. Type *Nogaus latreillii*
Leach, monotypic.

Nogagus, auct.

Female.—Body an elongated oval or ellipse. Cephalothorax semielliptical, usually narrowed anteriorly, and covered with a smooth carapace without grooves. Posterior lobes short, margin between them armed with teeth or spines, or sometimes sinuate. Eyes usually invisible in adult, but visible in young. Free thorax segments, each with pair of dorsal plates, these stiff, rigid, elytraform. Those on second segment lateral, others median, and third pair overlapping to greater or less extent genital segment. Latter considerably enlarged, elliptical, some narrowed posteriorly and prolonged backward into lobes at posterior corners. Dorsal surface of genital segment hardened like carapace, usually gives evidence of being fusion of two plates like those of other thorax segments. Sixth segment represented by a median lobe or process attached to base of posterior sinus of genital segment, without dorsal plates or rudimentary legs. Abdomen short and broad, two-jointed, usually narrowed anteriorly and attached to ventral surface of genital segment. Abdomen covered dorsally by rudimentary sixth segment lobe, ventrally by short wide plate and not reaching hind margin of dorsal lobe. Attached to either side of ventral plate at base and to side of abdomen a peculiar modified anal lamina. The two usually divergent, with thickened conical outer margin and two membranous wings, dorsal and ventral, on inner margin. Four pairs of adhesion pads on ventral surface of carapace, one pair at base of first antennæ, one at base of second antennæ, third between bases of first maxillipeds and fourth on lateral margins of first pair of thorax plates, opposite first legs. Second maxillipeds much swollen and enlarged, armed with a pair of roughened forceps-like knobs instead of terminal claw. Four pairs of biramose swimming-legs, rami all laminate, indistinctly jointed, and usually armed with

spines only. Egg-tubes straight, uniserrate, close together and usually much larger than the body.

Male.—Carapace broad, well rounded, hind lobes prominent, triangular, usually turned inward. Hind edge straight, armed with pair of secondary lobes, one on either side, close to base of posterior lobe. Lateral grooves distinct, turned sharply outward near front end and extending to edge of carapace just behind first antennæ. Frontal plates wide, prominent, anterior margin fairly straight and not deeply cut at center. Eyes often visible in adults. Free thorax segments without dorsal plates, diminishing in width from in front backward, first one (really second segment) with pair of lateral lobes extending diagonally backward and outward, others without lobes. Genital and sixth segments fused, considerably enlarged, furnished with two pairs of rudimentary legs, one, the sixth, at posterior corners, and other, the fifth, on lateral margins. Both pairs prominent. Abdomen two-jointed, joints same size. Anal laminæ large, well flattened, armed with four large setæ, of which inner separated from other three. Ventral surface of carapace with same adhesion pads as in female. Second maxillipeds enlarged, sometimes with terminal claw and sometimes with pincher knobs, both varieties occurring in the same species. Four pairs of biramose swimming-legs, all rami two-jointed and armed with large plumose setæ.

Pandarus sinuatus Say.

PLATES 28, 29, AND 150 FIGURE 1.

Pandarus sinuatus Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 436. *On Mustelus canis of our coast*.

— Wilson, Proc. U. S. Nat. Mus., XXXIII, 1908, p. 417, Pls. 32-33. Off Avon, New Jersey (on *Mustelus*). Albatross Station 2237 N. Lat. 39° 12' 17" W. Long. 72° 9' 30" (from shark).

Description of female.—Carapace elliptical to ovate, broader behind, about two-fifths entire body length, without egg-strings. Posterior lobes short, mostly sharp and turned in at tips. Perfected hind edge with rounded median projection and three or four short broad sharp teeth each side. Projections usually

blunt, rounded, irregular, forming jagged sinuate edge. Frontal plates narrow, scarcely prominent, not covering more than half basal joints of first antennæ. Eyes not evident in adult, visible in young, placed one-third of space from front edge and close together. Second segment with paired dorsal plates broadly elliptical to oval, one-half longer than wide, well inclined from median axis, inner edges nearly straight to concave, widely separated, hardly touch second pair and extend back to center of lateral edges of third pair. Impaired median plate of second segment wide, short, with straight entire hind edge. Third segment with small dorsal plates, almost circular, separated by deep sinus, slightly enlarged at base. From wide separation of first plates second pair entirely visible as seen above. Fourth segment with dorsal plates well enlarged, broader than genital segment and covering front third or two-fifths, well fused with only wide and very shallow posterior sinus. Genital segment elliptical, one-fifth longer than wide, hind lobes broad, evenly rounded, with shallow median sinus. Sixth segment plate small, its edge forms four-fifths of circle, rest narrowed into an anterior stem or neck where joining genital segment. It projects behind lobes of genital segment for half or two-thirds its length. Anal laminae rather narrow, slender, long as sixth segment plate, acute at tips, and armed with two or three small spines irregularly on inner edge, wings entirely absent in adult. Ventral plate of abdomen much wider than sixth segment plate, its hind edge usually evenly rounded. First maxillipeds slender. Second maxillipeds much swollen, armed with pair of knobs acting like forceps, knobs oblong. Basal joints of swimming-legs increase in size from in front backward, all biramose with two-jointed rami, but joints of fourth pair thoroughly fused and jointing only indicated by marginal notches. Color in life said to be light yellowish-white, turning largely light straw-brown in alcohol. These latter sometimes show a large deep brown to dusky blotch on each side of carapace in front, followed by several others less distinct on outer lateral regions, and often another also paler on genital segment medianly above. Length 8 mm.

Male.—Carapace orbicular, wider than long, with lateral margin evenly rounded. Posterior lobes broadly triangular, curved

little inward toward median line. Supplementary lobes very short, at least three times wide as long and close to bases of posterior lobes. In preserved material these secondary lobes often turn white or whitish and become opaque. Lateral grooves bent sharply outward at anterior ends, nearly at right angles to lengthwise-axis and end just behind sucking-disks. Frontal plates nearly wide as carapace, project over bases of first antennæ, thus very prominent. Free thorax segments about same length, diminish greatly in width backwards. Second segment not entirely filling space between hind lobes of carapace, only slightly overlaps inner edges of secondary lobes, its lateral plates broad and enlarged at tip into spathulate form, hind edge nearly straight. Fourth segment one-fifth narrower than genital segment, lateral edges with narrow sharp curve at center. Genital segment elliptical, much longer than wide, with evenly rounded corners. Fifth legs small, blunt, slightly enlarged at tips, carried forward some distance in front of sixth pair. Latter little longer, situated at hind corners and usually curve inward toward median line. Inside each and close to its base on hind edge of genital segment a single large spine. Abdomen elongate, longer than wide, two joints of same length, basal spindle-shaped and terminal wedge-shaped with no protuberance between bases of anal laminæ. Latter nearly twice as long as wide, ends rounded diagonally, outer edge longer. Each armed with four setæ, inner removed some distance from others. First antennæ normal, basal joints almost wholly covered by projecting ends of frontal plates. First adhesion pads ovate, their longitudinal diameters well inclined to body axis, placed so near edge of carapace behind first antennæ that nearly half of pad projects beyond carapace, visible in dorsal view. Second pair just outside bases of second antennæ, elliptical, with long diameters parallel to body axis. Third pair egg-shaped, in usual position between first maxillipeds. Fourth pair elongate-elliptical, on lateral edges of second segment lobes, and parallel with body axis. First and second pairs much smaller than in female. Second antennæ larger than in female, two basal joints considerably swollen besides sharing in formation of adhesion

pad. Terminal claw large and stout, armed on outer edge with two large accessory spines, one near basal and other at center. First maxillipeds with stout basal joint and short slender terminal joint, with two accessory claws on inner edge close to base of terminal claw. Ventral of these two claws more than twice size of dorsal. Second maxillipeds much enlarged, relatively more so than in female, armed with stout well-developed terminal claw shutting down against group of three tuberculated knobs placed side by side on basal joint. Color as in female, except without pigment spots or blotches and body quite transparent. Length 7.23 mm.

Remarks.—The above description of the female is from material collected by Mr. Witmer Stone at Point Pleasant about twenty-five years ago. Twelve examples, all females, were secured at that time, and though the host is not given it very likely may have been some shark, such as *Mustelus canis*? The account of the male as given above is from Wilson's monograph. Wilson lists the following sharks as hosts for the species: *Carcharodon carcharias*, *Carcharias littoralis*, *Mustelus canis*, *Eulamia obscura*, *Lamna cornubica* and *Scoliodon terra-novæ*.

Genus PERISSOPUS Steenstrup and Lütken.

Perissopus Steenstrup and Lütken, Kon. Dansk. Vid. Sels., (5) V, 1860, p. 393.

Type *Perissopus dentatus* Steenstrup and Lütken, first species, designated by Wilson, Proc. U. S. Nat. Mus., XXXIII, 1908, p. 354.

Lepidopus (nec Gouan 1770) Dana, Proc. Amer. Acad. Art. Sci., 1843, p. 60.

Type *Lepidopus armatus*, Dana, monotypic.

Female.—Carapace wider than long, narrowed anteriorly, and short posterior lobes sometimes almost lacking. Frontal plates narrow, but distinct, with broad and well-defined median incision. Eyes three in number, placed nearly in a row, and middle one the smaller. Three free thorax segments, each with pair of dorsal plates, first pair lateral and oblique, second median and nearly horizontal, and third largest, extending entirely across body. Genital segment considerably larger than carapace, evenly rounded anteriorly, almost squarely truncated posteriorly, with short and acute spines at corners and a wide median incision.

Fifth legs some distance from margin on ventral surface. Abdomen small and entirely hidden in dorsal view. Anal laminae also small, with very short and nonplumose spines. Terminal joints of second maxillipeds enlarged and fleshy, reniform, with rough scaly surface. Legs all biramose, rami of third and fourth pairs minute and rudimentary. Egg-strings narrow and much longer than body.

Male.—Carapace, including posterior lobes, elliptical, slightly longer than wide, narrowed anteriorly, posterior lobes long and narrow, and posterior margin between lobes nearly straight. Eyes three in a row, median much smaller than others. Free thorax segments, about same length, diminishing regularly in width. Genital segment small, subquadrangular, with fifth legs very prominent at posterior corners. Abdomen large, one-jointed. Anal laminae large and armed with long plumose setae. Second antennae larger than in female, but with adhesion pad much reduced in size. Second maxillipeds with stout curved terminal claw shutting down against a pair of corrugated knobs as in *Pandarus*. Swimming-legs all biramose, rami of fourth pair indistinctly segmented, of other pairs two-jointed.

***Perissopus communis* R. Rathbun.**

PLATES 30 AND 31.

Perissopus communis R. Rathbun, Proc. U. S. Nat. Mus., X, 1887, p. 560, Pls. 29-30. *Vineyard Sound, Massachusetts; Noank, Connecticut; mouth of St. Mary's River and Pensacola, Florida.*

Perissopus communis var. *stimpson* R. Rathbun, l. c., p. 560. *Great Egg Harbor, New Jersey.*

Perissopus dentatus (nec Steenstrup and Lütken) Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 165. *Beesley's Point, New Jersey (on fin of shark).*

Description of female.—Carapace generally partly elliptical, scarcely narrowed in front, and greatest width slightly posterior in length. Lateral edges slightly convex or almost straight. Hind lobes short, angular. Hind edge of carapace straight or slightly concave, and sometimes small spine either side. Frontal plates narrow, distinct, with broad shallow median emargination. Eyes mostly invisible in adult, distinct in young, as three

placed transversely in a row, of which little smaller central one slightly posterior. Portion of dorsal plates visible on second thoracic segment inclined out at an angle of forty-five degrees to body axis, their contour elliptical, and longer diameter nearly twice that of shorter diameter. Outer edges of these plates truly extends forward to reniform pads of second maxillipeds, and when removed from body appear spindle-shaped, each end pointed, about twice as long as wide and joined nearly at center of inner margin, leaving both ends free. Wide space between bases of these plates and behind posterior edge of carapace left unprotected or with only small central plate. Dorsal plates of third thorax segment smaller than first pair, elliptical, nearly horizontal or only but slightly inclined, so their tips meet and often overlap in median line. Dorsal plates of third pair somewhat enlarged, extend across entire body width, circular, inner edges overlap on median line and their hind edges reach short space over genital segment. Hind edges of first and third pairs of plates scalloped, points ending in short sharp teeth. Edges of second pair of plates smooth. Genital segment about equals carapace in size, evenly rounded in front, lateral edges convex, and hind edge emarginated obliquely each side, forming broad, deep median sinus. Outer hind edge of genital segment ends in short, sharp spine each side. Between this and sinus posterior edge of body sigmoid in form. Abdomen small, plump, barrel-shaped, little longer than wide, one-jointed, and entirely concealed below genital segment. Anal laminæ short, triangular, with minute irregular spines.

First antennæ small, two-jointed, basal joint heavily, and terminal joint lightly, furnished with setæ. Basal joint also much wider than terminal and twice as long, its tip reaching well beyond edge of frontal plate. Second antennæ small, weak, terminal claw long as rest of appendage, slender and not very strongly curved. Sucking-pads of first pair ovate, and circular second pair much smaller at the base of second antennæ on ventral surface of carapace. Mouth tube and mandibles as usual. Second maxillæ lamellar, each tipped with long narrow spine. First maxillipeds of usual pattern, terminal claws rather stout, and outer considerably longer than

inner. Second maxillipeds swollen, fleshy, terminal joints enlarged as huge, kidney-shaped adhesion pad, without pinchers, knobs or claws. Swimming-legs biramose, each ramus of first two pairs distinctly two-jointed, of third pair partially, and of fourth pair almost entirely fused into single joint. Exopods each armed with stout spines, of similar number and arrangement, one at outer distal corner of proximal joint and four as row across end of distal joint. Endopods partly covered with minute papillæ or spines. Outside each exopod in three posterior pairs small rounded knob, like rudimentary third ramus, bearing on its summit long flexible spine. Basal joints of each pair of legs subrectangular, increasing greatly in size backward, and those of fourth pair about eight times larger than first. In first two pairs basal joints attached by anterior margins, in third pair by front interior corners, and in fourth pair by centers of interior margins, rami in each case borne on hind margins. In all exopods basal joint much larger than terminal. In endopods of first and second pairs terminal joint larger, and in third and fourth pairs reduced to mere knob on side of basal joint. Fifth legs formed of long papilla, broadly triangular at base and strongly flattened, attached to ventral surface of genital segment half way between lateral margin and median line, with three slender spines. External egg-sacs slender, of even calibre, and reaching length twice rest of body. Color when fresh in alcohol sandy-gray or whitish, without any pigment spots. In life said to be light yellowish-white. Length of body without egg-strings 6 mm., and total length sometimes 18 mm.

Remarks.—This species is known to me from New Jersey by the variety *stimpsoni* described by R. Rathbun, and Leidy's record of an example taken from the fin of a shark captured at Beesley's Point. I have every reason to believe that the shark in question is possibly an example in the collection of the Academy, and which I have identified as *Eulamia milberti*, though Leidy mentions that the host was not determined. Leidy says the cephalothorax is a little smaller than the abdominal segment, and between them are three pairs of dorsal lobes which completely cover the space. The egg-pouches are linear and 0.25

mm. thick. Length, 5 mm. In my description given above, I have largely followed the points given by Wilson in his exhaustive account of the species.¹ My examples, eight in number, were all taken from the caudal fin, belly and hind portion of the body of an example of *Eulamia milberti* secured at Corson's Inlet, September, 1910, by Dr. R. J. Phillips. These parasites were all females, and were found clinging tenaciously to their host, which after being placed in alcohol were easily removed. Where each one was attached a small swelling was noticed on the host.

Sub-Family CALIGINÆ.

Carapace broad, always flattened dorso-ventrally. Free thorax segment without plates or appendages of any sort except fourth pair of legs. Genital segment enlarged, but usually smaller than carapace, and seldom much larger. First and fourth thoracic legs uniramous, second and third biramous, fifth pair rudimentary, but often visible as pair of small papillæ at hind corners of genital segment. Adults active, most of females, as well as males, capable of swimming about freely.

Key to the genera.

a. Frontal plates without lunules; second maxillæ bifurcate or simple; genital segment simple, without plates or processes. LEPEOPHTHEIRUS

aa. Frontal plates with lunules; second maxillæ simple, spine-like; genital segment usually smaller, never much larger than carapace, and flattened.

CALIGUS

Genus LEPEOPHTHEIRUS Nordmann.

Lepeophtheirus Nordmann, Mikrog. Beitr., II, 1832, p. 30. Type *Lernæa pectoralis* Müller, monotypic.

Pupulina Van Beneden, Bull. Acad. Roy. Belg., (3) XXIV, 1892, p. 254. Type *Pupulina flores* Van Beneden, monotypic.

Carapace large, shield-shaped. Basal joints of first antennæ without sucking-disks characteristic of *Caligus*, and terminal joints free. Mandibles toothed only on inner margins. Second

¹ Proc. U. S. Nat. Mus., XXXIII, 1908, p. 354.

maxillæ small, bifurcate, branches acuminate. First and fourth thoracic legs uniramose, second and third biramose. Free thoracic segment simple, without dorsal plates. Genital segment also simple, without plates or processes. Abdomen one or two segmented. Young with frontal filament during chalimus stage, as in *Caligus*.

Lepeophtheirus edwardsi C. B. Wilson.

PLATE 32.

Lepeophtheirus edwardsi C. B. Wilson, Proc. U. S. Nat. Mus., XXVIII, 1905, p. 627, Pl. 21, Pl. 22, fig. 258, figs. 1, 4a, 4b, 11, 31, 34, 39 in text. *Great Egg Harbor, New Jersey. Wood's Holl, Mass.*

Description of female.—Carapace ovate, widest posteriorly, longer than wide. Frontal plates distinct, strongly curved, not quite half width of carapace. Posterior sinuses shallow, wide, well rounded. Median lobe three-eighths entire width, squarely truncated posteriorly, and projecting well back of lateral lobes. Latter short, blunt, straight. Free thoracic segment of medium length, about half wide as genital segment and contracted anteriorly where it joins carapace. Genital segment slightly obovate with gracefully rounded sides and angles, contracted to very short neck before joining abdomen. Latter one-fifth long as genital segment, wider than long, tapering posteriorly, and made up of single joint cut for one-third its length at anus. Anal papillæ small, wider than long, with short stout setæ. Egg-tubes nearly long as entire body and wide as abdomen, each with seventy-five to eighty eggs. Anterior antennæ of medium size, well armed with spines and setæ. Posterior antennæ rather slender and strongly curved. All other appendages either lamellate or furnished with lamellæ somewhere in their structure. Two pairs of maxillæ with wide wings either side of central spines. In second maxillæ though spines well separated and divergent, these wings nearly touch each other at center. First maxilliped with spatulate lamella instead of spine inserted in inner margin of terminal joint near its center. Second maxillipeds large, stout, with swollen basal joint furnished on pos-

terior ventral margin, where it joins body, with stout tongue-like lamella which projects downward at a right angle to ventral surface. Terminal claw three-quarters as long as basal joint, rather slender, with very long hair-like accessory spine on its inner margin. Furca large, base longer and narrower than branches, and both base and branches strongly flattened into fan-like lamellæ. Branches nearly twice wide as long, with radiating ridges and lines extending outward from thickened center. Median sinus triangular, branches so widened toward tip as to nearly meet. First swimming-legs with small spine on end of basal joint pointing outward, and much stouter blunt spine on posterior border of same joint pointing backward. Three claws on terminal joint about equal, with serrated lamellæ along their posterior margins. Second legs with wide rounded flange or wing along outer margin of exopod. Fourth legs stout and four-jointed, basal joint swollen and carries slender flexible hair on its outer margin near distal end. Short curved claw at tip of second joint and longer ones on third and fourth joints, flanged on one or both sides with serrate laminae. Fifth legs distinct and of medium size, plainly visible ventrally, but not so dorsally. Color delicate pinkish-yellow, with small pigmented spots of a purplish or reddish-brown distributed evenly over entire dorsal surface, so that color uniform throughout. Total length, 7.5 mm.

Male.—Carapace as in female, except relatively much larger, five-eighths of entire length. Free thoracic segment considerably shortened by overlapping of medium lobe of carapace. Genital segment and abdomen together form an almost perfect oval, widest end anterior, while it narrows rapidly posteriorly. Genital segment one-third length of carapace, considerably wider than long, squarely truncated posteriorly, furnished with two pairs of papillæ, as one on lateral margins one-third distance from posterior end and other pair at posterior corners. In both pairs papillæ sharply conical and with quite large plumose setæ. Testes very large, elongate-elliptical in shape, and fill nearly entire segment. Semen ducts open on posterior ventral surface, on either side of abdomen. Latter and anal papillæ similar to

those of female. The usual difference in appendages, but while second antennæ increased in size not branched as in most species. Instead, at bases two large corrugated ridges of chitin, inclined diagonally, outward from mid line, which serve to prevent slipping. Color as in female. Total length, 3.6 mm.

(C. B. Wilson.)

Remarks.—This species occurs upon the external surface and always upon the dorsal side of the following fishes: *Raja erinacea*, *Tylosurus marinus*, *Caranx hippos*, *Paralichthys dentatus* and *P. oblongus*. Wilson says: "When disturbed the males scuttle about over the surface in a lively manner, but the females ordinarily remain quiet. In the aquarium both sexes swim about freely, but the male is the more lively and usually lives longer. They can be kept more successfully than many other species and do not bother by crawling up out of the water. Females with eggs which are nearly ripe retain the egg strings even under rough treatment, and the nauplii may be reared successfully. The egg cases are separated rather more than usual at their origin in the genital segment. At first they approach each other rapidly until about their own diameter apart, and then extend backward parallel with each other. They are light colored even when well developed, so that it is difficult to judge of their maturity by their color. This is due to the paucity of pigment in the larvæ."

The species is only known from New Jersey by Wilson's record from Great Egg Harbor, his material not having the identity of the host.

Genus CALIGUS Müller.

Caligus Müller, Entomost. Insect. Dan. Norweg., 1785, p. 128. Type *Caligus curtus* Müller, first species.

Chalimus Burmeister, Nov. Act. Acad. Nat. Cur. Bonn., XVII, 1835, pp. 294, 330. Type *Chalimus scomberi* Burmeister, monotypic.

Carapace large, shield-shaped. Basal joints of first antennæ furnished with lunules. Two terminal joints of first antennæ free, heavily armed with setæ. Mandibles often toothed along both margins. Second maxillæ simple, spine-like. First and

fourth thoracic legs uniramous, second and third biramous. Fourth thoracic segment without dorsal plates. Genital segment simple, without plates or processes. Abdomen one to many segmented. Young of both sexes with frontal filament for attachment during chalimus stage. Anal lamellæ strongly flattened and armed with long plumose setæ.

Caligus tenuis (Leidy).

Chalimus tenuis Leidy, Proc. Acad. Nat. Sci. Phila., 1889, p. 95. *Beach Haven, New Jersey* (on young *Leptocephalus*).

Description.—Cephalothorax nearly twice length of breadth, obcordate and proportionately much narrower than in *Chalimus scomberi*. Frontal segment narrow, not prominent laterally, and biarticulate antennæ concealed beneath. Abdomen half length of cephalothorax, shows three conspicuous divisions, and short caudal appendages end in three minute setæ. Abdominal feet ending in biramous leaf-like segments fringed with short setæ. Rostrum linear and almost long as cephalothorax. Whole length 1.125 mm., of cephalothorax 0.5 mm. (Leidy.)

Remarks.—This species is only known from the above account, having been taken on a larval fish *Leptocephalus (Atopichthys)*, to the tail fin of which it was attached by means of a long filiform rostrum. In this respect it was thought to resemble *Chalimus scomberi* as figured by Baird, rather than by Burmeister.

Family ERGASILIDÆ.

Head of moderate size, rounded. Antennæ formed of five or more articulations. Mouth parts poorly developed. Body ovoid or pyriform in contour, and thorax sometimes much enlarged laterally. Feet very small, branched, not attached to a basal joint extending across under surface of thorax in form of broad plate, but basal joints detached from one another. Abdomen well developed. Parasitic.

Key to the genera.

- a. Body slender, long, ends in swollen head with two or three simple curved horn-shaped appendages. LERNEONEMA
- aa. Body broad, cyclops-like, with five distinct segments, of which first is large; head large, not beaked in front. ERGASILUS

Genus LERNEONEMA Milne-Edwards.

Lerneonema Milne-Edwards, Hist. Nat. Crust., III, 1840, p. 524. Type
Lerneonema lesueurii Milne-Edwards, first species.

Body long, slender, narrowed anteriorly in form of neck which ends by swollen head, furnished with two or three simple, curved, horn-shaped appendages. Abdominal portion of body of inconsiderable length, simple. Oviparous tubes long and slender.

Lerneonema procera Leidy.

Lerneonema procera Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 165.
Beesley's Point, New Jersey (on Carcharias littoralis).

Description.—Head horizontal, semi-oval, convex above, with three short blunt occipital tubercles, fore part convex, excavated beneath and closing mouth, antennæ and maxillipeds. Neck long, linear, cylindrical. Body short, fusiform, truncate behind. Tail longer than body, linear, cylindrical. Egg-strings long, linear and cylindrical. Color pale yellowish. Length 70 mm., including egg-strings 90 mm. (Leidy.)

Remarks.—Only known from the above account. Leidy's examples, apparently lost, were found attached to the mouth of *Carcharias littoralis*, taken at Beesley's Point many years ago, and still in the Academy. These lerneans were found hanging from the upper lip on each side of the mouth, and were in turn themselves thickly parasitized by a hydroid, *Eucope parasitica*.

Genus Ergasilus Nordmann.

Ergasilus Nordmann, Mikrog. Beitr., II, 1832, p. 7. Type *Ergasilus sieboldii* Nordmann, first species, suggested by Wilson, Proc. U. S. Nat. Mus., XXXIX, 1911, p. 338.

Body shaped much as in *Cyclops*. Cephalothorax elongated, with five distinct segments, first large. Anterior antennæ short, six-jointed, setaceous. Antennules in female large, long, three or four-jointed, ending in strong claw. Mouth opening in center of very large head, which not beaked in front, placed some distance behind antennules. Mouth-parts inconspicuous, maxilliped stout, ending in a long claw. Four anterior pairs of feet biramous, setiferous and each ramus three-jointed. Outer ramus of fourth foot two-jointed. Fifth pair of feet absent or rudimentary. Abdomen three to five-jointed, stylets rather short. Ovisacs two, large.

The animals of this group are more or less like *Cyclops* in appearance, and at least during part of their existence parasitic. They are represented by fresh-water as well as marine species, many of them living in the gill-cavities of fishes.

***Ergasilus labracis* Kröyer.**

PLATE 33.

Ergasilus labracis Kröyer, Naturh. Tidssk., (3) II, 1863, p. 303, Pl. II, fig. 2-a-c. Baltimore, Maryland (on *Roccus lineatus*).

— Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 166. Philadelphia market (on *Roccus lineatus*).

— Wilson, Proc. U. S. Nat. Mus., XXXIX, 1911, p. 329, Pl. 42. Washington, D. C. Franklin, Va. Wood's Holl, Mass.

Ergasilus labracis S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 573 (note).

Ergasilus labracis Leidy, l. c., p. 125. Philadelphia market (on *Roccus lineatus*).

Description of female.—Form elongate, slender. First antennæ rather short, four or five times shorter than anterior, broad, six-articulate, setiferous. Posterior antennæ slender, four-articulate. Branches of swimming-feet triarticulate. Caudal appendages equally long, ending in two short segments, each trisetose with inner spine much longest. (Kröyer.)

Remarks.—Leidy first records this from Philadelphia. He found it attached to the gills of the striped bass (*Roccus lineatus*). "The little crustacean lives suspended on the outer surfaces of the gills, where it is conspicuous, from the white color of its

thorax and egg-pouches on the red color of the gills. The length of the parasite, together with its egg-pouches is 2.125 mm.; without the latter, 1.25 mm." (Leidy, l. c.)

Family CYCLOPIDÆ.

Body elongated. Cephalothorax ovate and usually sharply separated from abdomen, which much more slender. Anterior antennæ of moderate length, scarcely ever longer than cephalothorax, and those of male alike on both sides and adapted for clasping. Posterior antennæ four-jointed and destitute of secondary branch. Palps of mandibles and maxillæ well developed, or sometimes rudimentary. Foot-jaws nearly similar to those of *Calanidæ*, but usually less strongly developed. First four pairs of feet alike or nearly so, two-branched and adapted for swimming, never in any case for prehension. Fifth pair rudimentary, alike in both sexes. Heart wanting. Eye consisting of two coalescent lenses. Two ovisacs in female.

A large and homogeneous group of copepods, including mostly marine genera. The fresh-water forms are perhaps the most familiar, and among the most abundant of all micro-crustacea. The great similarity, changes with age, conditions, etc., render these creatures among the most difficult among the crustacea in which to distinguish species.

Genus CYCLOPS Müller.

Cyclops Müller, Zoöl. Dan. Prodröm., 1776, p. 200. Type *Monoculus quadricornis* Linnæus, eighth and last species.

Macrocyclops Claus, Anz. Ak. Wiss. Wien, Nr. IX, 1893, p. 82. Type *Monoculus quadricornis* var. *fuscus* Jurine, first species.

Microcyclops Claus, l. c. Type *Cyclops diaphanus* G. O. Sars, first species.

Eucyclops Claus, l. c. Type *Cyclops serrulatus* Fischer, first species.

Paracyclops Claus, l. c., p. 83. Type *Cyclops affinis* G. O. Sars, first species.

Homocyclops E. B. Forbes, Bull. Ill. State Lab. N. Hist., V, 1897, p. 49. Type *Cyclops ater* Herrick, monotypic.

Orthocyclops E. B. Forbes, l. c., p. 51. Type *Cyclops modestus* Herrick, monotypic.

Body expanded in front, attenuated behind, in male composed of ten and in female of nine segments. Head anchylosed with

first thoracic segment. Both anterior antennæ in male forming powerful hinged clasping organs, shorter than cephalothorax. Posterior antennæ unbranched, four-jointed. Mandible dilated and toothed at extremity. Palp reduced to small tubercle which bears two branchial filaments. Maxillary palp obsolete. Maxillæ themselves conical and bearing several strong curved apical teeth and marginal setæ. First pair of foot-jaws slender, armed with several long marginal spines and setæ, four-jointed. Second pair much more robust, somewhat like first pair in *Calanidæ* third joint forming broad laminar process armed on margin with powerful claws, and smaller apical joint bearing in like manner two slender claws and setæ. First four pairs of swimming-feet two-branched, both branches three-jointed. Fifth pair rudimentary, composed of not more than three joints. One eye. Two ovisacs.

Species numerous, and very difficult to identify. This is due to their extreme variability and plastic nature. Though numerous nominal species have been described, but fifteen are admitted by C. D. Marsh in his account of the North American species in 1909. Some of the forms have very wide distribution, ranging over most of North America, Europe and Asia, without exhibiting any differences in structure. Only one species included here as identified positively from New Jersey, though doubtless most of those in Marsh's work will be found eventually.

Cyclops serrulatus Fischer.

PLATE 34.

Cyclops serrulatus Fischer, Bull. Soc. Imp. Nat. Moscow, XXIV, 1851, p. 423, Pl. 10, figs. 22, 23, 26-31. *Sergiefskoje, near St. Petersburg, Russia.*
(Not consulted.)

—— Byrnes, Cold Spring Harbor Monogr., VII, 1909, p. 27, Pl. 12. Cold Spring Harbor, Long Island.

—— C. D. Marsh, Trans. Wisconsin Acad. Sci. Art. Let., XVI, pt. 2, No. 3, 1909, p. 1094, Pl. 88, figs. 5-9, Pl. 89, figs. 4-8. Cosmopolitan.

?*Cyclops setosa* Haldeman, Journ. Acad. Nat. Sci. Phila., VIII, 1842, p. 331. *Spring near Marietta, Pa.*

Cyclops serrulatus var. *elegans* Marsh, Proc. U. S. Nat. Mus., XLII, 1912, p. 245. Sodus Bay, Long Island.

Description.—Cephalothorax rather evenly ellipsoid, broadest nearly at middle, segments most all closely joined with smooth

lateral contours, and fourth segment rather well emarginated posteriorly. Abdomen broad anteriorly, first segment becomes narrow behind, and remaining segments of nearly equal narrow width. Stylets usually nearly straight, sometimes well diverging, and their width one-third to one-fourth their length. Outer edge of each stylet in female with a series of curved hooks or spinules, extends from insertion of outer seta to base. Outer and inner setæ shortest, similar. Median pair of setæ long, and inner usually twice length of outer, sometimes equals half length of entire animal. All setæ more or less plumose, especially distally.

Antennæ twelve-segmented, last three usually long and slender, and reach back to third or fourth segments. Antennal bristles usually moderate. Swimming-feet with spines as three, four, four, three. Fifth foot one-segmented, plate-like, very strong serrate spine on inner side, at tip very long, slender seta parallel to spine, and delicate little seta projects outward on outer side.

Egg-sacs usually long, with many or a few eggs in a spherical mass or sometimes taper to sharp point below, and often stand out from abdomen at wide angle.

Color often very dark or dusky, with violet and purple tints in many cases. Length 1.47 mm.

Remarks.—A common and abundant species most everywhere, and largely cosmopolitan in distribution. I have found it near Florence and Trenton during the summer of 1912. It is quite variable.

Tribe PODOPLEA.

Mouth furnished with organs developed for mastication, as foot-jaws. Branchiæ few, attached to mouth-organs. Body divided into several very distinct rings, and with an envelope inclosing head and thorax, in form of buckler. Five pairs of feet, mostly adapted for swimming. Articulations more or less cylindrical and serve animal for purpose of locomotion. One eye. Two pairs of antennæ, of which one pair used as organs of motion. Ovary external. Free-swimming.

Family CALANIDÆ.

Cephalosome well defined or coalescent with first pedigerous segment, front carrying below two soft posteriorly curving tentacular filaments. Last pedigerous segment not confluent with preceding one, and its lateral corners but slightly produced. Urosome not very slender, in female of four and in male of five segments, caudal rami comparatively short, with normal number of setæ. Eye simple, very small, sub-ventral. Anterior antennæ in female long, slender, of twenty-five articulations, supplied anteriorly with comparatively short and uniform bristles. Penultimate and antepenultimate articulations each have behind an unusually strong and densely plumose seta extending straight backwards. Anterior antennæ in male thickened at base, with some of proximal articulations fused together and supplied below with restricted number of comparatively short sensory appendages. Posterior antennæ with rami of about equal length. Oral parts normal, but slightly transformed in male. Legs with both rami triarticulate, terminal joint of outer ramus with only two spines outside. Fifth pair of legs in female of similar structure to preceding pairs, in male more or less transformed, left leg the stronger.

Two genera in northern seas.

Genus CALANUS Leach.

Calanus Leach, Dict. Sci. Nat., XIV, 1819, p. 539. Type *Cyclops finmarchicus* Müller, monotypic.

Cetochilus Vanzème, Ann. Sci. Nat., (2) I, 1834, p. 333. Type *Cetochilus australis* Vanzème, monotypic.

Body comparatively slender, with anterior division, oblong subcylindric in form, and more than twice as long as posterior. Cephalosome generally well defined from first pedigerous segment, slightly carinated dorsally in male, frontal part obtuse, and more or less projects between insertions of anterior antennæ. Lateral corners of last pedigerous segment generally rounded off. Urosome symmetrical with genital segment in female comparatively short and but slightly protuberant below. Caudal

rami well defined from anal segment, and in male movably articulated to it, admitting of being spread outwards, second caudal seta (from within) longer than others. Anterior antennæ generally longer than body, much more strongly built in male than in female, with first two articulations fused together into a broad, somewhat flat segment. Posterior antennæ with outer ramus seven-articulate. Posterior maxillipeds with terminal part larger than either of basal joints and five-articulate, setæ of outer edge in male remarkably developed and densely spinous. Legs comparatively slender, inner ramus well developed, though considerably shorter than outer, its second joint (except in last pair) with two natatory setæ inside. Last pair of legs with first basal joint denticulate along inner edge, but without plumose setæ present in other pairs. Outer ramus in male without any natatory setæ and more strongly developed in left side, though imperfectly prehensile. Inner ramus in both legs well developed, resembling that in female.

Several species in most seas.

Calanus finmarchicus (Gunner).

PLATE 35.

Monoculus finmarchicus Gunner, K. Danske Vidensk. Selskab. Skdiifter, Kjöbenhavn, X, 1765, p. 175, figs. 20-23. *Scandinavia*. (Not consulted.)
Calanus finmarchicus Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 164. Vineyard Sound.

— Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 406. Off Delaware Bay.

?*Daphnia dorsalis* Rafinesque, Amer. Month. Mag. Crit. Rev., II, November, 1817, p. 42. *In the sea and on the shores of Long Island, etc.*

Description of female.—Body as viewed above elongately ovoid, greatest width about one-third of length, also about midway in length, frontal region only slightly produced. First segment long, about equal to succeeding three, and posterior ones (two) much shorter. Lateral edges of last pedigerous segment a little produced, with rounded end. Urosome about half length of metasome, and caudal rami but slightly longer than anal segment. Anterior antennæ reach about opposite end of trunk, and æsthe-

tasks not duplicated on any of joints. Distal edge of second basal joint of second to fourth pairs of feet with pointed process. First basal of fifth pair of legs with concave inner border denticulated. Color mostly transparent, with scarcely any reddish tinge in life, though after preservation in formaline several dark bodies appeared. Length 2.7 to 4.5 mm.

Male.—Body more sharply defined behind than in female, so that at dorsal end a slightly gibbous projection. Cephalosome distinctly carinated above, and frontal part somewhat more prominent. Lateral corners of last pedigerous segment less produced than in female. Head, as in female, separate from first thoracic segment. Anterior antennæ straight, with first and second joints fused. Mouth-parts as in female. Urosome rather narrow, second segment largest. Outer rami of last pair of legs not very dissimilar, though left one a little longer than right, and obpyriform terminal joint nearly long as preceding joint. Corresponding inner branch of last pair of legs reaches beyond middle of second joint of outer. Color mostly transparent with several dark bodies, as of pigment, like in female. No red tints. Length 2.3 to 3.6 mm.

Remarks.—On June 21st, 1911, this species was taken in great abundance in surface towings in Great Egg Harbor Bay off Ocean City, by Mr. W. B. Davis and the writer. We found quantities of the megalops of various common crabs, together with the fry of *Menidia menidia notata* and *Syngnathus fuscus*, and various medusæ, associated. It was also very abundant in Great Bay, in Ocean County, on July 1st to 3d, 1912, when we secured myriads in surface towings. Inland, as far as the salt water extended, we found them in countless numbers, even in the quiet little estuaries. In such places many were eagerly devoured by the abundant young silversides (*Menidia menidia notata*). The above description and the accompanying figures were made from examples obtained in Great Bay. Mr. F. J. Keeley has also obtained it in abundance in surface towings off Longport.

The coloration of this species is given by most writers as often more or less tinged with light red, and the antennæ are often

bright red. It also reaches a rather large size, as Sars says Arctic specimens attain 5 mm. in length. He further adds, "of all the marine Calanoids of Norway this form is by far the most common, often occurring in enormous shoals, and thus sometimes giving the sea a conspicuously reddish hue. It is found everywhere in the open sea, more frequently at the very surface, though at times it may also descend to greater depths, or be carried by the waves and currents towards the shores or into the bays and fjords. * * * It moves rapidly, with abrupt bounds caused by energetic strokes of the natatory legs. At times, however, it is seen quietly suspended in the water, with the anterior antennæ spread out to each side at right angles to the body, or proceeding slowly by rapid vibrations of the posterior antennæ and the mandibular palps. The male is still more agile than the female, and the motion effected by the posterior antennæ and mandibular palps is more energetic, in accordance with the somewhat stronger development of these appendages and the pertaining muscles, being changed to a somewhat jerky leap through the water. At some seasons male specimens are by no means rare, though the female sex always preponderates considerably in number. This Calanoid is eagerly devoured by some of our common food-fishes, for instance the herring and the mackerel and in some cases, as stated by Prof. Rob. Collett, forms almost the exclusive nourishment of one of our great whales, *Balænoptera borealis*."¹

Wheeler records it in Vineyard Sound near Gay Head, Martha's Vineyard, on July 10th, 1899, but does not mention it south of that region from the Gulf Stream.² Except possibly for Sharpe's account, then, the present is the first record of its occurrence in New Jersey, or so far to the south. It differs from *Calanus minor* Claus in the shorter furcal bristles, and *Calanus princeps* Brady in the shorter second antennæ.

¹ Crust. Norway, IV, 1903, pp. 10-11.

² Bull. U. S. F. Com., XIX, 1899 (1901), p. 165, fig. 1.

Sub-Order BRANCHUIRA.

Body flattened, consists of shield-shaped cephalothorax in which first thoracic segment is fused with head, a free thorax of three segments, and a two-lobed abdomen without segments. Four pairs of swimming-feet, long and furnished with two rows of plumose setæ. Two large compound eyes, movable and surrounded by a blood sinus. Testes in abdomen. Heart present. Females without ovisacs. Eggs attached to foreign objects. Ectoparasitic.

These include the highest type of parasitic copepods, attaching themselves to their hosts or leaving them at will.

Family ARGULIDÆ.

Characters expressed above.

A single genus in our region.

Genus ARGULUS Müller.

Argulus Müller, Entomostr. Dan. Norweg., 1785, p. 121. Type *Argulus charon* Müller, first species.

Ozolus Latreille, Hist. Nat. Crust., IV, 1802, p. 128. Type *Ozolus gasterostei* Latreille, monotypic.

A sheathed stylet or sting in front of mouth, used for a piercing organ. Anterior maxillipeds transformed into sucking-disks. Posterior maxillipeds armed with setæ, spines and chitinous plate on basal joint. This plate elevated above surrounding surface and roughened by spines or warts, and prolonged into three sharp spines in its hind border. Two pairs of antennæ, anterior armed with stout sickle-shaped hooks and function as organs of prehension. Basal joints of posterior swimming-legs usually prolonged into lobes projecting beneath abdomen.

Key to the species.

a. Carapace elliptical, longer than wide; general color yellowish and not variegated much or with brilliant tints.

b. No dark pigment spots on dorsal face of thorax. *alosa*

bb. Three rows of dark or dusky pigment spots on dorsal face of thorax. *trilineata*

- aa. Carapace orbicular, wider than long; color variegated and brilliant; in males carapace lobes just reach base of abdomen, anterior swimming-legs with flagella, and abdomen broadly triangular; in females carapace lobes not reaching abdomen, anterior swimming-legs with full-sized flagella, and oval abdomen medium. *versicolor*

Argulus alosæ Gould.

PLATE 36.

Herring Louse.

- Argulus alosæ* Gould, Rep. Invert. Mass., 1841, p. 340, fig. (On gills of "alewife *Alosa vulgaris*") *Massachusetts*.
 — R. Rathbun, Proc. U. S. Nat. Mus., 1884, p. 485. Great Egg Harbor, New Jersey.
 — Wilson, Proc. U. S. Nat. Mus., 1903, p. 707, Pl. 12, Pl. 26, fig. 80. Great Egg Harbor, New Jersey. Patchogue, Long Island.

Description.—Carapace elliptical, longer than wide. Antero-lateral sinus shallow, often becomes deep and sharp on shrinking in alcohol, so that cephalic area protrudes in sort of semi-circle. Posterior sinus rather narrow, about one-third length of carapace, three times long as wide, and lobes well rounded. Sucking-disks large, about one-fifth width of carapace. Posterior maxillipeds medium, with triangular basal plate armed with three short blunt teeth and strongly papillated. Antennæ small and armed with rather weak spines and hooks. Body projects considerably beyond carapace, with thoracic segments long and wide, and posterior one projects over abdomen as well-rounded lobe on either side with shallow sinus between. Abdomen broad and long, more than one-third length of rest of body, with well-rounded lateral margins. Anal sinus broad, triangular, cut to center, leaving two lobes sharply pointed and flaring slightly at their tips, papillæ small and basal. Swimming-legs long, projecting far beyond carapace, and lobes on basal joints of posterior pair small and rectangular. Abdomen in male very much longer, but no modifications of legs except regular peg and semen vesicle. No flagella. Color yellowish-white, mottled along carapace lobes with brown. Some measure 12 by 6 mm.

(C. B. Wilson.)

Remarks.—Found rather abundantly parasitic on the alewife *Pomolobus pseudoharengus*, and also said to occur on *Osmerus eperlanus* and *Gasterosteus aculeatus*. In New Jersey limits it has as yet been found only by Rathbun and Wilson, whose material was obtained at Great Egg Harbor from unknown hosts.

Argulus trilineatus Wilson.

PLATE 37.

Goldfish Louse.

Argulus trilineatus Wilson, Proc. U. S. Nat. Mus., XXVII, 1904, p. 651, figs. 34-38. Macon, Georgia (on *Carassius auratus*).

Description.—Carapace elliptical, extending well beyond abdominal base. Posterior sinus not quite equal to half length of carapace, and a little over twice as long as wide. Antero-lateral sinuses hardly evident. Horseshoe suture long, rather attenuated. First thoracic segment quite short, and all increase in length posteriorly till last is several times larger, and thus most of free thorax nearly all exposed. Abdomen spindle-shaped, small, its length one-fourth rest of body and at center its width about two-thirds its own length. Anal sinus excised to center of abdomen, narrowly uniform, and papillæ small, basal. Both antennæ rather weak, small, and rather well furnished with hooks and spines. Anterior and lateral hooks on basal joint of first antennæ slender, and spine on hind border large. End of first antennæ slender, not extending beyond lateral hook. Basal joint of second antennæ equals, though much thicker than two terminal joints, and latter attached obliquely to one of its distal corners, thus two portions of antennæ stand nearly at right angles to each other. Basal joint with stout spine on its hind edge, where joining head, and two long ventral slender spines at distal end. Second joint with single long spine on front edge at distal edge, while terminal joint with five or six large stout spines. Spines along either side of median line of body opposite bases of antennæ, those on hind edge of basal joints of antennæ and lateral hooks on first antennæ yellow, and all others colorless and transparent. Eyes small,

lunate, mostly inclined to central axis, well forward and widely separated. Sucking-disks small, well anterior, widely separated. Posterior maxillipeds large, well armed. Basal joint of posterior maxillipeds with an oval papillose area, oblique, elevated and covered with short conic spines. Three teeth on hind edge of this joint, stout, acute and long. Second joint with larger papillose area on distal end. Third and fourth joints enlarged at distal ends, and whole surfaces below covered with spines and papillæ. Terminal joint ends in two curved claws and a fleshy thumb. Swimming-legs all reach well out beyond edge of carapace, and two anterior pairs with recurved flagella. Distal joints of all four pairs with a row of plumose setæ along posterior edge. Lobes on basal joints of last pair small and well rounded. Tactile papillæ at opening of oviduct broad and rather well fused with ventral surface of abdomen. Ventral surface of anterior portion of carapace covered with numerous triangular and rather large spines.

Color uniform or pale yellowish, slightly deeper along median axis of body, paler about edges. Dorsal surface of thorax with three or four well-defined rows of dark or dusky pigment-spots, strongly contrasted against the yellowish color of the body generally. Length 6 mm.

Remarks.—A number of examples were secured June 1st, 1912, by Mr. W. T. Innes, Jr. They were found attached to the fins of gold fish (*Carassius auratus*) in captivity in Philadelphia. They were removed from the living fish simply by scraping with a small instrument. Among fish fanciers, and those interested in raising gold fish, these parasites are often very annoying. Sometimes they are very difficult to exterminate, and "lousy fish" are never desired by the aquarist. So far as I know it has not yet been found in a wild state in New Jersey, but is often brought into towns and different localities by those interested in aquaria. Some fish fanciers claim that the *Argulus*, evidently this species, also attaches itself to tadpoles (*Rana catesbeiana*) when in captivity.

Argulus versicolor Wilson.

PLATE 38

Pike Louse.

Argulus versicolor Wilson, Proc. U. S. Nat. Mus., XXV, 1903, p. 716, Pl. 20, Pl. 26, fig. 83. *Powdermill Pond, Warren; Wickaboag and Podunk Ponds at Brookfield; Lake Lashaway between Brookfield and Spencer; Ashley Ponds at Holyoke; Congamon Ponds at Southwick, all in Massachusetts (on Esox reticulatus).*

Description.—Carapace orbicular, long as wide. Antero-lateral sinus shallow or very slight. Posterior sinus rather narrow, its length a little less than one-third length of carapace, and its width about half its own length. Unlike any other species, the larger chitin ring in the carapace lobes extends forward opposite base of posterior maxillipeds, concave on its inner surface at the anterior end, so that into this concavity the other much smaller ring fits, and thus the front of the carapace is clear. Sucking-disks of moderate or medium size, placed near front edge of carapace symmetrically distant about equal to diameter of either. Posterior maxillipeds well armed, medium in size, and somewhat wedge-shaped basal plate with long blunt teeth. Large antennæ long, furnished with very long sharp spines and powerful hooks, those at base of second antennæ with complement of other smaller ones. Proboscis long and wide, and narrow sting very sharp. Body projects but little beyond the carapace, with the thoracic segments small and the posterior not projecting over the abdomen. Latter ovate, its length about two-sevenths entire length of body, a trifle longer than wide. Very narrow anal sinus slit-like, only extending for about last sixth in length of abdomen. Abdominal papillæ subterminal. Swimming-legs extend far out beyond edge of carapace and thus very long. Lobes of last pair of swimming-legs of moderate size, boot-shaped and just reaching edge of abdomen. Flagella present and thickest papillæ at oviduct opening of good size. In male second legs with large conical projection on their hind surfaces at outer end of basal joint. A similar and much smaller one in relative position on third legs. These legs also with

rounded knob on front surface of second joint at end next to body, and regular lobes on basal joints of last legs longer and more slender than in female, also separated from joint itself at heel as well as at toe.

The colors are quite striking and I cannot do better than to quote from Wilson, whose account quite agrees with my example: "This is a very clean-looking *Argulus*, and by far the most beautiful of any American species. It is a veritable Joseph among its brethren in the colors of its coat. The chitin framework and the spines on the ventral surface are a clear orange, the longitudinal ribs of the carapace having the orange bordered by yellow-green. The digestive tube is a deep wine red anteriorly, fading into yellow-green in the abdomen. The testes and semen receptacles are a still deeper red, almost purple. The ground color of the body is a yellow-green, this color forming a wide border around the edge of the carapace and extending inward diagonally as a wide band on either side from the edge just behind the sucking disks to the base of the posterior sinus. From the center of these diagonal bands another narrower band of the same color extends backward parallel with the edge of the carapace to near the posterior border of the lobes. At about their center these last bands are joined with the border along the edge by radial bands. In addition to these bands there are areas of the same color just outside the sucking disks and a large one in either lobe opposite the base of the first swimming legs. The rest of the surface is filled in with orange-yellow of various shades, the posterior part of the lobes being tinged with brown, while over the side branches of the stomach it takes more or less of a reddish hue from the stomach contents. As may well be imagined, the whole presents a beautiful variegated appearance, whence the name given to the species. But the most wonderful thing about these beautiful colors is their permanency. They are "fast" colors in the fullest sense of the word, for they defy any preservative so far tried. Chrome-acetic and corrosive-acetic, Perenyi's and platinum chloride have no effect upon them, and after preservation in these solutions they have been kept in alcohol for over

a year with so little change of color that they can hardly be distinguished from fresh specimens, save for their greater opacity." Length 6 mm.

Remarks.—This species occurs occasionally on *Esox reticulatus*, the common pickerel of New Jersey waters. I have no New Jersey specimens, however, but include the species for the above reason. My description, given above, is drawn up^o from an example I secured May 10th, 1912, which dropped, or was rubbed off of a roach, *Abramis crysoleucas*, which I angled in the Pocomoke River near Willards, in Maryland. This host was of the usual size, about six inches long, and infested with numerous parasitic protozoa. The species has not been secured, so far as I can find, on any other host than *Esox reticulatus*, prior to this time. Dr. Wilson observes "they have not been looked for in a single pond where they have not been found, and in all probability they infest this fish more or less throughout its habitat." The variegated and brilliant coloration will distinguish this species from all the others of the genus.

Wilson states that by actual experiment they have been found capable of living on red-fin shiners, breams, etc., for a long time. He says the parasites were placed directly upon the red fins. They attached themselves at once, seeming to prefer the neighborhood of the dorsal and ventral fins, and, so far as watched, made no attempt to crawl under the opercle. They did not seem to irritate the fish perceptibly, although they could be plainly seen to crowd forward under the scales to pierce the skin. They were kept in this way more than two months. Remaining thus upon the external surface where they could be easily watched, it was seen that the individual parasites changed about considerably from one fish to another. One of the red fins proved particularly attractive, and often had nearly all the parasites (fifteen in number) on his body. He was no larger than some of the others, but very plump and vigorous. Although the red fins were fiercely hungry when obtained, having been kept without food since they were caught in the fall, no one of them took any notice of the Arguli, which were placed free in the aquarium for that purpose. Finally one of the parasites fairly rubbed

against a red fin's nose in swimming about, and the latter, unable to resist such a call, opened his mouth and apparently swallowed the Argulus. But it was only apparently, for in a moment or two the Argulus was forcibly ejected uninjured, and no further attempt was ever made to swallow one.

Wilson further states that while the parasite is only known from the pickerel (*Esox reticulatus*), it may likely be found upon other fish at the breeding-season. According to him, not more than two or three specimens are found upon a single fish, and these always in the gill-cavity. Often it is necessary to examine fifteen to twenty fish before finding a single parasite, so that they could be easily overlooked, and a good summer catch of fish may not reveal their presence. For this reason winter is the best time to secure them upon fish caught through the ice, and as they remain alive for some time after the fish is dead, an entire day's catch can be looked over. In this manner as many as thirty have been obtained in a single afternoon from three adjacent ponds. Thus far they have not been sought in a single locality without success. When kept in aquaria they are lively, moving about and changing from one fish to another more often than other species. The long plumose setæ upon the swimming-legs make powerful oars, and enable them to dart about with great rapidity. One of their favorite movements is to leave the side of the aquarium and, turning back downward, scuttle swiftly along the under side of the surface film of the water after the manner of the very much slower aquatic snails.

Order CIRRIPIEDIA.

The Barnacles.

Size often considerable. Body imperfectly segmented. Either fixed or parasitic during adult life. Sexes united and sperms motile.

Though the barnacles include many genera and species but few have been recorded from New Jersey. Likely many will be added with future collections. In drawing up the present account I have followed the descriptions given by Darwin in his celebrated

monograph. These have only been modified to allow comprehension in variation, etc. The keys are mostly made up from those given by Dr. Henry A. Pilsbry in his studies of this interesting group.

Sub-Order EUCIRRIPEDIA.

Cirripedia with carapace, consisting either of capitulum on peduncle or an operculated shell with basis. Body formed of six thoracic segments, generally furnished with six pairs of cirri. Abdomen rudimentary, often with caudal appendages. Mouth with labrum not capable of independent movements. Larva firstly unioocular with three pairs of legs, lastly binocular with six pairs of thoracic legs.

This group comprises three families. These are the sessile forms or *Balanidæ*, the off-shore *Verrucidæ* of our waters, and the *Lepadidæ* or stalked forms.

The other forms, which undergo extreme degeneration are grouped under another sub-order, the *Rhizocephala*.

Key to the families.

- | | |
|---|----------|
| <i>a.</i> Body with stalk, and more or less flexible. | LEPADIDÆ |
| <i>aa.</i> Body sessile, without stalk. | BALANIDÆ |

Family LEPADIDÆ.

The Goose Barnacles.

Body stalked, or with peduncle, flexible, and furnished with muscles. Scuta with abductor muscle only, and other valves, when present, not united into an immovable ring.

These animals are distributed over the whole world, most of them being found attached to floating objects or other animals capable of changing their position. The others live attached to fixed organic or inorganic bodies.

Key to the sub-families.

- a. Valves none to five; when present umbones of scutum and carina median or above middle. ALEPADINÆ
- aa. Valves three to five; umbones of scutum at or near rostral angle; carina with two ends unlike, umbo basal or below middle. LEPADINÆ

Sub-Family ALEPADINÆ.

Plates vary from five, much reduced, to none. When present umbones of scutum and carina are median or above middle.

Genus CONCHODERMA Olfers.

Conchoderma Olfers, Ges. Naturf. Fr. Berlin, VIII, 1818, p. 177. Type *Lepas virgata* Spengler, first species.

Otion Leach, Journ. Phys. Chim. H. Nat. Paris, LXXXV, 1817, p. 67. Type *Otion blainvillii* Leach, first species.

Nude cirripedes. Peduncle long. Capitulum generally striped or maculate, with two to five small vestigial widely separated plates. Scutum at base of orifice two or three-lobed, with umbo near middle in occludent border. Carina narrow, arched, with two ends nearly alike, umbo near middle, sometimes wanting. Terga small, or in adults, sometimes wanting. Lateral filaments numerous. Mandibles with five finely pectinated teeth. Maxillæ with distinct steps. Caudal appendages none. Cirri with spines arranged comb-like.

These barnacles are found attached to ship bottoms, sea turtles, buoys and whales' "bonnets." Two species are known, nearly distributed world-wide.

Conchoderma virgata (Spengler).

PLATE 39.

Lepas virgata Spengler, Skrift. Naturh. Selskabet., I, pt. 1, 1790, p. 207, Pl. 6, fig. 9. *Locality not given.*

Conchoderma virgata Darwin, Monogr. Cirrip., 1851, p. 146, Pl. 3, fig. 2, Pl. 9, fig. 4. World-wide.

— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 580. All the seas.

- Leidy, Proc. Acad. Nat. Sci. Phila., 1890, p. 281. Beach Haven, New Jersey (on *Pennella filosa*, itself on *Mola mola*).
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 85. On bottom of vessels and on large sluggish fishes (New England).
- Conchoderma virgatum* Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 99, Pl. 9, fig. 1. Albatross Station 2713 (on *Neptunus sayi*).

Description.—Capitulum flattened, gradually blends into peduncle, summit square, rarely obtusely pointed. Membrane thin. Valves thin, small, variable, always remote and imbedded in membrane. Scuta trilobed, formed of an upper and lower lobe (latter usually widest) joined into straight flat disc, with third lobe projecting out from middle of outer edge and usually bending slightly inward. Form of lateral lobes variable from rounded oblong to equilateral triangle. Terga shape very variable, at nearly right angles to scuta. Upper ends of terga imbedded in membrane, projecting freely like little horns about one-third their length. Free projecting portion generally curled inwards and carinal portion more or less outwards. Whole valve generally of nearly equal width, carinal part very little wider. Valve deeply concave internally, with both points generally blunt and rounded. Terga generally about two-thirds length of scuta, rarely only half, and usually separated from apices of scuta by about once their own length, rarely by twice. Terga usually shorter than carina, sometimes very little longer, and distant by third or fourth their own length from apex of carina, rarely by their entire length. Carina lie nearly parallel to scuta, concave within, very slightly bowed, of nearly same width throughout, but with lower third beneath umbo generally slightly wider than upper part. Carina length varies, usually longer than scuta or terga. Upper and lower points of carina rounded, rarely both ends acuminate.

Peduncle flattened, gradually widens as it joins capitulum, to which, generally about equal or a little longer in length. Filamentary appendages six each side, one below basal articulation of first cirrus longest and placed on hind edge of a swelling. Second filamentary appendage little lower in side of prosoma, short and thick. Third on hind edge of pedicel of first cirrus above basal articulation, and fourth, fifth and sixth in similar

positions on pedicels of third, fourth and fifth cirri. These three latter filaments shorter and smaller than first three. At base of second cirrus, which has no proper filament, a swelling. Mandibles with basal edges of five teeth pectinated by minute short, strong spines in one side, lower angle extremely short. Sometimes minute pectinated tooth between first and second, again second tooth bifid on summit, or still others with fourth rudimentary. Maxillæ with five steps, sometimes each step begins with spine rather larger than others, and at upper angle two large unequal non-pectinated spines, with longer thinner third placed a little below. Outer maxillæ simple. Cirri with twice as many segments in sixth cirrus as in first. Spines in first and second cirri doubly serrated.

Color of capitulum and peduncle gray, tinged blue, and six black bands, tinged purplish-brown. Two bands near carina become confluent on peduncles and sometimes disappear. Carina edged, and interspace between two scuta, colored same dark tint. Whole body and pedicels of cirri dark lead-color, with segments of cirri almost black. Ova white, turning pinkish and then yellow in spirits. Dark bands on capitulum and peduncle become purple or fade, when gray tint disappears. Length of capitulum one inch, and width three-fourths. (Darwin.)

Remarks.—World-wide in the sea, and very common on the bottoms of ships. It is found attached to sea weeds, large sea turtles, large fishes and parasitic copepods on the same, besides other objects. Besides occurring alone, it is often found associated, according to Darwin, with *Conchoderma aurita*, *Lepas anatifera*, *Lepas hillii* and *Lepas anserifera*.

Known from New Jersey by Leidy's record. He secured a bunch of seven from a single lernean (*Pennella filosa*) found on a large sunfish (*Mola mola*) at Beach Haven. His examples were mostly two inches long. Pilsbry records an example from between Nantucket and Cape Charles on *Neptunus sayi*. I have already noted an example on *Pennella filosa*, itself taken on *Mola mola* (see p. 90). Specimens are in the Academy, labeled New York Harbor.

Sub-Family LEPADINÆ.

Valves three to five. Carina with two ends unlike, umbo basal or below middle. Umbo of scutum at or near rostral angle. Caudal appendages one-jointed. Peduncle wide.

Genus LEPAS Linnæus.

Lepas Linnæus, Syst. Nat., Ed. 10, 1758, p. 667. Type *Lepas anatifera* Linnæus, fifth species, designated by Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 79.

Anatifarius Dumeril, Zoöl. Analyt., 1806, p. (170) 331. Atypic. (Type *Lepas anatifera* Linnæus.)

Valves five, approximate, fully calcified. Carina extending up between terga, ending below in an embedded fork or external disk. Scuta subtriangular, umbones at rostral angle. Caudal appendages unarticulate, smooth. One or more lateral filaments at bases of first cirri.

Found in all seas attached to floating objects.

Key to the species.

- a. Carina ending below in flat oblong external disk, umbo angularly projecting; valves thin, papery. *fascicularis*
- aa. Carina ending below in fork, umbo basal; valves well calcified.
 - b. Valves smooth or very minutely striate radially. *anatifera*
 - bb. Valves radially furrowed or strongly striate.
 - c. Occludent margin of scutum arched, protuberant. *anserifera*
 - cc. Occludent margin close to ridge from umbo to apex. *pectinata*

Lepas fascicularis Ellis and Solander.

PLATES 40, 44, FIGURE 2, AND PLATE 150, FIGURE 10.

Lepas fascicularis Ellis and Solander, Zoöphytes, 1786, p. 197, Pl. 15, fig. 6. *St. George's Channel*.

—— Darwin, Monogr. Cirriped., 1851, p. 92, Pl. 1, fig. 6. World-wide.

—— Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 431. Beach Haven, New Jersey (feeding on *Cyclops*).

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 85. On floating seaweed and other small objects (Maine and Massachusetts).

Lepas fasciculatus Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 81. Pl. 9, fig. 6. Albatross Station 2532, N. Lat. 40° 34' W. Long. 66° 48'.

Description.—Capitulum very variable, one-fifth longer or less than width. Valves generally approximate, excessively thin, brittle, transparent, colorless, smooth. Scuta with lower part of tergo-carinal edge extremely protuberant. Occludent edge more or less but slightly reflexed, with depressed line extending from umbo to apex, basal edge variably much reflexed, at variable angle, or even to a right angle, thus forming an external rim or collar. No distinct internal teeth, but basal edge under umbones more or less distinctly produced into rounded disc or projection, generally not so much outwardly reflexed as rest of basal edge, and no distinct internal basal rim. Primordial valves usually visible, not lying close to basal edge, but a little above. Terga flat, occludent edge slightly arched, not formed of two sides, apex bent towards carina, and width of lower half very variable. Widest part of tergum from two-thirds to equal width of broadest part of carina below its umbo. Carina very variable, part above umbo either spear-shaped and slightly concave within, or nearly flat with central external ridge. Upper part of carina very and equally narrow, deeply concave within, appears as if only central ridge developed. Part below umbo about one-third whole valve length, generally twice, or even thrice, width of upper part. Disc, or lower part, usually slightly concave within, exteriorly with or without central ridge, basal edge rounded and lateral edge more or less curved according to form of upper part. Disc not more deeply imbedded in membrane than upper part of valve. Heel or umbo either angular and prominent, or rounded. Very young with carina simply bowed instead of bent rectangularly.

Peduncle short, narrow, abruptly inflected all round under basal edges of capitulum, lower part of very variable shape and often suddenly contracted into mere thread which sometimes widens again at extreme end. External membrane very thin, penetrated by usual fine tubuli leading to corium, and wrinkled surface with few or no spines. Peduncle often completely surrounded by yellowish ball, sometimes half width of capitulum, formed of very tender vesicular structureless membrane and of pulpy substance. Filamentary appendages five each side, four in pairs at base

of first cirrus and one on flanks of prosoma. Mouth with palps accuminated. Mandibles with five teeth, first not far remote from second, and inferior point rather broad and finely pectinated. Maxillæ with two large unequal upper spines and four regular steps. Posterior cirri with upper parts of segments slightly protuberant. Young with spines of five pairs in two converging lines in upper half of each segment, with numerous minute lateral marginal and intermediate little bristles. Large examples with all latter so increased that normal five pair indistinguishable, and front of each segment covered by triangular thick brush of bristles, all pointing in same direction. Dorsal tuft on each segment of six or seven large spines with one to three dozen fine ones. First cirrus and anterior ramus of second cirrus with broad brushes and bristles. Pedicels of all cirri thickly covered with bristles. Caudal appendages smooth, with rounded summits.

Color in alcohol with front surfaces of segments of cirri and of pedicels purple. Sometimes parts of sack and interspaces between two scuta fine purple. Shell and body said to be pale blue, and cirri spotted with brown, when fresh. Length of capitulum, 1.6 inches; breadth, 1.2. (Darwin.)

Remarks.—Recorded from Beach Haven by Leidy, in 1888, who found it feeding on *Cyclops*. I have examined examples from Cape May and Atlantic City, the latter obtained by the late John Ford. Mr. Witmer Stone obtained it at Point Pleasant.

Widely distributed in most seas. Darwin says it occurs attached to fuci, *Spirulæ*, *Janthinæ*, *Verellas*, and often to feathers and cork. He also says it is often associated with the young of *Lepas anserifera* (var. *dilatata*), and *Lepas pectinata*. The yellowish ball, noted above in the description, is said to serve as a buoy to float the animals.

Lepas anatifera Linnæus.

PLATES 41, 42 AND 44, FIGURES 7, 9, 10.

Lepas anatifera Linnæus, Syst. Nat., Ed. 10, 1758, p. 668. "*In Pelago.*"

— Darwin, Monogr. Cirrip., 1851, p. 73, Pl. 1, fig. 1 (var.). Mundane.
(Atlantic Ocean.)

- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 580. Warmer Atlantic (eastern United States).
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 84. Gulf Stream off Martha's Vineyard.
- Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 79, Pl. 9, figs. 3-5. Off New Jersey (Albatross Station 2039; also Long Island Sound).
- Anatifa laevis* De Kay. N. Y. Fauna, Moll., V. 1843, p. 255. Bottoms of vessels and driftwood (New York).
- Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 151. Atlantic City and Beesley's Point, New Jersey.

Description.—Valves white, more or less translucent and thick, tinged bluish-gray from underlying corium, or sometimes brownish cream-colored, rarely tinged purple. Surfaces of valves smooth, traces of very fine lines radiating from umbones, sometimes rather plain on basal part of scuta. Scuta with occludent edge considerably curved or straight. Internal tooth of right scutum close to umbo varies, either pointed, square or obliquely truncated on either side, or with notch on summit. Internal basal rim of scuta either plainly developed or nearly absent. Often on scuta, or on scuta and terga, nearly straight line diagonally across capitulum of slight quadrilateral depressions, dirty greenish with edges blending away, and either conspicuous or obsolete. These marks increase in size from umbones to margins of valves. Sometimes two or even three rows on scuta. Margins of valves sometimes slightly notched on line of marks. Interspace between carina and scuta and terga, not wide. Carina convex and smooth, or with knobs or extremely long sharp teeth, exteriorly. Small examples under half an inch generally most strongly barbed. Apex more or less acuminate, width and thickness variable, sides strongly furrowed. Forks generally less wide than broadest upper part of valve, two prongs diverge from each other at less than right angle, their sharpness and precise form variable, and rim between them reflexed to form slight notch behind.

Peduncle smooth, wrinkled, length varies in proportion to that of capitulum, from barely equal to six times as long. Filamentary appendages never more than two each side, sometimes only one, length variable. One placed on flank of prosoma under first cirrus, and second close under basal articulation of this cirrus on hind face of slight swelling. Mandibles with usual fine teeth, all

point down. Maxillæ with lower step of variable width. Posterior cirri with segments bearing six pairs of spines, intermediate fine spines rather long. First cirrus with anterior ramus longer, by only two segments, than posterior ramus. Second cirrus with anterior ramus, with very broad transverse rows of bristles. Spine-bearing surfaces considerably protuberant and caudal prominences smooth, rounded.

Color of valves noted above. Edges of orifice bright scarlet-orange. Basal edges of scuta, sometimes of all valves, with torn border of orange membrane. Interspaces between valves dull orange-brown. Peduncle dark purplish-brown, lower part sometimes pale. Chitine membrane itself tinted orange. Young with peduncle pale. Sack internally dark purplish lead-color, sometimes tinged with orange, darkest under growing edges of valves. Body of animal pale purplish lead-color. Four posterior cirri blackish-purple. Second and often third cirrus sometimes tinged orange. Very young with cirri only barred with purple. Ova and contents of ovarian tubes, azure blue, yellow in alcohol. Capitulum $\frac{2}{3}$ inches, and total length with peduncle, 16 inches. (Darwin.)

Remarks.—World-wide, and said to be extremely common, attached to vessels, seaweed, bottles, floating timber, etc., and to each other. Leidy records it from Atlantic City and Beesley's Point. My examples from Cape May Point.

Lepas anserifera Linnæus.

PLATES 39 AND 44, FIGURES 1 AND 3.

Lepas anserifera Linnæus, Syst. Nat., Ed. 12, I, 1767, p. 1109. "*In Pelago Americano.*"

— Darwin, Monogr. Cirriped., 1851, p. 81, Pl. 1, fig. 4. World-wide.

— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 580. Warmer Atlantic.

— Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 80. Asbury Park, New Jersey. Smith's Island and Cherrystone, Virginia; Albatross Station 2104, N. Lat. $38^{\circ} 48'$, W. Long. $72^{\circ} 40' 30''$; Albatross Station 2221, N. Lat. $39^{\circ} 5' 30''$, W. Long. $70^{\circ} 44' 30''$; Albatross Station 2584, N. Lat. $39^{\circ} 5' 30''$, W. Long. $72^{\circ} 23' 20''$; Albatross Station 2711, N. Lat. $38^{\circ} 59'$, W. Long. $70^{\circ} 7'$; Albatross Station 2712, N. Lat. $38^{\circ} 20'$, W. Long. $70^{\circ} 5' 30''$; Albatross Station 2713, N. Lat. 38° , W. Long. 70° ; Albatross

Station 2714, N. Lat. $38^{\circ} 22'$, W. Long. $70^{\circ} 17' 30''$; Albatross Station 2715, N. Lat. $38^{\circ} 29' 30''$, W. Long. $70^{\circ} 54' 30''$.

Anatifa anserifera De Kay, N. Y. Fauna, Moll., V, 1843, p. 254, Pl. 34, fig. 315. New York harbor (on ships' bottoms).

Description.—Capitulum more or less elongated relatively to breadth. Valves white, thick, closely approximated and surfaces variably furrowed. Terga generally more plainly furrowed than scuta, of which basal portion generally less furrowed than upper part. Ridges often rough, generally much narrower than furrows, variable, sometimes alternately wide and narrow, range from eighteen to thirty-two. Scuta with occludent edge rounded, variably protuberant, always leaving rather wide space between edge and ridge running from umbo to pointed apex. Right-hand internal tooth considerably larger than left, which often reduced to mere ridge. Internal basal rim thick, sometimes furrowed along upper edge, thickness variable, sometimes not extending far as basal carinal angle. Terga two-thirds to equal to scuta length. Young with two occludent edges forming right angle with each other. Older examples have form less than right angle, and thus portion of valve so bounded unusually protuberant. Carina deeply concave within, exterior sides finely furrowed longitudinally, generally denticulated. Valve only slightly narrowed in above fork, of which prongs wider than widest part of valve. Rim between prongs reflexed, and heel or external angle just above fork sometimes considerably prominent.

Peduncle generally about long as capitulum, generally short in young. Filamentary appendages five usually, sometimes six, on each side. One placed on side of prosoma and four others in pairs below basal articulation of first cirrus. Lowest posterior filament of four generally largest. Young with upper pair of four, often not developed or represented by mere knobs. Cirri with longer ramus of first pair almost equal to shorter arms of second pair, and spine-bearing surfaces only slightly protuberant. Caudal appendages smooth, curved, pointed.

White valves edged with bright orange membrane, and so close together that no interspaces left, colored from underlying corium. Peduncle dark orange-brown, uppermost part

under capitulum bright orange all around. Sack internally dark purplish lead-color. Body and cirri nearly white or pale purplish lead-color, with arms of second, third and fourth cirri, and pedicels of fifth and sixth, more or less tinted orange. Fresh ova peach-blossom red, immature ova, in ovarian tubes, pale pink. Capitulum one and one-half inches. (Darwin.)

Remarks.—Common on ships' bottoms from tropical seas, and distributed world-wide. Also often attached to fuci, pumice, Janthinæ, Spirulæ, etc. It is often associated with *Lepas anatifera* and *Lepas hillii*, and in a young state with *Lepas fascicularis*, according to Darwin. It has been found at Asbury Park, according to Pilsbry.

Lepas pectinata Spengler.

PLATES 43 AND 44, FIGURES 4, 5, 6, 8.

Lepas pectinata Spengler, Skrift. Naturhist. Selskabet., II, 1793, p. 106, Pl. 10, fig. 2. *Mediterranean Sea near Cadiz* (on curly *Fucus*).

—— Darwin, Monogr. Cirriped., 1851, p. 85, Pl. 1, fig. 3. Atlantic Ocean.

—— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 579. Warmer Atlantic (on bottoms of ships).

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 84. Attached to ships' bottoms, but probably does not live long after arriving on our coast.

Anatifa dentata De Kay, N. Y. Fauna, Moll., V, 1843, p. 255, Pl. 34, fig. 317. Harbor of New York (on bottoms of vessels).

—— Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 151. Atlantic City and Beesley's Point, New Jersey.

Description.—Capitulum variable in length compared with breadth, chiefly due to greater or less production of occludent portion of terga. Valves thin, brittle, variable furrowed surface narrow and broad ridges often alternating. Frequently each ridge, especially one extending from umbo to apex of each scutum, sometimes that alone, covered with prominent curled flat calcareous spines, or these sometimes absent. From thinness of valves and depths of furrows, edges of valves sinuous. Ridge extending from umbo to apex of scuta unusually prominent and curved, runs very close to occludent edge, so that only very narrow space left between this edge and ridge. Internal

teeth under umbones either sharp and prominent or mere knobs, sometimes that of right side much larger than left, again equal, or sometimes left scarcely distinguishable. Internal basal rim absent, barely developed. Valves of terga with conspicuous notch to receive apex of scuta, two occludent edges either meet each other at rectangle or at much smaller angle, causing portion thus bounded to vary much in outline, area and degree of prominence. Carina broad, deeply concave within, edges sinuous and sometimes strongly barbed externally, narrow above wide fork, which latter wider than widest upper part of valve. Prongs sharp, thin, and rim connecting prongs not, or only slightly, reflexed.

Peduncle narrow, shorter than capitulum. Filamentary appendages more or only one, short, obtuse projection on each side, on posterior face of swelling under first cirrus. Mandibles with inferior point produced into single pectinated tooth, rarely into two pectinated teeth. Palpi very narrow. Maxillæ very variable, formed of five steps, of which two lower generally united as one, divided by mere trace of notch. Sometimes three lower steps blended into irregular projecting surface with even fourth step indistinct. First pair of cirri rather far removed from second pair, with longer ramus about three-fourths length of shorter ramus of second cirrus. Spine-bearing surfaces hardly at all protuberant. Lateral marginal spines on posterior cirri rather long. Caudal appendages smooth, rounded, extremely minute.

Color in alcohol with sack and cirri, especially first cirrus, clouded with pale purple. Peduncle brownish. Valves bluish in fresh examples. Capitulum six-tenths of an inch long. (Darwin.)

Remarks.—Distributed in the Atlantic Ocean, attached to various floating objects, as wood, cork, charcoal, seaweed, spirulæ, bottoms of vessels, bottles, etc. It is sometimes found associated with *Lepas anatifera* and often with *Lepas fascicularis*. Leidy found it at Atlantic City and Beesley's Point.

Family BALANIDÆ.*The Acorn Barnacles.*

No peduncle or stalk developed. Scuta and terga furnished with depressor muscles. Other valves united immovably together.

Sub-Family BALANINÆ.*The Acorn Barnacles.*

Shell with rostrum having radii, but without alæ. Lateral compartments all with alæ on one side and radii on the other side. Parietes generally either porose or longitudinally ribbed on inner surfaces. Mouth with labrum notched in middle, not swollen. Palpi large, almost touch each other. Mandibles generally with lower teeth laterally double. Third pair of cirri with segments resembling those of second pair.

Section BALANÆ.

Scutum and tergum articulated together, or overlapping each other. Each branchia composed of a single plicated fold. Genera seven.

Key to the genera.

- a.* Compartments six; basis calcareous or membranous; opercular valves sub-triangular. BALANUS
aa. Compartments six, extremely thick, but one of them, rostrum, composed internally of three rudimentary compartments united together; basis membranous; scuta narrow, united to terga by horny articular ridge.

CHELONOBIA

Genus BALANUS Da Costa.

The Acorn Barnacles.

Balanus Da Costa, Hist. Nat. Testac. Britan., 1778, p. 249. Type *Balanus porcatus* Costa (= *Lepas balanus* Linnæus), second species.

Balanus Dumeril, Zoöl. Analyt., 1806, p. (170) 333. Atypic. (Type *Lepas balanus* Linnæus.)

Messula Leach, Zoöl. Journ., II (VI), 1825, p. 210. Atypic.

Chirona (Gray) Lyell, Philosophi. Trans. Roy. Soc. London, pt. I, 1835, p. 37. Type *Lepas tulipa* Müller, monotypic.

Compartments six. Basis calcareous or membranous. Opercular valves sub-triangular. World-wide in warmer seas.

Key to the species.

- a. Basis membranous. *balanoides*
 aa. Basis and radii not permeated by pores; parietes permeated by pores. *crenatus*
 aaa. Radii not permeated by pores; parietes and basis permeated by pores. *eburneus*

Balanus balanoides (Linnæus).

PLATES 45 AND 150, FIGURE 11.

Rock Barnacles.

Lepas balanoides Linnæus, Faun. Svecica, Ed. 2, 1761, p. 515. Atlantic seas.

Balanus balanoides Darwin, Monogr. Cirrip., 1854, p. 267, Pl. 7, fig. 2a-2d. Delaware.

— Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 151. Atlantic City and Beesley's Point, New Jersey.

— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 579. Whole North Atlantic.

— R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 828. Our coast (Eastern U. S.).

Description.—Shell in medium and old examples almost invariably folded lengthwise and irregularly, dirty-white or pale-brown, punctured from outer lamina being corroded. Young with surface usually white and smooth. Shell sometimes much depressed, generally conical, but when crowded together cylindrical or club-shaped. Isolated examples occasionally become cylindrical.

Orifice of shell in elongated examples usually deeply toothed. Radii always narrow, sometimes extremely so, and summits smooth and rounded. Opercular valves like those in next species. Scuta thicker and tips less reflexed, articular ridge

rather less prominent and no distinct adductor ridge. Terga often rather narrow, occasionally moderately deep longitudinal furrow, and spur often rather long and pointed. Internally articular ridge prominent and crests for tergal depressor muscles well developed or almost absent. Parietes quite solid or often permeated by minute pores, or small irregular square tubes, which only run up each successive zone of growth for very short distances, giving shell cancellated structure, from which corrosion often externally visible. Lengthwise septa, when present, not denticulated at bases. Internal surface of parietes quite smooth or traversed by very slight anastomosing ridges, but never by regular lengthwise ribs. Carinal margin of each compartment on inside projects inwards beyond general surface of shell, and running downward rests on basal membrane. Lower edge of sheath rarely hollow. Walls lined by purplish or pale brown, sometimes by almost black corium. Numerous tubuli penetrate under sides of walls and opercular valves and intersection of these tubuli give punctured appearance to often corroded surface of shell. Radii usually very narrow, upper and outer edges as seen externally very oblique, rounded and smooth. Sutural edges either quite smooth or sometimes just perceptibly pitted, like basal margin of walls, or occasionally with globular or arborescent little ridges. Alæ very oblique, though sometimes only slightly so, and sutural edges either smooth or obscurely crenated. Basis membranous, minute in pointed specimens.

Mouth having labrum with teeth each side of central notch unusually variable, from two each side, four each side, five one side and four on other, five one side and none on other, and six both sides. Mandibles with fourth and fifth teeth small or rudimentary. Maxillæ with scarcely even trace of notch under upper pair of spines. First pair of cirri with one ramus one-third or one-fourth longer than other, segments nine and sixteen in two rami. Second and third cirri short, nearly equal in length, with ten and eleven segments. Sixth cirrus with twenty-five segments, each about broad as long, supporting six pairs of spines. Length 2.5 inches. (Darwin.)

Remarks.—Widely distributed in the north Atlantic Ocean. Very common. It lives attached to rocks, shells and wood.

within tidal limits. Darwin says it occurs attached, often continuously coating many square feet of the surface, to rocks, pebbles, wooden piers, littoral shells and ulnæ. The most northern point from which he received material was N. Lat. $66^{\circ} 34'$, in North America, and the most southern point was Delaware Bay in Lat. 39° . Leidy records it from Atlantic City and Beesley's Point. Mr. Witmer Stone found it at Point Pleasant. My specimens from Ocean City.

Balanus crenatus Bruguière.

PLATE 46.

- Balanus crenatus* Bruguière. Encyclop. Method. (des Vers), I, 1789 (1792), p. 168. *English Coasts and North Sea*.
 — Darwin, Monogr. Cirrip., 1854, p. 261, Pl. 6, fig. 6a-6g. United States.
 — S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 579. Vineyard Sound to the West Indies.

Description.—White, usually of dirty tint, from yellowish or brownish persistent epidermis. Shell conical, generally with parietes rugged and irregularly folded longitudinally, sometimes much depressed and extremely smooth, often cylindrical and very rugged, occasionally club-shaped with upper part much wider than lower, and latter sometimes with extremely narrow parietes like mere ribs, also with wide radii.

Orifice in cylindrical varieties often most deeply toothed. Radii generally narrow, with jagged oblique summits, sometimes so narrow as to form mere linear borders to compartments. Orifice rhomboidal, passing into oval, very deeply or but slightly toothed. Scuta with lines of growth but little prominent, surface generally covered by disintegrating membrane. Upper ends usually little reflexed, so that tips project freely as small flattened points. Articular ridge internally highly prominent and somewhat reflexed, no adductor ridge, very distinct impression for adductor muscle and depression for lateral depressor muscle small but variable. Terga rather small, short spur placed at rather less its own width from basi-scutal angle, and basal edge slopes little towards spur, of which lower end rounded or variably bluntly

pointed. No longitudinal furrow, hardly even a depression. Internally articular ridge very prominent in upper part, and variable crest for tergal depressors well developed. Internal carinal edge of each compartment from sheath to basis usually projects little inwards beyond general internal surface of shell. Basal edge of projecting margin rests on calcareous basis and crenated like basal edges of longitudinal parietal septa. Whole internal surface of shell ribbed, but ribs not very prominent. Parietal tubes large, crossed in upper part and often low down by thin transverse septa. Longitudinal parietal septa only slightly denticulated at bases, and occasionally dividing at basis close to outer lamina of parietes, making some short outer subordinate pores. In circular furrow below lower edge of sheath sometimes little ridges dividing into small cells, though sometimes this furrow filled up by irregular knobs of calcareous matter. Radii always rather narrow, often form mere linear ribbons of nearly uniform width along edges of compartments. Summits or edges always more or less irregular and jagged. Their septa fine, barely or not at all denticulated. Alæ with oblique summits, sutural edges rather thick and distinctly crenated. Basis flat, calcareous, very thin, surface slightly marked by radiating furrows corresponding to radiating pores in bases of most species.

Labrum of mouth with six teeth. Mandibles with fourth tooth minute or rudimentary, and fifth generally confluent with inferior angle. Maxillæ usually with small notch under upper pair of great spines. First pair of cirri with rami very unequal in length, one ramus nearly twice length of other. Segments in two rami of first cirrus ten to twenty-three, or eight to thirteen. Second cirrus with only two or three more segments than shorter ramus of first pair. Third cirrus with one or two more segments than second though decidedly longer. On dorsal surfaces of both segments of pedicel of third cirrus tuft of fine spines. Segments of these three pairs of cirri not much protuberant in front. Segments of posterior cirri have each four, or five, or six pairs of spines. Basal diameter three-quarters of an inch, 1.6 inches in distorted individual. (Darwin.)

Remarks.—A species of very wide distribution. Very common, and usually attached to shells and crustacea in deep water, sometimes on ships' bottoms. It does not, apparently, attach to rocks uncovered by the tide, though is found on floating timber, sticks, fuci and occasionally on pebbles at the bottom of the sea.

Specimens were obtained at Cape May by Mr. C. LeR. Wheeler.

It is also known in a fossil state from Canada and Europe.

Balanus eburneus Gould.

PLATES 47 AND 150, FIGURE 12.

Ivory Barnacle.

Balanus eburneus Gould, Nat. Hist. Mass., VII, 1841, p. 15 (floating wood, crustacea, shells, etc.). *Massachusetts*.

— Darwin, Monogr. Cirrip., 1854, p. 248, Pl. 5, figs. 4a-4d. United States, from about lat. 42° to Charlestown.

— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 579. Massachusetts Bay to West Indies.

— R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 828. Massachusetts Bay to West Indies.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 81. Long Island Sound. From Salem, Massachusetts, southward.

Description.—Shell conical or almost tubular, white, surface very smooth, covered by thin yellowish epidermis but radii naked.

Orifice large, rhomboidal to pentagonal, moderately toothed. Scutum plainly striated longitudinally, teeth on occludent edge small, internally upper surface roughened. Articular ridge prominent and slightly or not at all reflexed, pit for adductor muscle distinct, and adductor ridge variably prominent, almost confluent with articular ridge. Tergum with basal margin on carinal side of spur sometimes deeply or slightly hollowed out, though rarely at all. When much hollowed valve almost two-pronged and carinal prong narrower than spur. No distinct longitudinal furrow on tergum, but whole scutal edge projects above general surface of valve. In carinal edge, in upper part, a remarkable convexity or protuberance in same

plane with valve, from which separated by very slight narrow ridge. Spur about one-fourth of valve, lower end abruptly truncated. Internally upper surface much roughened with finely crenated ridges, and distinct crests for depressors cover whole of so-called carinal prong. Compartments have radii and alæ with oblique summits, sometimes a little rounded, but not smooth. Septa on sutural edges of radii remarkably fine, closely approximate, and denticuli excessively minute. Sutural edges of alæ most delicately crenated. Alæ largely added to during diametric growth of shell, and above level of opercular membrane. Parietal pores square, rather large, crossed by transverse septa almost close down to basis, and longitudinal septa with tolerably large denticuli at bases. Pores in basis crossed by numerous transverse septa. Basis sometimes irregularly cup-formed in group-growing examples.

Mouth with serrated labrum, teeth small and decrease in size downwards on each side of central notch. Mandibles with third tooth rather thick, blunt, and fourth and fifth knob-like. Maxillæ with inferior part projecting much beyond rest of edge, bears two long single spines, between which and large upper pair in full-sized example about seven pairs of moderately long spines, feathered on their sides. Outer maxillæ thickly clothed with very fine spines and remarkably prominent. First cirrus with one ramus with twenty-six segments, longer by ten segments than shorter ramus, and both rami of second pair with segments remarkably protuberant in front. Protuberance in upper segments equals length of supporting part of each segment, and rami of second cirri unequal in length by five segments. Third cirrus with segments only slightly protuberant, rami considerably longer than those of second cirrus, and no tuft of fine hairs at dorsal base of pedicel. Sixth pair with upper segments elongated, bearing six to seven pairs of spines, and dorsal spines short, thin, few. Average full size about one-inch in basal diameter.

(Darwin.)

Remarks.—Known from the United States from about N. Lat. 42° south to Charleston, the West Indies, Venezuela and Honduras. It lives attached to floating wood, shells, bottoms

of ships, etc., and also occurs in brackish water. It is found associated on ships' bottoms with *Balanus tintinnabulum*, *B. amphitrite* and *B. improvisus*, according to Darwin.

It has been obtained at Seaside Park, Beesley's Point, Sea Isle City and five miles below Port Republic, in New Jersey. I obtained it on floating logs near Ocean View, Virginia. Mr. Witmer Stone found it at Point Pleasant.

Genus CHELONOBIA Leach.

The Turtle Barnacles.

Chelonibia Leach, Journ. Phys. Chim. H. Nat. Paris, LXXXV, 1817, p. 67.

Atypic. (Type *Lepas testudinaria* Linnæus.)

Chelonobia, auct.

Astrolepas (Klein) Gray, Ann. Philos. (n. s.), X, 1825, p. 105. Type *Lepas testudinaria* Linnæus, first species.

Compartments extremely thick, six. But one of them, the rostrum, internally composed of three rudimentary compartments, united together. Basis membranous. Scuta narrow, united to terga by horny articular ridge.

Distributed world-wide in tropical and warm temperate seas. Found attached to smooth gastropod molluscs, crustacea, and sea turtles.

***Chelonobia testudinaria* (Linnæus).**

PLATE 48.

Turtle Barnacle.

Lepas testudinaria Linnæus, Syst. Nat., Ed. 10, 1758, p. 668. *In Pelago* (saepe in Testudinibus).

Chelonobia testudinaria Darwin, Monogr. Cirrip., 1854, p. 392, Pl. 14, figs. 1a-1d, fig. 5, Pl. 15, fig. 1. (Mediterranean, Atlantic Ocean, Pacific Ocean.)

Description.—Shell strong, globulo-conical, outline broadly oval, surface smooth when well preserved but when disintegrated upper part finely striated. Color dead white. Orifice oval elongated, rather exceeding in length one-third of longer

basal diameter of shell. Radii rather narrow, deeply depressed, their summits square and outer lamina on both sides of each suture usually divided into teeth, points of which face and touch each other. These teeth give quite peculiar appearance to shell, sometimes blunt and partially obliterated. Occasionally all six radii perfectly smooth. Radiating parietal septa and descending sheath thick, their basal edges plainly seen by naked eye to be dentated with numerous points. Thickness of these plates and sheath varies considerably. Descending sheath not generally perforated, except at sutures by loop-holes for entrance of ribbons of corium. Sheath and inner lamina of parietes together fully equal one-third entire thickness of walls. Flattened cavities or tubes run up between parietal septa about two-thirds height of inside of shell. Thickness of inner portion of radii varies considerably to generally notched outer lamina. Scutum with occludent edge always sinuous, though variable. Terga vary, according to more or less truncated basi-carinal corner. External furrow, marking position of rudimentary spur, varies in distinctness, chiefly depending upon its nearness to carinal edge of valve. Labrum of mouth sometimes has its teeth worn away. Second pair of cirri relatively shorter and thicker to others. Length 0.55 inches, basal diameter 2.3 inches. (Darwin.)

Remarks.—I have examined several examples from Point Pleasant, secured by Mr. Witmer Stone. This species occurs on our large sea turtles. Doubtless a large loggerhead (*Caretta caretta*) taken in Delaware Bay near Green Creek several years ago and found more or less covered with rounded plate-like and other barnacles, belonged largely to this species. Mr. H. W. Hand, who gives this information, says the turtle was easily captured. After removing the barnacles and giving a coat of copper paint over the carapace, the liberated turtle swam away with apparent relief.

The species does not appear to have ever been recorded from New Jersey previously. It is known from the Mediterranean, west Africa, northeast coast of Australia, the low Archipelago and the Pacific Ocean. It is found attached to large sea-turtles.

Section CORONULÆ.

Scutum and tergum (when both present) not overlapping each other, or articulated together. Basis membranous. Parietes often deeply folded, with outer lamina, towards basis, generally imperfect. Each branchia composed of two plicated folds. Shells attached to living vertebrata.

Genus CORONULA Lamarek.

The Whale Barnacles.

- Coronula* Lamarek, Ann. Mus. H. Nat. Paris, I, 1802, p. (468) 473. Type *Lepas balænaris* Gmelin, monotypic.
Diadema Schumacher, Ess. Nouv. Syst., 1817, pp. 39, 40. Type *Lepas diadema* Linnæus, monotypic.
Cetopirus Ranzani, Mem. Stor. Nat., 1820, p. —. Type *Lepas balænaris* Gmelin. (Not consulted.)
Polylepas (Klein) Gray, Ann. Philos. (n. s.), X, 1825, p. 105. Type *Lepas diadema* Linnæus, first species.

Compartments six, of equal sizes. Walls thin, deeply folded, with folds forming cavities, open only on under side of shell. Opercular valves much smaller than orifice of shell.

Species world-wide in distribution, found attached to Cetacea.

Coronula diadema (Linnæus).

PLATE 49.

Whale Barnacle.

- Lepas diadema* Linnæus, Syst. Nat., Ed. 12, 1767, p. 1108. *Mare Mediterraneum et Indicum.*
Coronula diadema De Kay, N. Y. Fauna, Moll., V, 1843, p. 250. Off Sandy Hook, N. J. (on whale).
 — Darwin, Monogr. Cirrip., 1854, p. 417, Pl. 15, figs. 3, 3a-3b, Pl. 16, figs. 1, 2, 7. United States.
 — S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 579. Whole North Atlantic (on whales south of Cape Cod).
 — M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 80. On whales north and south of Cape Cod.
Coronula balænaris (nec Gmelin) De Kay, N. C. Fauna, Moll., V, 1843, p. 251. Off Sandy Hook, New Jersey (on whale).

Description. — Shell crown-like in shape, but passing into cylinder. Radii extremely broad. Orifice large, nearly hexagonal. When operculum removed whole inside of cup-formed shell visible at once, as flat membranous base much smaller than orifice. Under side of shell deeply concave. Outside of each compartment formed by broad, rounded and somewhat prominent though rarely divided ribs, as transverse ends of folded walls. These ribs closely united together by finely serrated lines of junction. Their outside surfaces delicately striated longitudinally, plainly crossed by irregular transverse ridges, especially in lower part of shell.

Scuta placed close together at rostral end of orifice, imbedded in brownish tough longitudinally plicated horny substance, which extends far beyond both ends of valves. In outline mitre-shaped, or rounded and sub-triangular, a little curved, more or less elongated, especially in young. Terga usually absent or rudiment, as short thin plate of shell, barely visible to naked eye, extending parallel and near to tergal edge of scutum. Lips of aperture of sack prominent, highly so towards carinal end. As shell not spreading much at base new folds in walls seldom formed and external longitudinal ribs much more seldom divided. When new folds form, only one formed on one, as rostral, side of each suture, instead of on both sides. Inner ends of folded walls surrounding basal membrane narrow, instead of almost square. Lower edge of sheath, which projects freely, descends almost to level of basal edges of walls. Outer ends of folded walls, forming transverse loops, internally filled up solidly by calcareous matter, instead of by septa forming tubes. Radii little thicker in lower and outer than in upper and inner part of each compartment. In middle not reaching sheath by about half thickness of compartment, consequently separated from plates in which alæ rest by large chambers, which extend up nearly to apices of compartments. Sinuous plates forming main portion of compound radii rather thinner and closer together than in some species. Alæ thick, thickest medianly and there equal radii in thickness, almost wedge-formed as lower edges very short compared with upper.

Mouth with teeth and fine hairs on labrum sometimes obscure, sometimes plain, and close outside bottom of medial notch small hard prominence. Palps broad, on basal exterior edges short row of spines, not equal in length to width of palps. Mandibles with five main teeth, second and third show only an obscure rudiment of being double. Between these two teeth, and between third and fourth tooth, a small intermediate tooth. Inferior angle narrow, rounded, spinose. End of apodeme of maxillæ expanded. Pedicel of first cirrus extremely broad, and rami set in an unusually crooked manner. Basal segment of shorter and broader ramus of this cirrus with dorsal surface produced into plate fringed with very fine hairs. Height two inches, diameter two and one-half inches. (Darwin.)

Remarks.—Known from the Atlantic Ocean, Arctic seas and Gulf Stream. It is found attached to whales, and included here as De Kay records it from whales from off Sandy Hook.

Sub-Class MALACOSTRACA.

Crustacea of high organization, and usually of considerable size. With the exception of one order the body is commonly divided into a thorax of eight, and an abdomen of seven segments. Appendages usually highly differentiated. Usually mesenteron forming only small portion of adult enteric canal, and gastric mill present. Renal organs as antennary glands. The Nauplius stage is usually passed through in the egg, but there is a more or less complex metamorphosis.

Of the various orders included in the present assemblage, six are here admitted, as the Arthrostraca, Cumacea, Phyllocarida, Stomatopoda, Schizopoda and the Decapoda.

Key to the orders.

- a. Eyes sessile; first, and also sometimes second thoracic segment, joined with head and bearing maxillipeds; remaining seven segments free and bear legs. ARTHROSTRACA
- aa. Eyes stalked.

- b. Three posterior thoracic segments not covered by carapace; abdomen very large; five anterior thoracic limbs formed as maxillipeds, of which second very large and forms defensive weapon, and last three small biramous legs. STOMATOPODA
- bb. Thorax covered by carapace.
- c. Thorax more or less completely covered by soft carapace; all thoracic appendages biramous. SCHIZOPODA
- cc. Thorax united with head to form cephalothorax usually covered by carapace; three anterior pairs of the thoracic limbs biramous foot-jaws, and posterior five pairs of walking-legs without exopodites. DECAPODA

Order ARTHROSTRACA.

First, and sometimes second thoracic segment joined with head and bearing maxillipeds. Remaining seven segments free and bearing legs. Eyes usually sessile.

This group contains many familiar types, though usually of rather small size. Many are parasitic, others terrestrial, while some few are fresh-water in habitat. These are among the most numerous of all our crustacea, and many others will no doubt be added to our fauna with future studies.

Key to the sub-orders.

- a. Body usually compressed or flattened from side to side; gills carried on thoracic appendages. AMPHIPODA
- aa. Body usually depressed or flattened from above downwards; gills carried on abdominal appendages. ISOPODA

Sub-Order AMPHIPODA.

The Amphipods.

Head well defined. No carapace. Eyes sessile and usually compound. Thorax of seven segments. Abdomen typically of six segments and a telson. First three abdominal appendages fitted for swimming. Last three pairs of abdominal appendages very different from preceding ones, directed backward and fitted for springing. Gills borne on inner side of basal joints of thoracic legs. Eggs carried in a marsupial pouch under thorax of female.

Key to the tribes.

- a. Abdomen rudimentary; first thoracic segment fused with head: forms of aberrant structure. CAPRELLIDEA
- aa. Abdomen well developed; head and eyes generally not of unusual size; maxillipeds with palps. GAMMARIDEA

Tribe CAPRELLIDEA.

Head fused with first segment of thorax. Abdomen rudimentary. Second gnathopods larger than first. Usually gills present only on third and fourth segments of thorax. Anterior pairs of pereopods usually wanting. No pleopods. Uropods rudimentary or wanting.

*Family CAPRELLIDÆ.**The Skeleton Shrimps.*

Body narrow, cylindrical, very flexible, last segment of mesosome generally defined from cephalon by slight dorsal depression, third and fourth segments in female much broader than in male, and carrying marsupial pouch. Superior antennæ slender and elongated, with multiarticulate flagellum. Inferior antennæ well developed, though usually much smaller than superior. Buccal area rather prominent. Anterior lip broad, bilobed. Posterior lip with distinct inner lobes. Mandibles with or without palps. First pair of maxillæ without any basal lobe, palp well developed, biarticulate, and second pair small. Maxillipeds normally developed, with large pediform palps. Gnathopoda very unequal, anterior comparatively small and originating far in front, beneath cephalon, and posterior much larger and often very differently shaped in both sexes. Pereopoda more or less reduced in number, two posterior pairs always strongly developed and prehensile. Metasome and urosome forming together generally very small nodiform appendage issuing between bases of last pair of pereopoda, and carrying more or less distinct rudiments of limbs (uropoda).

These animals are usually found among algæ or hydroids to which they cling firmly by means of their powerfully developed posterior peræopoda. Easily known by the long narrow cylindrical flexible body which may be bent to a complete circle. Genera about ten.

Genus CAPRELLA Latreille.

The Skeleton Shrimps.

Caprella (Lamarck) Latreille, Hist. Nat. Crust., III, 1802, p. 39. Type *Cancer linearis* Linnæus, first species, designated by Bocck, Skand. Ark. Amphipoder, 1872, p. 686.

Liparis (nec Scopoli 1777) Bosc, Hist. Nat. Crust., I, 1802, p. 79. Type *Squilla lobata* Fabricius, monotypic.

Capreola De Brébisson, Cat. Crust. Calvados, 1825, p. 225. Type *Caprella scolopendroides* Lamarck, virtually monotypic.

Body more or less slender, usually much more elongated in adult male than in female, with anterior part sometimes enormously prolonged. Cephalosome of moderate length, with distinct dorsal impression, indicating boundary between cephalon and first segment of mesosome. Superior antennæ more or less elongated, with joints of peduncle in male often lamellarly expanded. Inferior antennæ generally densely setous posteriorly, with flagellum biarticulate. Mandibles without any palps. Maxillipeds with masticatory lobes scarcely larger than basal ones, palps very strong. Anterior gnathopoda of usual structure. Posterior gnathopoda strongly developed, often very differently shaped in both sexes. Two anterior pairs of peræopoda quite wanting, three posterior pairs of equal structure and generally very strongly built, subcheliform. Branchial lamellæ only present on third and fourth segments of mesosome. Urosome in female without distinctly defined appendages, in male with pair of biarticulate limbs in front.

Many species have been described, though the great sexual differences have been found to be the only excuse in many cases.

Caprella acutifrons Latreille.

PLATE 50.

Skeleton Shrimp.

- Caprella acutifrons* Latreille, Nouv. Dict. Hist. Nat., Nouv. Ed., VI, 1816, p. 433. *Coasts of England.*
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 77. Off Martha's Vineyard.
- Caprella geometrica* Say, Journ. Acad. Nat. Sci. Phila., I, pt. 2, 1818, p. 390. *Salt-water bays.*
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 41. Along our coast (N. Y.).
- White, Cat. Crust. Brit. Mus., XXV, 1847, p. 92. United States (Say's material).
- Bate, Cat. Amph. Crust. Brit. Mus., 1860, p. 357, Pl. 56, fig. 8 (Say's example).
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 480. Brackish waters. (Vineyard Sound.)
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 567, Pl. 5, fig. 20. Great Egg Harbor, New Jersey (North Carolina to Vineyard Sound).
- Uhler, Ches. Z. Lab. J. Hopkins Univ., I, 1878, p. 26. Fort Wool, Va.
- Kingsley, Standard Nat. Hist., II, 1884, p. 73, fig. 96. Atlantic coast, U. S.
- Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, New Jersey.
- Heilprin, An. Life Sea Shore, 1888, p. 96, Pl. 7, fig. 3. New Jersey and southern Long Island.
- Holmes, Amer. Nat., XXXVII, 1903, p. 291. Cape Cod to Cape Hatteras region.
- Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 526, fig. Cape Cod to Cape Hatteras region.
- Paulmier, 53th An. Rep. N. Y. State Mus., IV, 1904 (1906), p. 168, fig. 38. South Beach, Staten Island.

Description.—Body unusually stout, without tubercles or spines. Head with large spine pointing anteriorly. Antennæ stout, first pair much less than half length of body, second joint much stouter than third and nearly twice as long. Flagellum shorter than peduncle, composed of about twelve segments. Second antennæ in adult male about two-thirds long as first and fringed below with numerous long hairs. Hand of first gnathopods with palm straight, and armed with pair of spines at well-defined upper angle. Second gnathopods in adult male very short and stout, basal joint several times smaller than hand.

Latter turned, strongly convex in front. Palm strongly setose, with strong spine at posterior end and blunt tooth or tubercle near base of finger. Gills nearly round. Three posterior peræopods stout, carpus wide as long and about one-third length of propodus. Palms of propodi extend nearly to base and defined above by pair of spines. Lower margins of third and fourth thoracic segments produced into laminæ. Color very variable, sometimes nearly colorless, again reddish or variously mottled. Length of adult female 15 mm.

Remarks.—The skeleton shrimp has been recorded from New Jersey several times. According to Holmes the females do not differ greatly from the males in the form of the body, though of much smaller size and have the second antennæ, as in the young male, nearly as long as the first. In the female the second gnathopoda are relatively smaller and more slender, the basal joint being several times longer than broad, with the hand more like that of the first gnathopods than in the male. Also the palm has only a small projection armed with a spine at the upper end, and devoid of a prominent tubercle near base of dactyl. Young males differ somewhat from the adults. Their antennæ are of more nearly equal length with first and second joints of first pair less tumid, gills more oval in outline, hand of second gnathopods less stout, two spinous projections instead of one near upper end of palm, and tubercle near base of dactyl small or absent. The range of the species is from Massachusetts to North Carolina, living among eel-grass. My material eight or nine dried examples from Cape May, all in poor preservation, as they were obtained many years ago. The previous New Jersey records were for Beach Haven and Great Egg Harbor.

Tribe GAMMARIDEA.

Head and eyes usually not greatly enlarged. Maxillipeds with palps and basal lobes not joined or fused together in middle. Coxal plates usually well developed. Abdomen not reduced in size, and last two segments, with rare exceptions, free.

Key to the families.

- a.* First antennæ not shorter than second; mandibles with palps.
b. Body more or less depressed, with posterior divisions poorly developed. COROPHIIDÆ
bb. Body slender, more or less compressed, with posterior divisions normally developed.
c. Cephalon not produced in front.
d. Peræopods without dactyls, but peculiarly modified for digging. PONTOPOREIIDÆ
dd. Peræopods with dactyls, not peculiarly modified.
e. Rami of last pair of uropoda more or less foliaceous. GAMMARIDÆ
ec. Rami of last pair of uropoda more or less conspicuously hooked. PODOCERIDÆ
cc. Cephalon produced in front to a deflexed rostrum. IPHIMEDIDÆ
aa. First antennæ shorter than second; mandibles without palps. ORCHESTIIDÆ

Family COROPHIIDÆ.

Body smooth, depressed, metasome and urosome comparatively poorly developed. Coxal plates very small, non-contiguous. Cephalon broad, more or less produced in front, lateral lobes small and narrow. Eyes, when present, placed within lateral lobes of encephalon. Antennæ more or less slender, inferior ones usually more strongly built than superior, and accessory appendage of latter either present or wanting. Mandibular palps well developed and triarticulate, or comparatively small with smaller number of joints. Oral parts otherwise normal. Gnathopoda of different structure in various genera, generally rather unequally developed. Peræopoda short and stout or very much elongated. Last pair of uropoda small, uniramous. Telson usually lamellar and entire.

Genera in moderate number. They are generally distinguished by their depressed body and poor development of posterior regions.

Key to the genera.

- a.* First two pairs of peræopods with spinning-glands.
b. Mandibular palp three-jointed. CERAPUS
bb. Mandibular palp two-jointed. COROPHIUM
aa. First two pairs of peræopods without spinning-glands. UNCIOLA

Genus CERAPUS Say.

Cerapus Say, Journ. Acad. Nat. Sci. Phila., I, pt. 1, 1817, p. 49. Type *Cerapus tubularis* Say, monotypic.

Cyrtophium Giles, Journ. As. Soc. Bengal, LIV, pt. 2, 1885, p. 54. Type *Cyrtophium calamicola* Giles, monotypic.

Body slender, sublinear, with metasome and urosome very small. Cephalon produced in front to well-marked rostrum. Anterior pairs of coxal plates exceedingly small, three posterior pairs considerably larger and distinctly bilobed. Eyes distinct, but small. Antennæ not very slender, subequal in length, superior ones without an accessory appendage, but have first joint of peduncle more or less greatly expanded, and flagella in both pairs very short. Mandibular palps well developed, triarticulate, with terminal joint fully as large as second, and edged with long curved setæ. Anterior gnathopoda of similar structure in two sexes, and distinctly subcheliform. Posterior gnathopoda in female scarcely stronger than anterior, not subcheliform, those in male very powerfully developed with carpus exceedingly large and more or less produced below so to form together with propodus and dactylus complex chela. Anterior pairs of peræopoda subequal, basal joint large and broad, and three posterior pairs comparatively short and strongly recurved, with dactylus small and inverted. Branchial lamellæ narrow, only present at base of three middle pairs of legs. Three anterior pairs of incubatory lamellæ likewise narrow, and fourth pair, however, large and expanded, closing marsupial pouch posteriorly. First pair of pleopoda rather large, and two succeeding pairs imperfectly developed. Penultimate pair of uropoda uniramous, and last pair with terminal joint extremely small and hooked-shaped. Telson short and broad, slightly bilobed, upper face densely spinous. Species few.

***Cerapus tubularis* Say.**

PLATE 51.

Tube Shrimp.

Cerapus tubularis Say, Journ. Acad. Nat. Sci. Phila., I, pt. 1, 1817, p. 50, Pl. 4, figs. 7-11. Amongst fuci on the sea beach at *Egg Harbor, New Jersey.*

- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 38 (nec Pl. II, fig. 43, which is *Cerapus abditus* Templeton) (on Say).
- Bate, Cat. Amph. Crust. Brit. Mus., 1862, p. 262 (on Say).
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 396. In large compound ascidians. (Vineyard Sound.)
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 565. Vineyard Sound (in *Amouroucium pellucidum*).
- S. I. Smith, Trans. Conn. Acad., IV, 1882, p. 277, Pl. 2a. Great Egg Harbor, N. J.
- Holmes, Amer. Nat., XXXVII, 1903, p. 288. Cape Cod to Cape Hatteras region.
- Cerapus tabularis* Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 517, fig. New Jersey. (Cape Cod to Cape Hatteras region. Impr. err.)

Description.—Head with small rostrum and faint dorsal carina. First and second antennæ subequal in length, in male little over half length of body. First segment of first antennæ stout, laterally compressed, furnished below with a carina, which more prominent near base, and second and third segments subequal. Flagellum three-jointed, about long as last joint of peduncle. Second antennæ with flagellum three-jointed, nearly long as last peduncular segment. Coxal plates broader than deep. First gnathopods with carpus produced downward at postero-distal angle into small lobe. Propodus oblong, narrower than carpus, but about as long. Palm oblique, spinulose. Second gnathopoda in male with carpus furnished at postero-inferior angle with large acute tooth, above which a rounded sinus separating latter from a small, rounded tooth. Propodus oblong, slightly incurved, nearly long as carpus, inner edge irregular, with dactyl large and stout. Second gnathopoda in female similar to first pair. Third peræopods very small, merus with long spatulate lobe on posterior edge, carpus articulated to posterior margins of merus above distal end of latter and produced greatly beyond articulation of oblong propodus, and short and broad dactyl with an abruptly recurved hook-like tip. Terminal uropoda much like preceding pair but stouter. Telson twice as broad as long, distally emarginate, two lobes rounded and armed above with minute hooks. Length 4.4 mm. (Holmes.)

Remarks.—This species was originally described from Great Egg Harbor, and does not seem to have been noticed in our limits since that time (1817). It lives in tubes, which it carries about.

According to S. I. Smith the tubes of all the specimens seen are black externally, thin, very regularly cylindrical, except that they are usually slightly enlarged at one or at both ends. Within they are smoothly lined with a layer of cement, while externally they are covered, to a great extent at least, with minute elongated pellets, apparently the excrement of the animal, arranged transversely to the tube and closely crowded together. There appear, however, to be other materials, probably minute fragments of algæ, hydroids, etc., mixed with the pellets. The tube is apparently never attached, but is carried about by the animal, very much after the manner of the larvæ of some species of Phryganeidæ, as described by Say. It is very difficult to force the living animal from its tube, and it probably never quits the tube voluntarily. The ordinary position of the animal when at rest is with the head only protruding from one end of the tube, the antennulæ stretched out in front and diverging at about a right angle while the antennæ are held out each side at right angles to the tube. The antennulæ and antennæ are the only appendages which are ordinarily used in locomotion, and by means of these alone the animal appears to move about with its tube with the same ease and rapidity as the species of *Podocerus* and *Corophium* do when unencumbered. As noticed by Say, the animal turns about within its tube very readily, and uses either end of it indifferently as the front. If the tube catch in any way while the animal is moving about or if it be held fast by forceps, the head is protruded first from one and then the other end of the tube in quick succession, and the antennulæ and antennæ are thrust along the outside of the tube to discover the obstruction. While thus held fast, fully half the body is often protruded from the tube. In turning about within the tube, the terminal segments of the pleon are thrust forward beneath the anterior segments and the peræon pulled back over them, and then the peræon is folded back upon itself in the same way, but the antennulæ, antennæ and head are never first bent beneath the peræon. The structure of the telson, second and third uropods, and of a part of the peræopods is well adapted to the performing of this evolution. The hooks of the second and third uropods and of the telson holding the tail fast to the side of

the tube, while the third, fourth and fifth peræopods, holding on with their opposing hooked tips, pull the posterior part of the peræon back over the pleon, and then the first gnathopods help to complete the evolution. The tubes are usually kept quite free from foreign growths. He was unable to discover, however, how the diameter of the tube is enlarged to accommodate the growing animal, but thinks it is probably accomplished by building on a larger portion at one end and pulling to pieces the other end until the whole tube is reconstructed.

According to Smith, in life, a large portion of the animal appears almost black from the crowding together of numerous specks of very dark purplish pigment. The first segment of the peduncle of the antennula nearly all colored in this way, and broad band of same character at distal end of each of other segments of peduncle. Proximal segments of antenna also dark-colored, and broad band of color at distal end of fourth segment. Other parts of peduncles of antennulæ and antennæ semi-transparent, and so with flagella. Head and whole anterior and middle portions of body and epimera, more or less colored in same way, as also gnathopods and bases of first and second peræopods. Distal portions of these peræopods, whole of third, fourth and fifth pairs, and caudal appendages semi-translucent and nearly or quite devoid of pigment.

Genus COROPHIUM Latreille.

Corophium Latreille, Gen. Crust. Insect., I, 1806, p. 58. Type *Gammarus longicornis* Fabricius, monotypic.

Podocerus Leach, Edinburgh Encyclop., VII, 1814, p. 433. Type *Podocerus variegatus* Leach, monotypic.¹ (Not consulted.)

Body comparatively stout, much depressed, with extremely small coxal plates of which first pair conically produced and tipped by number of strong ciliated bristles. Cephalon rather broad, with lateral lobes narrow and more or less projecting between insertions of antennæ. Urosome flattened, segments sometimes coalesced. Eyes small or imperfectly developed, placed at base of lateral lobes of cephalon. Antennæ rather

¹ Leach, l. c., Am. Ed., VII, 1815, p. 272.

unequal, superior ones slender without any accessory appendage, but flagellum well developed and multiarticulate. Inferior antennæ strong, pediiform, usually much more powerful in male than in female, with penultimate joint of peduncle large and produced at end posteriorly to more or less strong spiniform projection, and short triarticulate flagellum terminating in several small hooks. Anterior lip large and broad. Posterior lip with inner lobes well defined. Mandibles normally developed, palp small and narrow and of two joints only, each carrying strong ciliated seta. First pair of maxillæ with basal lobe subobsolete, and second pair with outer lobe larger than inner. Maxillipeds sublamellar, basal lobes narrowly produced, masticatory lobes long and narrow with inner edge fringed with slender spines, palp comparatively slender with last joint rather small, and short dactylus setous at tip. Gnathopoda of same structure in two sexes, anterior rather slender with ischial joint forming below rounded densely setous expansion, carpus much elongated and densely setous below, propodus narrow with distinctly defined though very short palm. Posterior gnathopoda somewhat stronger than anterior, meral joint forming broad lamellar expansion firmly connected with lower side of carpus and edged with double row of extremely elongated and finely ciliated setæ curving anteriorly, and propodus sublinear, without any distinctly defined palm. Two anterior pairs of peræopoda with large broad basal joint, and meral joint more or less expanded. Two succeeding pairs comparatively stout, of same structure, both having meral joint obliquely expanded in front, and carpal one armed outside with two oblique rows of strong spines, dactylus short and inverted. Last pair of peræopoda rather elongated and slender, basal joint lamellarly expanded and densely fringed on both edges with long ciliated setæ. Branchial lamellæ well developed, wanting at base of posterior gnathopoda, and incubatory narrow, but edged with strong setæ. Pleopoda with basal part greatly expanded inside. Two anterior pairs of uropoda with rami comparatively short and coarsely spinous outside. Last pair of uropoda with basal joint scarcely expanded, terminal joint lamellar, setiferous. Telson small and distinctly defined from last segment.

Several species in the northern and southern hemispheres. Characterized largely by the stout depressed body, very strongly-built pediform inferior antennæ, and the peculiar structure of the gnathopoda.

Corophium cylindricum (Say).

PLATE 52.

Podocerus cylindricus Say, Journ. Acad. Nat. Sci. Phila., I, pt. 2, 1818, p. 387.

Egg Harbor, New Jersey.

—— De Kay, N. Y. Fauna, Crust., VI, 1844, p. 39 (on Say).

—— Bate, Cat. Amph. Crust. Brit. Mus., 1862, p. 256. Pl. 44, fig. 4 (Say's record; part).

Corophium cylindricum Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 370. Among eel-grass. (Vineyard Sound.)

—— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 566. New Jersey to Vineyard Sound.

—— Holmes, Amer. Nat., XXXVII, 1903, p. 288. Cape Cod to Cape Hatteras region.

—— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 521, figs. New Jersey to Provincetown, Massachusetts.

—— Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1906), p. 167, fig. 37. Along the shore of N. Y. City.

Description.—Antennæ of nearly equal length in female, about half as long as body. Peduncle of first pair of antennæ with first joint rather stout, a little longer than second, and armed below with three or four spines. Third joint scarcely half as long as second, and flagellum somewhat shorter than peduncle. Second antennæ stout, very large in male with thick fourth joint produced into a large upturned spine at distal end of lower margin, above which two teeth. Fifth joint subcylindrical, scarcely half as thick as preceding one, distal end produced into a lobe on one side. Flagellum shorter than preceding joint of peduncle, three-jointed, first joint longer than second, third joint minute, bears two curved terminal spines and numerous setæ. Second antennæ in female with peduncle quite different from that of male, although flagellum much the same in both sexes. Fourth joint less stout relatively than in male, devoid of large curved spine at distal end, and armed with two or three large spines on lower side. In last joint lobe at distal end slight or

absent and lower edge with one or more strong spines. First gnathopods with carpus and hand subequal, former fringed behind with long plumose setæ. Hand oblong. Palm nearly transverse, rounded behind where it bears prominent spine. Second gnathopods with merus articulated below carpus as far as distal end of latter and fringed with two rows of very long plumose setæ. Propodus long, somewhat tapering, not chelate, infero-posterior angle produced into a tooth. Finger with one or two spines on lower margin behind tip. First and second peræopods subequal, merus expanded to twice width of succeeding joints. Dactyl slender, gently curved, about long as propodus. Fifth peræopods slender, nearly twice length of preceding, both edges of subovate basal joint with long plumose setæ. Propodus nearly four times as long as curved dactyl and furnished with tuft of very long setæ at tip. First uropods extend beyond others, rami about half length of peduncle. Ramus of terminal uropods flattened, broadly ovate, and edges with long setæ. Color marked with purplish-brown pigment cells. Dark transverse band across posterior end of each segment and another near middle. Anterior portion of head dark. Peduncles of both antennæ with a few pigment cells near base. Rest of body pellucid, with sometimes tinge of reddish-brown on antennæ. Eyes black. Length 3 to 4 mm. (Holmes.)

Remarks.—This species was originally described from Great Egg Harbor. It is met with in either a free state among various marine animals, such as bryozoa, hydroids, etc., and among sea-weeds or other marine vegetable matter. It also lives in soft tubes, often occurring on eel-grass near the roots of the plant.

Genus UNICOLA Say.

Unciola Say, Journ. Acad. Nat. Sci. Phila., I, pt. 2, 1818, p. 388. Type *Unciola irrorata* Say, monotypic.

Glaucanome (nec Goldf. 1826, Gray 1828) Krøyer, Nat. Tidssk., 1845, p. 403, Pl. 7, fig. 2a-e. Type *Glaucanome leucopsis* Krøyer, monotypic.

Body more or less slender, depressed, with small angular coxal plates. Cephalon produced in front to distinct rostrum, lateral

lobes small. Eyes either distinct or imperfectly developed. Superior antennæ provided with an accessory appendage, longer than inferior. Latter more strongly built in male than in female, in former with very movable articulation between penultimate and antepenultimate joint of peduncle, flagellum multiarticulate. Mandibular palps, well developed, triarticulate. Maxillipeds with masticatory lobes short and broad, armed inside with strong flattened spines. Gnathopoda rather unequal, anterior ones much stronger than posterior, and somewhat differing in male, propodus long and broad, subcheliform. Peræopoda comparatively slender, three posterior pairs successively increasing in length, and with basal joint more or less expanded. Pleopoda normally developed. Last pair of uropoda very small, with basal joint expanded inside. Telson comparatively large, lamellar, rounded.

Differs from *Corophium* in the presence of a distinct accessory appendage to superior antennæ and in structure of gnathopoda. Species few.

***Unciola irrorata* Say.**

PLATES 53 AND 150, FIGURE 4.

- Unciola irrorata* Say, Journ. Acad. Nat. Sci. Phila., I, pt. 2, 1818, p. 389. Egg Harbor, New Jersey.
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 38 (on Say).
- White, Cat. Crust. Brit. Mus., XXV, 1847, p. 90. Egg Harbor, New Jersey (Say's material).
- Bate, Cat. Amph. Crust. Brit. Mus., 1862, p. 279 (Say's record).
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 340, Pl. 4, fig. 19. New Jersey to Labrador.
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 567, Pl. 4, fig. 19. New Jersey to Bay of Fundy.
- S. I. Smith, Rep. U. S. Nat. Mus., III, 1880, p. 448. N. Lat. 39°—40°, W. Long. 70°, in 65-192 fathoms.
- S. I. Smith, Trans. Conn. Acad. Sci., IV, 1880, p. 280. Great Egg Harbor, N. J.
- Kingsley, Standard N. Hist., II, 1884, p. 76, fig. 103. Atlantic coast (understood), U. S.
- Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 559 (compiled).
- Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, New Jersey.
- Heilprin, An. Life of our S. Shore, 1888, Pl. 7, fig. 10. New Jersey and southern shore Long Island.

- Holmes, Am. Nat., XXXVII, 1903, p. 278. Arctic America to Cape Hatteras.
- Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 520, figs. New Jersey to Greenland.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 75. Bay of Fundy to Long Island Sound.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1906), p. 166, fig. 36. Along the shore of New York City.

Description.—Body rather long, slender, depressed. Cephalon produced anteriorly to form an acute rostrum. Eyes rounded. Antennæ subequal in length, more than half length of body, with long peduncles. Superior antennæ with shorter, narrower peduncle than that of the inferior antennæ, and second segment nearly twice length of first and third. Flagellum of superior antennæ much shorter than peduncle, and secondary flagellum formed of four joints and shorter than last basal joint. Inferior antennæ very stout in adult male, base compressed laterally, penultimate joint high at base, though distally tapering, armed within with row of spines and sometimes an inferior lobe at proximal end. Same organ also rounded anterior lobe to antepenultimate joint. Last subcylindrical or slightly tapering joint much narrower though nearly long as preceding joint. Flagellum frequently exceeds last basal joint. Inferior antennæ in female much more slender than those of male, scarcely compressed laterally at bases, penultimate joint hardly tapers, and flagellum and last basal joint like those of male. Anterior gnathopoda very robust, form alike in both sexes, with thickened basal joint excavated in front to receive carpus. Latter appears to form part of hand, short. Form of hand with carpus ovoid, though somewhat irregular, and at upper end of palm process with stout spine. Posterior gnathopoda small, with an oblong hand, broadest basally where wide as carpus, and distal end tapers. Palm short, nearly transverse, with angle of hand inside posteriorly produced and hind edge concave above this angle. All along edges of basal joint anteriorly, and both edges of carpus and hand with tufts of long setæ. Last pair of paræopoda longest, coxal plates wider than deep, and last ones with posterior angle produced, like corresponding segments above.

First and second abdominal segments with sides formed below into an acute tooth posteriorly. Angle of third segment postero-laterally produced as well upturned large hook. Uropods short. Short spine or denticle exerted backward from hind end of peduncle of first pair below rami, and strong spine on inner posterior angle. Rami of first pair of uropoda about two-thirds peduncle in length. Second pair of uropoda with strong spine at inner hind angle of peduncle, but without terminal spine below rami. Terminal uropoda small, short ramus not half length of peduncle. Inner hind angle of peduncle produced lobe extending behind till equal with tip of ramus, producing a biramous appearance. Telson rounded posteriorly, of rather large size. In life color usually bright red, generally mottled with white, sometimes latter predominating. Bases of antennæ said to be red with orange, and flagella with double row of red spots, one pair to a segment. Length 15 mm.

Remarks.—Originally this species was discovered at Great Egg Harbor Bay. It has since been recorded from Beach Haven, and was also obtained some years ago at Point Pleasant by Mr. Witmer Stone. Northward it extends to Labrador.

It ranges from low tide water to over five hundred fathoms in depth. Holmes gives its life colors as follows: Body mottled with bright crimson. Head with broad median crimson band, bifurcated in front. First thoracic segment more colored than others. Row of small crimson spots on either side of mid-dorsal line. Bases of both pairs of antennæ crowned with orange. Flagella with double rows of crimson spots, pair to each segment. Large hand with crimson blotches.

Verrill says it is very common on shelly and rocky bottoms, and although it habitually lives in tubes it does not always construct its own tube, but is ready and willing to take possession of any empty worm-tube into which it can get, and having once taken possession it seems to be perfectly at home, for it remains near the end of the tube protruding its stout claw-like antennæ, and looking out for its prey, in the most independent manner. It will also frequently leave its tube and swim actively about for a time, and then return to its former tube, or hunt

up a new one. It seems, however, to be capable of constructing a tube for itself, when it cannot find suitable ones ready made. It contributes very largely to the food of many fishes, such as scup, pollock, striped bass, etc.

Family PONTOPOREIIDÆ.

Form of body various, compressed to tumid. Cephalon not produced anteriorly in form of hood. Coxal plates moderate in size, generally fringed with bristles, those of fifth pair bilobed. Metasome generally well developed, with large epimeral plates. Urosome short and stout. Superior antennæ usually shorter than inferior, with an accessory appendage, and joints of peduncle sharply defined. Epistome not at all projecting. Anterior lip forms simple rounded prominence and posterior lip quadrilobate, inner lobes small but well defined. Mandibles comparatively short, thick, with greatly expanded masticatory part, cutting-edge divided into two superposed lamellæ, and large protruding molar expansion, triarticulate palp more or less elongate. Maxillæ and maxillipeds as usual. Gnathopoda comparatively small and feeble, generally imperfectly subcheliform, or sometimes approach chelate form. Three posterior pairs of peræopoda mostly dissimilar, adapted for burrowing in loose bottom deposit. Branchial lamellæ ample. Incubatory lamellæ slender, fringed at tip with long curved setæ. Pleopoda usually well developed, especially in male. Uropoda biramous, last pair unlike preceding pairs in structure. Telson flattened, more or less deeply cleft.

Genera about nine, though only one in our region.

Genus HAUSTORIUS P. L. S. Müller.

Haustorius P. L. S. Müller. Phys. Belust. Microps. Wahrn. Slabber, Nürnberg, 1775, p. 52. Type *Oniscus arcnarius* Slabber, monotypic.

Lepidactylis Say. Journ. Acad. Nat. Sci. Phila., I, 1818, p. 380. Type *Lepidactylis dytiscus* Say, monotypic.

Lepidactylus, auct.

Pterygocera Latreille, Règne An. Cuv., IV, 1829, p. 124. Type *Oniscus arcnarius* Slabber, monotypic.

Bellia (nec Milne-Edwards 1848) Bate, Ann. Mag. N. Hist., VII, 1851, p. 318. Type *Oniscus arenarius* Slabber, monotypic.

Sulcator Bate, l. c., XIII, 1854, p. 504. Type *Oniscus arenarius* Slabber, monotypic.

Body short, robust, with rather large coxal plates, three anterior pairs of which curved and obtusely pointed at tip. Cephalon depressed and produced in front to short rostral projection. Metasome poorly developed, with small epimeral plates. Urosome generally folded beneath metasome. Superior antennæ with joints of peduncle sharply defined and densely setous, accessory appendage well developed. Inferior antennæ longer than superior, penultimate joint of peduncle laminarly expanded and fringed posteriorly with long ciliated setæ. Mandibles of usual structure, with rather large palp. First maxillæ with densely ciliated flap-shaped expansion outside basal part, masticatory lobe transversely truncated at tip, basal lobe not very large, palp well developed with curved terminal joint and furnished with tufts of slender bristles. Second maxillæ largely developed, outer lobe forming thin semi-lunar lamella finely ciliated on outer edge and fringed along inner edge with dense series of very delicate setæ, inner lobe much shorter than outer, and outside with sigmoid setous ridge. Maxillipeds of moderate size, basal and masticatory lobes nearly equal in size, setous on inner edge. Palp rather large, with second joint produced at end interiorly to rounded lobe, and on inner side with several transverse rows of very delicate bristles. Third joint of maxillipeds securiform, bent at right angle in middle, and dactylus wanting. Gnathopoda comparatively feeble, propodus of anterior ones simple and without any distinctly defined palmar edge, that of posterior ones forming minute chela at tip. Two anterior pairs of peræopoda comparatively robust, carpal joint posteriorly with rounded lamellar expansion, propodal joint constricted at base and outer part rounded obtusely. Three posterior pairs of peræopoda very largely developed, with basal, meral and carpal joints expanded to scale-like pieces, flanking sides of animal. Dactyls wanting to all peræopoda. Pleopoda poorly developed. Uropoda of rather dissimilar structure, first pair comparatively strong, with both rami

coarsely spinous at truncated tips. Second pair much smaller, with rami setous. Last pair with rami slender, linear, outer biarticulate and longer than inner, both set out at tip. Telson forms broad plate, slightly incised in middle.

A single species.

Haustorius arenarius (Slabber).

PLATES 53 AND 150, FIGURE 9.

Oniscus arenarius Slabber, Nat. Verl. Micros. Waarn. Haarlem, 1769, p. 92.

Pl. II, figs. 3-4. *Dorpe Oost-kappelle, op het Eiland van Walcheren.*

Oniscus arenarius Slabber, l. c. (nom. in index).

Haustorius arenarius Holmes, Amer. Nat., XXXVII, 1903, p. 279. Arctic America to Virginian province.

— Holmes, Bull. U. S. Bur. Fisher., XXIV, 1904 (1905), p. 476, fig. Georgia to Cape Cod.

— Paulmier, 58 Rep. N. Y. State Mus., VI, 1904 (1906), p. 157, fig. 25. Bayshore and Freeport, N. Y.

Lepidactylis dytiscus Say, Journ. Acad. Nat. Sci. Phila., I, pt. 2, 1818, p. 380. Georgia.

Lepidactylis ditiscus Bate, Cat. Amph. Crust. Brit. Mus., 1862, p. 112 (on Say).

Lepidactylus dytiscus Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 339. Burrows in sand at low water.

— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 556. Georgia to Cape Cod.

Description.—Head with short triangular rostrum. Eyes small, nearly round. Both pairs of antennæ short, and peduncle of first pair with numerous plumose setæ and secondary flagellum over half length of primary. Last two joints of second antennal peduncle compressed and much dilated, lower edges fringed with long plumose setæ, and penultimate joint several times larger than last one and produced into rounded lobe at anterior lower angle. Flagellum not exceeding peduncle of second antennæ. First four coxal plates increasing successively in size, first three concave behind, strongly convex in front and tapering below to rather obtuse point. Fourth coxal plate larger than others, concave behind, strongly convex in front and broadly rounded below. Gnathopods rather small, carpus widened at middle, larger than propodus, which very thickly setose and bears small terminal dactyl which much reduced

in second gnathopods. First two pairs of peræopods similar, carpus much dilated, produced into very large rounded posterior lobe and with several spines on edge. Propodus more or less pyriform, flattened, constricted toward base, and rounded end armed with several spines. Third peræopods with basal joint, merus and carpus much dilated, propodus narrow. Fourth peræopods much larger than third, with same joints dilated, small and narrow propodus joined to hind angle of quadrate carpus. Fifth peræopods large, basal joint much enlarged, wider than long, short merus produced behind into large lobe over twice as broad as long, carpus much dilated and propodus much larger than in preceding pairs. Three posterior abdominal segments small. First uropods with very stout peduncle, bent upward, upper edge with several stout spines and concave except near base, where a prominence surmounted by unusually stout spine, first of the series and in front of which (proximally) several long setæ. Rami of first uropods unequal, narrow. Terminal uropods with rami about twice length of peduncle, inner ramus larger and two-jointed. Telson broad, divided into two lobes, which setose on outer and distal edges. Color light yellowish-gray, resembling the sand in which the animal lives. Length 18 mm.

Remarks.—Known from both sides of the Atlantic along the coasts of France, Britain, Holland and Norway, and on our shores from Georgia to Cape Cod. This species is a burrower in the sandy beaches of our shores at low-water mark, strongly suggestive of *Emerita talpoida*. My specimens, four in number, obtained at Point Pleasant from Mr. Witmer Stone. Previously it has not been recorded from New Jersey.

Family GAMMARIDÆ.

Body more or less slender, with segments of urosome well defined. Coxal plates of moderate size, or very small. Antennæ generally rather slender, and as a rule but little different in the two sexes, superior ones provided with an accessory appendage often greatly developed. Oral parts normal, except in *Lilljeborgia*. Gnathopoda generally rather powerful

and subcheliform, as a rule much more strongly built in male than in female. Peræopoda more or less slender, three posterior pairs generally increasing in length, and have basal joint laminar. Last pair of uropoda, as a rule, projecting beyond others, and with rami more or less foliaceous. Telson generally small, lamellar, more or less deeply cleft.

Genera numerous, and representing the typical development of the Amphipoda.

Key to the genera.

- a. Inner ramus of terminal uropods scale-like, rudimentary. MELITA
- aa. Inner ramus of terminal uropods not rudimentary, although often smaller than outer.
 - b. Last three segments of abdomen with fascicles of spines.
 - c. Abdomen carinated dorsally. CARINOGAMMARUS
 - cc. Abdomen not carinated dorsally, last three segments not produced behind into teeth. GAMMARUS
 - bb. Last three segments of abdomen without fascicles of spines, although spiniform projections from hind margins of segments may be present. ELASMOPUS

Genus MELITA Leach.

Melita Leach, Edinburgh Encyclop., VII, 1813, p. 403. Type *Cancer Gammarus palmata* Montagu monotypic¹. (Not consulted.)
Ceradocus A. Costa. Rend. della Soc. Reale Borbonica, II, 1853, p. 170 (173). Type *Ceradocus orchestiiipes* A. Costa, monotypic.

Body more or less slender, with segments of mesosome always evenly rounded above, those of metasome and urosome sometimes produced dorsally to dentiform projections. Cephalon without any distinct rostrum, lateral corners rounded. Coxal plates of moderate size, fourth pair largest, and more or less emarginated posteriorly. Eyes distinct, though rather small. Antennæ of very same structure in two sexes, anterior ones very slender and much longer than inferior, accessory appendage more or less developed. Oral parts normal. Gnathopoda rather unequal, anterior ones comparatively small and alike in two sexes, and posterior ones much larger, in male often enormously developed, and approaching sometimes to cheliform

¹ Leach, l. c., Am. Ed., VII, 1815, p. 272.

character. Peræopoda rather elongated, three posterior pairs successively increasing in length, and have basal joint laminarily expanded. Branchial lamellæ simple, and incubatory lamellæ narrow. Two anterior pairs of uropoda normal, last pair projecting considerably beyond others and with very unequal rami, as outer rather large and spinous with terminal joint obsolete and inner very minute and scale-like. Telson small, bipartite.

Several species in the northern and southern hemispheres. Allied to *Gammarus*, but differ in the small eyes and structure of the gnathopoda.

Melita nitida S. I. Smith.

PLATE 54.

Melita nitida (S. I. Smith) Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 314 (near low-water mark).

—— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 560. *New Jersey to Cape Cod*.

—— Holmes, Amer. Nat., XXXVII, 1903, p. 280. Cape Cod to Cape Hatteras.

—— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 505, figs., Pl. II, fig. 3. *New Jersey to Cape Cod*.

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 69. *Cape Cod southward*.

—— Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1906), p. 162, fig. 31. *Bartow and South Beach, Staten Island*.

Description.—Body slender, compressed. Eyes small, round. First antennæ two-thirds or more of body length. Second joint of peduncle longer than first, nearly twice length of third. Flagellum longer than peduncle. Secondary flagellum three-jointed in adults, not longer than third joint of peduncle. Second antennæ shorter than first, last joint of peduncle nearly long as preceding joint. Flagellum shorter than peduncle, joints with whorls of long setæ like those of last joint of peduncle. First four coxal plates deeper than segments, first three oblong, somewhat curved backward. Palm about one-third length of nearly transverse distal edge of hand. Finger short, much curved, very thick at base, articulated in middle of distal edge of hand. Hand of second gnathopods in male large, oval, palm evenly convex, about long as hind edge above

it, with which it forms almost continuous curve. Finger tip closing against inner side of hand. Hand of second gnathopods of female much like that of male, smaller in size. Basal joints of last three peræopods large, oblong, armed with short spines in front and serrated behind. Posterior edges of abdominal segments not dentate nor produced. Fifth segment with several spines at hind edge on either side of mid-dorsal line. Last uropods long, inner ramus minute, situated in sinus of peduncle, and outer ramus of mostly uniform width, armed either side with several fascicles of strong spines of moderate length. Median spine of terminal cluster not unusually large. Telson with tip of lobes triangular, acute. Few spines around tip and on distal part of inner edge. Color of body and appendages generally grayish, color not confined to pigment cells, but scattered in form of minute pigment granules in cells below integument. Body and legs crossed by bands of somewhat darker color. Red spot above on anterior portion of head. Eyes black, with slight tinge of red. Length 10 mm.

(Holmes.)

Remarks.—This amphipod was described as ranging from New Jersey to Cape Cod. Its habits are said to be similar to those of other Gammari.

Genus CARINOGAMMARUS Holmes.

Carinogammarus Holmes, Amer. Nat., XXXVII, 1903, p. 280. Type *Gammarus mucronatus* Say, first species.

Abdomen dorsally carinated. Posterior edge of first three abdominal segments produced backward in median dorsal line into a prominent acute tooth. Last three segments of abdomen with fascicles of spines. Terminal uropods flattened, projecting beyond others. Inner ramus of terminal uropod not rudimentary, though often smaller than outer. Telson deeply cleft, small and flattened. Mouth parts normal. First antennæ with accessory flagellum. Gnathopods subchelate, larger in male than in female, and second pair usually larger than first. Carpus of gnathopods joined as usual, not in front of proximal end of propodus. Peræopods with dactyls.

Species few.

Carinogammarus mucronatus (Say).

PLATES 55 AND 150. FIGURE 6.

Gammarus mucronatus Say, Journ. Acad. Nat. Sci. Phila., I, pt. 2, 1818, p. 376. Bay of Egg Harbor, New Jersey. Near mouth of St. John's River, Florida.

—— De Kay, N. Y. Fauna, Crust., VI, 1844, p. 37, New Jersey to Florida.

—— White, Cat. Crust. Brit. Mus., XXV, 1847, p. 89. Egg Harbor, New Jersey (Say's material).

—— Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 466 (brackish pools); p. 479 (in eel-grass); p. 520, Great Egg Harbor, N. J. (in *Lophossetta maculata*).

—— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 559. North Carolina to Cape Cod.

Gammaracanthus mucronatus Bate, Cat. Amph. Crust. Brit. Mus., 1862., p. 203 (copied Say).

Carinogammarus mucronatus Holmes, Amer. Nat., XXXVII, 1903, p. 280. Cape Cod to Cape Hatteras.

—— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 503, figs. Cape Cod to Florida and Alabama.

—— Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1906), p. 161, fig. 30. Along the shores of N. Y. City.

Description.—Body long, well compressed, and abdomen carinated dorsally. Eyes reniform. First antennæ little longer than second, first joint of peduncle longer than second, and third joint about three-fifths length of preceding. Flagellum nearly twice peduncle length. Secondary flagellum not half peduncle length, of three joints. Second antennæ with flagellum about equal to peduncle, of about ten oblong joints. First four coxal plates deep, first oblong and similar to second and third in shape, fourth deeper than wide. First gnathopoda of male stout, smaller than second. Carpus not quite long as hand, latter narrowly oval with very oblique uneven palm continuous with posterior margin. Hand of second gnathopod oblong, both sides nearly parallel, oblique palm with laminate cross-striated edge concave near middle and cluster of spines around distal end. Female gnathopoda nearly equal in size, hand of first pair subquadrate with anterior edge quite convex and oblique, palm quite evenly convex, with few slender spines around posterior end. Hand of second gnathopods oblong, nearly rectangular, nearly

transverse evenly convex palm with few slender spines around distal end, where it becomes more sharply curved. Hind edge of first three abdominal segments with edge produced backward in mid-dorsal line into prominent acute tooth. Last three segments with fascicles of spines. Telson with three terminal and few lateral spines to each division. General color olive-green. Reddish spot above bases of first four abdominal appendages formed as in *Gammarus locusta*. Length to 6 mm.

Remarks.—This species, originally described from Great Egg Harbor Bay, ranges south to Florida, and north to Cape Cod. It frequently occurs in brackish water, as brackish pools on the salt marsh and among the grass of the marshes. It is easily distinguished from all our other related forms by having the anterior abdominal segments produced into a slender pointed dorsal tooth.

The numerous specimens I examined are from Point Pleasant, the south side of Townsend's Inlet and Corson's Inlet. I have also met with it at Ocean City and Cape May.

Genus GAMMARUS Fabricius.

Scuds.

Gammarus Fabricius, Syst. Entomol., II, 1775, p. 418. Type *Cancer locusta* Linnæus, sixth species, designated by Boeck, Skand. Ark. Amphipoder, 1872, p. 364.

Gammarus, auct.

Gammarellus Herbst, Vers. Nat. Krab. Krebs., II, 1796, p. (2) 106. Type *Oniscus gammarellus* Pallas, by tautonomy, twentieth species.

? *Paphredo* Rafinesque, Amer. Month. Mag. Crit. Rev., II, November, 1817, p. 41. Type *Pephredo potamogeti* Rafinesque, monotypic.

? *Spherchius* Rafinesque, Annals of Nature, 1820, p. 6. Type *Spherchius lucidus* Rafinesque, monotypic.

? *Lepteurus* Rafinesque, l. c., p. 7. Type *Lepteurus ricularis* Rafinesque, monotypic.

Body more or less elongated, and compressed, with back usually evenly rounded, not carinated and segments of urosome provided above with fascicles of spines. Cephalon without any distinct rostrum, lateral corners rather broad, postantennal ones distinct. Anterior pairs of coxal plates of moderate size, fourth

pair largest and distinctly emarginated in its upper part, and three posterior pairs comparatively small. Eyes well developed, with dark pigment. Superior antennæ generally longer than inferior, and provided with well-developed accessory appendage. Inferior antennæ rather strongly built, flagellum in male often provided with calceolæ anteriorly. Oral parts normal. Gnathopoda distinctly subcheliform, and more or less strongly developed, being always much more powerful in male than in female. Peræopoda usually not much elongated, three posterior pairs nearly equal-sized, and with basal joint laminarily expanded. Branchial lamellæ simple, pedunculated, and incubatory lamellæ comparatively broad. Last pair of uropoda projects beyond others, rami spinous and setiferous, outer one generally much larger and having small terminal joint. Telson rather small and cleft at base.

Species numerous. Widely distributed in both fresh and salt water.

Key to the species.

- a. Habitat in salt or brackish water; accessory flagellum equals peduncle of first antennæ. *locusta*
 aa. Habitat in fresh water; accessory flagellum distinctly less than peduncle of first antennæ. *fasciatus*

Gammarus locusta (Linnæus).

PLATES 56 AND 150, FIGURE 5.

Scuds.

Cancer locusta Linnæus, Syst. Nat., Ed. 10, 1758, p. 634. *European Seas.*
 Mass. record).

Gammarus locusta De Kay, N. Y. Fauna, Crust., VI, 1844, p. 37 (on Gould's
 — R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 824. Great Egg Harbor to Labrador.

— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 500, figs. All along New England coast and probably considerably further south.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 66. Entire coast of New England.

— Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1906), p. 159, fig. 28. New York City.

Gammarus locusto Holmes, Amer. Nat., XXXVII, 1903, p. 281. Arctic America to Cape Hatteras.

- Gammarus ornatus* Milne-Edwards, Ann. Sci. Nat. Zoöl., XX, 1830, p. 367, Pl. 10, figs. 1-10. *Boston, Mass.*
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 314, Pl. 4, fig. 15. Among rock-weed near low water. New Jersey to Labrador.
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 557, Pl. 4, fig. 15. New Jersey to Greenland.
- Kingsley, Standard Nat. Hist., II, 1884, p. 76, fig. 104. Our shores (eastern U. S. understood).
- Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, New Jersey.
- Heilprin, An. Life of our Sea Shore, 1888, p. 96, Pl. 7, fig. 5. New Jersey and south shore of Long Island.

Description.—Body compressed, rather slender, elongated. Cephalon convex. Eyes reniform, nearly extend to front edge of short lateral cephalic lobes. First antennæ slightly longer and more slender than second, and in females usually shorter than body length. First joint of first antennæ a little longer than second, which twice as long as third. Secondary flagellum longer than second joint of peduncle, about eight-jointed. Second antennæ with stout peduncle, last two joints subequally long, and flagellum shorter than peduncle. First gnathopods of male with hand elongate, tapers from near base, hind edge continuous with somewhat uneven palm, stout spine near middle and large spine with row of several smaller ones above its distal end. Second gnathopods of male with much larger hand than that of first pair, about twice length of carpus, contour subquadrate. Somewhat uneven and oblique palms sharply defined from hind edge, with stout spine near middle and large spine followed by several smaller ones near distal end. Female gnathopods smaller than in male, more equal in size and uniform in shape. First pair of gnathopods in female less narrow than those of male, and hand of second pair similar to that of male in shape, with palm less oblique than those of first gnathopods. Postero-lateral angles of second and third abdominal segments acute, produced, margin above angles generally with short setæ. Three posterior segments with median projection bearing fascicle of spinules and lateral fascicle on either side. Last pair of uropods with both rami stout, inner nearly long as first joint in outer, and inner edge with about four stout spines. External

edge of outer uropods with about six groups of stout spines. Telson with cluster of two or three spines near base and three on apical edge, and another near latter close to external edge. Color olive-brown to reddish-brown, and segments with edges a little more deeply tinted than rest of body. Above pleopod bases and first pair of uropods reddish spot. Length 25 mm., and Arctic specimens reach 48 mm.

Remarks.—Frequently found in our limits, from where it has been recorded a number of times. It is very extensively distributed throughout practically the circum-boreal region. Along the eastern Atlantic shores ranges south to the Mediterranean, on our shores probably south to Virginia, and in the Pacific Ocean well down the shores of both North America and Asia. It appears to be most frequently met with near the shore, though sometimes ranges into water of over fifty fathoms in depth.

Verrill says it occurs in great numbers beneath stones and among the rock-weed near low-water mark. The males are much larger than the females, and sometimes become nearly an inch and a half long. They cannot leap like their cousins that live at high-water mark, but skip actively about on their sides among the stones and gravel, until they reach some shelter, or enter the water, when they swim rapidly in a gyrating manner back downward, or sideways. But although they can swim they are seldom met with away from the shore or much below low-water mark. The zone of *Fucus* is their true home.

Very many examples from Point Pleasant, Great Bay, Ocean City and South Dennis. I have also met with it at Sea Isle City, Corson's Inlet, Anglesea, Cape May, Town Bank and Dias Creek. Occasionally it is found in the stomachs of smelt (*Osmerus cperlanus*) in our markets. I also found it at Parmores Island on the Virginia coast.

Gammarus fasciatus Say.

PLATE 57.

Fresh Water Shrimp.

Gammarus fasciatus Say, Journ. Acad. Nat. Sci. Phila., I, pt. 2, 1818, p. 374.
Our rivers, and frequently introduced into Philadelphia, in the Schuylkill water.

- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 37 (on Say).
- White, Cat. Crust. Brit. Mus., XXV, 1847, p. 88. (Philadelphia, on Say's material.)
- Bate, Cat. Amph. Crust. Brit. Mus., 1862, p. 210. Pl. 37, fig. 6 (Say's example).
- S. I. Smith, Rep. U. S. F. Com., II, 1872-73 (1874), p. 653. Throughout the northern States. Fragments from shad's stomach taken in Delaware river.
- Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 357. Pennsylvania.
- M. J. Rathbun, Occas. Papers. Boston Soc. N. Hist., VII, July, 1905, p. 67. Fresh-water streams and ponds in New England.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1906), p. 160, fig. 29. New York City.
- ? *Gammarus minus* Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 376. *In brooks under stones.*
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 37. Pl. 9, fig. 29. (Most of our fresh-water streams.) (Part, sic S. I. Smith.)
- S. I. Smith, Rep. U. S. F. Com., II, 1873-74 (1875), p. 654 (remarks).
- Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 357. New York?
- Gammarus minimus* White, Cat. Crust. Brit. Mus., XXV, 1847, p. 88. United States (on Say's material).
- ? *Lepleurus rivularis* Rafinesque, Annals of Nature, 1820, p. 7. *Brooks of mountains of Pennsylvania, and at Shannon Run, near Bedford Springs.*

Description.—Body slender, elongate well compressed. Eyes rounded. Cephalon convex, not produced in front. Fourth and fifth body segments slightly angulated at hind edge dorsally, each with three fascicles of moderately long spines, with median fascicle of each segment elevated on distinct protuberance. Sixth segment with lateral and median fascicles of spines. Outer rami of posterior uropoda with terminal segment very narrow, styli-form, devoid of lateral hairs. Inner rami with usually one or two spines on inner edge. Telson divisions with spine and one or two hairs on outer edge, besides few spines and hairs at tip. Superior antennæ half length of body, flagellum longer than peduncle, and without hairs. Inferior antennæ shorter than superior, peduncle extends far at end of superior, and with long fine hairs. First pair of gnathopoda in male with short triangular carpus, with a few hairs. Palm edge of propodus with stout spine on middle of inner side, and two or three smaller spines near tip of retracted dactylus, but no spines on posterior edge proper. In female propodus only slightly narrowed distally, palm edge less oblique than that of male. Hind edge has

several fascicles of hairs, and no spines except cluster near tip of closed dactylus. Second pair of gnathopoda in male with carpus little longer than first pair, and three or four spines on each side near tip of closed dactylus. Second gnathopods of female with carpus and hand smaller than in male, and moderate in length. Peræopods with long fine hairs posteriorly, and last two pairs of these limbs longest, third pair being shorter than fourth and fifth. Posterior pair of pleopoda with subequal rami, longer than preceding. Color in life mostly pale to translucent brownish, though examples agreeing with Say's account are met with. These usually show very pale greenish streaks and the appendages with similar-colored blotches. Length 10 to 15 mm.

Remarks.—This is our common "fresh-water shrimp" throughout the Middle Atlantic States. It probably occurs also throughout New Jersey, though at present I have met with it only in Cedar Swamp Creek near Petersburg Bridge, Bass River near New Gretna, Alcyon Pond at Pitman, Crooked Run near Cape May Court House, Pensauken, Camden, Florence, Burlington and Trenton. In all these localities it was found entirely in fresh water, and seems to be equally abundant throughout the year.

I have examined a number of specimens from Staten Island, New York. These were obtained from the water-supply and in springs, by Mr. W. T. Davis. He also obtained it in Terrace Pond, New Jersey.

In Pennsylvania it is common in very many sections. My specimens are from Philadelphia, Holmesburg, Bristol, Gladwynne, Naylor's Run, Jacoby Creek at Mt. Bethel, Monocacy Creek at Bethlehem and Pocopson. In Delaware I secured it near State Road and at Wilmington. In Maryland it was common at Denton, the Pocomoke River at Willards, Bohemia Manor, Broad Creek and Deer Creek at the Rocks. In Virginia I found it on Chincoteague Island and in Locustville Branch. It is frequently abundant in springs, often in trout streams, and doubtless forms a good portion of the food of many of our predatory fresh-water fishes. Among aquarists it is in demand as fish food. Considerable variation is found

in this species, many often being pale or dark, in striking contrast with others.

Possibly *Gammarus minus* Say is identical with this species, though S. I. Smith says that it is very likely not a true *Gammarus*. Say's account is as follows: Body whitish, with a few pale fulvous lateral spots. Eyes reniform, blackish, placed at the exterior base of the superior antennæ. Superior antennæ obviously longer than inferior ones. Seta [secondary flagellum] short, attaining the tip of the second articulation of the terminal joint [flagellum]. Terminal joint with about twelve articulations. Length three-twentieths of an inch [nearly 4 mm.]. Found in brooks under stones, and may be readily discovered by taking a stone out of the water, and inspecting its inferior surface.

Genus ELASMOPUS A. Costa.

Elasmopus A. Costa. Rend. della Soc. Reale Borbonica, II, 1853. p. 170 (175).

Type *Elasmopus rapax* A. Costa, monotypic.

Body comparatively strongly built and quite smooth, with coxal plates of moderate size, fourth pair largest and distinctly emarginated posteriorly. Cephalon without any rostrum, with lateral corners rounded off. Eyes well developed. Superior antennæ longer than inferior, and provided with comparatively small accessory appendage. Oral parts normal. Gnathopoda subcheliform, rather unequal, posterior ones much larger and very strongly developed in male. Posterior pairs of peræopoda unusually robust, but joints more or less expanded, and basal one very large and laminar. Last pair of uropoda not very elongated, and somewhat robust in structure, with comparatively broad rami. Telson laminar, divided by deep narrow cleft into two halves, each spinous at tip.

Species rather few. This genus is largely characterized by its short robust body, powerful development of the posterior gnathopoda, unusually strongly built posterior pairs of peræopoda, and structure of last pair of uropoda and that of telson.

Elasmopus levis (S. I. Smith).

PLATE 58.

- Mara levis* (S. I. Smith) Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 315. Near low-water mark.
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 559. *New Jersey, Long Island Sound and Vineyard Sound.*
- Elasmopus lævis* Holmes, Amer. Nat., XXXVII, 1903, p. 282. Cape Cod to Cape Hatteras.
- Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 507, figs. New Jersey to Provincetown, Mass.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1906), p. 162, fig. 32. Bergen Beach, N. Y.
- Elasmopus levis* M. J. Rathbun, occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 69. Long Island Sound.

Description.—Eyes nearly round. First antennæ rather stout, about two-thirds body length, third joint about two-thirds length of second, which subequal to first, and flagellum about long as peduncle, segments rather short. Secondary flagellum not half long as last peduncle joint, of two oblong joints and minute very short terminal joint. Second antennæ scarcely longer than peduncle of first pair, slender, flagellum shorter than peduncle and of about eight joints. First four coxal plates not deeper than their segments, and fourth about broad as deep. First gnathopods in male with oblong hand, subequal to carpus, palm quite oblique and evenly convex. Second gnathopods of male very large, carpus scarcely one-fourth length of hand and much broader than long, with narrow posterior lobe. Hand oblong, opposite sides nearly parallel, and smooth palm oblique. Row of four or five spines near base of finger on ridge just within margin of palm, and stout finger closes not against palm but into an excavation on inner side of hand, also conical tooth at upper end of this excavation. Hand of first gnathopods of female much like male, but palm nearly transverse. Second gnathopods much smaller than in male, oblong in shape, somewhat resembling first gnathopods of male, oblique palm with two rows of spines along its entire length and with pair of larger spines at distal end. Finger more nearly straight than in male, and more evenly tapering and closing against palm. Merus

and carpus much expanded in last two peræopods of male. Terminal uropods project beyond others, short broad rami, inner narrower than outer and little shorter, with small spine near base of inner margin. Outer ramus of terminal uropods with three fascicles of stout spines on outer edge, and tips of both rami truncated, armed with numerous spines. Telson with oblong lobes, notched at tip, where one or two spines. Body olive-brown to grayish, marked with numerous small rounded lighter colored spots and series of larger light spots along mid-dorsal line. Color not confined to pigment cells, but scattered in form of minute pigment granules in cells below integument. In examples with much gray pigment legs barred with dark bands, in others these bands scarcely visible. Extreme tips of basal joints of both antennæ light colored. Eyes black. Length 10 mm. (Holmes.)

Remarks.—This species was originally described from New Jersey, and ranges north to Massachusetts. It is said to be found among seaweed and under rocks at low tide.

Family PODOCERIDÆ.

Body more or less slender, smooth, with coxal plates of moderate size, or very small, fourth pair of same shape as preceding ones, fifth pair with anterior lobe much deeper than posterior. Cephalon without any rostrum, frontal part more or less produced, postantennal corners well marked. Eyes generally distinctly developed. Antennæ elongated, superior ones with accessory appendage either very small or wanting, inferior ones generally stronger than superior, especially in male. Oral parts normal. Gnathopoda more or less unequal, posterior ones larger, and sometimes enormously developed in male. Peræopoda not very slender, three posterior pairs generally strongly reflexed, dactylus unguiform, and in antepenultimate pair as rule inverted. Last pair of uropoda rather strong, biramous or uniramous, rami shorter than basal part, more or less distinctly hooked. Telson very small.

Genera in moderate number.

Key to the genera.

- a. Terminal uropods uniramous. ERICTHONIUS
 aa. Terminal uropods biramous. AMPITHOE

Genus *Erichthonius* Milne-Edwards.

- Erichthonius* Milne-Edwards, Ann. Sci. Nat. Zoöl., XX, 1830, p. 382. Type
Erichthonius difformis Milne-Edwards, monotypic.
Erichthonius, auct.
Cerapodina Milne-Edwards, Hist. Nat. Crust. III, 1840, p. 62. Type *Cerapus
 abditus* Templeton, monotypic.
Dercothoe Dana, Amer. Journ. Sci. Art., (2) XIV, 1852, p. 313. Atypic.
 (Type *Gammarus emissitius* Dana, first species in Crust. U. S. Expl.
 Exped., 1852, p. 968.)
Pyctilus Dana, Amer. Journ. Sci. Art., (2) XIV, 1852, p. 313. Atypic. (Type
Erichthonius macrodactylus Dana, first species in Crust. U. S. Expl.
 Exped., 1852, p. 973.)

Body slender, subdepressed, with very small coxal plates, of which anterior pairs larger than posterior, and epimeral plates of metasome small. Urosome narrow, elongated. Cephalon with frontal part considerably produced, lateral lobes tumid and more or less projecting. Eyes well developed, placed within lateral lobes of cephalon. Antennæ slender, subequal, edged posteriorly with fascicles of slender bristles, superior ones without an accessory appendage, inferior ones issuing at considerable distance behind superior, and with antepenultimate joint of peduncle unusually elongated. Flagella of both pairs of antennæ multiarticulate. Anterior lip produced in front to an acuminate projection, and posterior lip with well-defined inner lobes. Mandibles short and stout, with palp much elongated, and terminal joint lamellar and densely setiferous. Maxillæ normal. Maxillipeds with palps comparatively narrow. Gnathopoda very unequal, anterior ones rather small and of similar structure in two sexes with carpus comparatively large and lamellarly expanded below, propodus short but broad, nearly triangular in form. Posterior gnathopoda in female considerably larger than anterior, carpus produced below to setiferous lobe, propodus rather expanded with palm well defined. In male posterior gnathopoda of enormous size, complexly chelate, carpus exceedingly large

and sending off from its end inferiorly an acuminate thumb-like process, propodus narrower than carpus and having palm imperfectly defined, and large dactylus when closed crossing carpal process. Anterior pairs of peraeopoda with basal joint lamellarly expanded, three posterior pairs successively increasing in length, having basal joint oval in form, and dactylus of antepenultimate pair inverted. Branchial lamellæ small, wanting at base of posterior gnathopoda, and incubatory large and broad. Last pair of uropoda with single lamellarly unguiform ramus. Telson short and broad, with two densely spinous prominences above.

Several species in the northern and southern hemispheres.

Erichthonius minax (S. I. Smith).

Cerapus minax S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 565.

Long Island Sound and Vineyard Sound.

Erichthonius minax Holmes, Amer. Nat., XXXVII, 1903, p. 288. Cape Cod to Cape Hatteras region.

— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 519, figs. Long Island Sound and Great Egg Harbor, New Jersey, to Woods Holl.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 74. Long Island Sound.

Description.—Eyes large, nearly round. Antennæ subequal in length, last two joints of peduncle of first pair subequal, and flagellum about long as peduncle. Second antennæ rather slender, without many or long setæ below, and flagellum nearly long as peduncle. First gnathopods short, large distally widening carpus setose behind, hand smaller than carpus, with narrowed base, about two-thirds broad as long, slightly convex palm cut into minute narrowly acute teeth and dactyl acutely serrulate within. Second gnathopods in male very large, merus very small, elongated carpus produced below propodus into very large acute process which has very large tooth on its upper edge. Propodus rather narrow, with low elevation near distal end of margin, and dactyl with long setæ at tip. Second gnathopod of female with carpus produced into long lobe extending below propodus far as tip of closed dactyl. Ovate hand with very oblique convex palm, armed above with few pairs

of spines between which dactyl closes. First uropods project beyond second and third peduncle slender, much longer than rami. Inner edge of peduncle of second uropods with acute serrations. Edges of rami of second and third uropods acutely serrate, serræ larger on inner rami. Third uropods with subconic ramus, curved, shorter than peduncle and two or three short spines at tip. Telson emarginate, lobes armed with numerous very short hook-like spines. Color? Length 6 mm.

(Holmes.)

Remarks.—Known from our limits according to Holmes, who mentions it from Great Egg Harbor.

Genus AMPITHOE Leach.

Ampithoe Leach, Edinburgh Encyclop., 1813-14, p. 402. Type *Cancer Gammarus rubricata* Montagu, monotypic.¹ (Not consulted.)

Amphithoc, *Amphitoe*, *Amphithæ*, *Amphita*, auct.

Cymadusa Savigny, Mem. An. Sans Vert., I, 1816, p. 109. Type *Cymadusa filosa* Savigny, monotypic.

Anisopus (nec Meigen 1803, Serv. 1835, Haan 1835) Templeton, Trans. Entom. Soc. London, I, 1836, pt. 3, p. 185. Type *Anisopus dubius* Templeton, monotypic.

Pleonexes Bate, Ann. Mag. Nat. Hist. London, (2) XIX, 1857, p. 147. Type *Pleonexes gammaroides* Bate, monotypic.

Sunamphitoe Bate, l. c. Type *Sunamphitoe hamulus* Bate, first species, designated by Boeck, Skand. Ark. Amphipoder, 1878, p. 593.

Sunamphithoe, *Synamphithoe*, auct.

Body slender, compressed, coxal plates of moderate size and closely contiguous, fifth pair with anterior lobe very large, forming together with preceding pairs a continuous series. Cephalon rather deep, with frontal part but little produced. Eyes small, but distinct. Superior antennæ without any accessory appendage and usually longer than inferior, and latter much stronger in male than in female. Buccal area strongly prominent. Anterior lip rounded, and posterior lip with outer lobes bifid at tip. Mandibles very strong, with cutting-edge coarsely dentate. Palp comparatively short with terminal joint large and expanded, and densely setous both at tip and inner edge. First

¹ Leach, l. c., Am. Ed., VII, 1815, p. 241.

pair of maxillæ with masticatory lobe coarsely spinous at tip, basal lobe small unisetose, palp of moderate size, and terminal joint slightly expanded. Second pair of maxillæ with outer lobe much larger than inner. Maxillipeds with masticatory lobes large and dentate inside, palp comparatively short. Gnathopoda distinctly subcheliform, in female not very strong and in male much more powerful, especially posterior ones, but otherwise of same structure as in female. Peræopoda rather stout, three posterior pairs successively increasing in length, and with propodal joint simple, basal joint of antepenultimate pair short and broad, that of last two pairs oval in form. Last pair of uropoda with basal part rather massive, rami subequal in length, outer one lamellar and armed with two recurved hooks, inner one conical in form. Telson of moderate size, with small tuberculiform projection on either side of tip.

Species few. Characterized by the long slender body, strong development of inferior antennæ in male, shape of mandibular palps and posterior lip, structure of gnathopoda in both sexes, and form of telson.

Key to the species.

- a.* Second antennæ with flagellum generally longer than last joint of peduncle; first gnathopods with carpus and hand narrow and very much elongated; palm very short, transverse; dactyl, when closed, projects far beyond end of palm; length nine mm.; common; color variable.
longimana
- aa.* Second antennæ subpediform, flagellum often shorter than last joint of peduncle; first gnathopods with short stout hand; length eighteen mm.
rubricata

Ampithoe longimana (S. I. Smith).

PLATE 59.

- Ampithoe longimana* (S. I. Smith) Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 370. Among eel-grass.
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 563. *New Jersey; Great South Bay, Long Island; Vineyard Sound.*
- Holmes, Biol. Bull., II, 1901, pp. 165-193, fig. 1. Provincetown to New Jersey.
- Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 509, figs. New Jersey to Massachusetts.

- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 72. Long Island Sound.
- Amphitha longimana* Holmes, Amer. Nat., XXXVII, 1903, p. 289. Cape Cod to Cape Hatteras region.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1906), p. 165. Hypothetical in New York City.
- ?*Amphithoe punctata* Say, Journ. Acad. Nat. Sci. Phila., I, pt. 2, 1818, p. 383. Great Egg Harbor, New Jersey.
- Amphithoe punctata* De Kay, N. Y. Fauna, Crust., VI, 1844, p. 38 (on Say).
- White, Cat. Crust. Brit. Mus., XXV, 1847, p. 87. Great Egg Harbor, New Jersey (Say's material).
- Bate, Cat. Amph. Crust. Brit. Mus., 1862, p. 241 (from Say).

Description.—Body rather slender. Eyes round, red in life. First antennæ slender, about long as body. Second basal segment longer than first, nearly twice long as third. Second antennæ stouter than first, especially in male, somewhat shorter. Peduncle much elongated, about twice length of flagellum. First five coxal plates much deeper than segments, first strongly produced at anterior angle and concave on superior free edge, and three following plates oblong. Gnathopods in male well developed, first pair unusually elongated. Carpus long and narrow, propodus three or more times long as wide, broad as and about long as carpus, short palm transverse, and large dactyl projects far beyond palm when closed. Both carpus and propodus with posterior edge thickly covered with rather short setæ. Second gnathopods with subtriangular carpus, much shorter than propodus. Latter oblong, much wider than in first pair. Palm oblique, concave, posterior angle prominent. Gnathopods in female comparatively small. Propodus of first pair oblong, longer than carpus, oblique palm rounded posteriorly where armed with strong spine, and dactyl projects beyond palm, but not nearly so far as in male. Second gnathopods with carpus produced into narrow distally setose lobe, oblong hand shorter and broader than in first pair, and oblique palm defined posteriorly by slight projection and strong spine. None of angles of abdominal segments produced posteriorly. Terminal uropods with rami of subequal length, not more than half length of peduncle. Color very variable, dark reddish to light green. Length 9 mm. (Holmes.)

Remarks.—The range for this animal is from Provincetown, in Massachusetts, south to New Jersey, though no definite record has been given for our limits. It is likely that Smith's record refers to Great Egg Harbor Bay.

The most interesting account is the exhaustive memoir by Holmes, which treats exclusively of this species, from which the following points are gathered. It appears to be not uncommon among seaweed near shore, especially in eel-grass. It is preyed on by small jelly-fish (*Gonionemus*), to which it falls an easy victim. Its food consists mostly of seaweed and small bits of flesh of most any animal. The swimming of the animal is mainly effected by the pleopoda, though the first impulse is gained by the sudden extension of the abdomen, giving the body a rapid forward movement. The abdomen is then held in an extended position and the pleopods, which then hang at nearly right angles to the body, serve to continue the forward motion. The animal is unable to walk over a plane surface, and out of the water makes indifferent progress by gliding movements produced by alternately flexing and extending the abdomen. It is incapable of leaping like the sand fleas. Its nests are tubular, generally exceeding the animal somewhat in their length. They are constructed upon red seaweeds, or in eel-grass, or *Ulva*. The nest is open at both ends of uniform diameter, and bits of seaweed are usually woven in. Though frequently leaving the nest, it does not seem to return to its own more readily than to any other, and simply enters the first unoccupied nest it meets with. When established in a nest it is driven out only with difficulty, and it appears to be on the alert to keep out all intruders. Its instinct to remain in the nest when danger threatens is in great contrast to its quickness in flight when roaming about free. A new nest is made in less than an hour. The male carries the female about for a considerable period, and maintains his hold against efforts to dislodge him with great pertinacity. The female remains remarkably passive when carried about by the male. Her body is usually held quite strongly flexed, the male doing the swimming for both, so that the female is transported as so much dead weight.

The *Ampithoe punctata* of Say is possibly identical. The original account gives the following characters: Eyes ovate, acute and distant above. Clypeus not projecting into an angle. Antennæ elongated, first pair two-thirds length of second pair and nearly equal to body, attenuated. Hands not dentated, equal, oval, not larger than carpus. Feet with posterior pair not serrated on hind edge of dilated thighs, but armed with three or four short spines. Body and antennæ above, sprinkled with numerous black points, fasciated on abdominal segments. Length rather more than three-tenths of an inch. It was obtained several years prior to 1818, at Great Egg Harbor, and was said to be not uncommon. Say's type was also deposited in the Academy of Natural Sciences of Philadelphia. Should it ever be proved the same, Say's name will supersede the present name of the species.

Ampithoe rubricata (Montagu).

PLATE 60.

- Cancer Gammarus rubricatus* Montagu, Trans. Linn. Soc. London, IX, 1808, p. 99, Pl. 5, fig. 1. *South coast of Devonshire.*
- Ampithoe rubricata* Holmes, Amer. Nat., XXXVII, 1903, p. 289. Arctic America to Cape Hatteras region.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 72. Bay of Fundy to Long Island Sound.
- Paulmier, 58th Ann. Rep. N. Y. State Mus., IV, 1904 (1906), p. 165. Hypothetical in New York city.
- Ampithoe valida* Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 315. Under rocks at low water.
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 563. *New Jersey and Long Island Sound.*
- Paulmier, l. c., p. 164, fig. 38. New York City.
- Ampithoe maculata* Kingsley, Standard Nat. Hist., II, 1884, p. 77, fig. 106. Our shores (eastern United State understood).
- Heilprin, An. Life of our Sea Shore, 1888, Pl. 7, fig. 7. New Jersey and south shore of Long Island.

Description.—Body rather stout, moderately compressed. Eyes small, circular to oval. First antennæ sometimes exceed half of body length, frequently in female. First and second joints subequal, twice length of third, and slender flagellum

usually longer than peduncle. Second antennæ stout, characteristic of male, in which sex they are sometimes subequal with first pair. Short thick flagellum of few joints, often less than half peduncle length. Coxal plates deeper than their segments, first with well extended anterior angle, this rounded narrowly. Second coxal plate broad, and front angle broadly rounded. First gnathopods in male stout, broad basal joint forming prominent lobe at inferior angle, oblong with obliquely-convex palm, and spine at rounded posterior angle. Second gnathopods with broad basal joint, and with smaller and more acute inferior lobe than in first pair. Rather stout hand with terminal tuft of plumose setæ, and oblique palm convex proximally, somewhat concave distally, hind angle produced. Carpus of first gnathopods in female shorter than in male, hand narrower though in other respects similar. Second gnathopods with hand of female like that of male, less setose at tip, and hind end of palm with strong spine. Hind angles of three front segments of abdomen rounded. Terminal uropods exceed half peduncle length. Color green to reddish, usually light-colored spots along median dorsal line in a series, arranged as a single spot to a segment. Length 20 mm.

Remarks.—A species of wide distribution, ranging south on the eastern Atlantic slope to France and the Azores, and along the coast of North America south to New Jersey at least. I have a single example, obtained some years ago at Point Pleasant, by Mr. Witmer Stone. This species is found under rocks and seaweed at low tide, and is also found in tubes covered with sand or other matter.

Family IPHIMEDIDÆ.

Body rather robustly formed, more or less spiny, integuments highly incrustated. Cephalon produced in front to a deflexed rostrum, postantennal corners not projecting. Coxal plates well developed, anterior pairs usually tapering to a point. Eyes distinct. Antennæ rather slender, superior ones usually longer, without any accessory appendage. Buccal area greatly projecting inferiorly, with oral parts more or less prolonged and

peculiarly modified to adapt them for semi-parasitic life. Gnathopoda rather unequal in structure, usually feeble and anterior ones always extremely slender, often showing an approach to cheliform character. Peræopoda normal, basal joint of three posterior pairs laminarily expanded. Last pairs of uropoda with rami narrowly lanceolate and edged with minute denticles. Telson unarmed, slightly incised at tip.

Genera three, represented in northern seas. Some are said to be parasitic and others are thought to be semi-parasitic.

Genus ACANTHONOTOZOMA Boeck.

Acanthonotozoma Boeck, *Island. Amphip.*, 1876, p. 237. Type *Acanthonotus cristatus* Owen, designated, first species.

Acanthonotosoma, *Acanthostoma*, auct.

Acanthonotus (nec Schneider 1801) Owen, *Append. Second Voy. Ross*, 1835, p. 90. Type *Acanthonotus cristatus* Owen, monotypic.

Vertumnus (nec Otto, 1821) (Leach) White, *Cat. Crust. Brit. Mus.*, 1847, p. 89. Type *Vertumnus cranchii* White, monotypic.

Body more or less compressed, distinctly carinated dorsally, and carina usually elevated to posteriorly pointing projections. Cephalon with rather large rostrum evenly curved downwards, lateral corners small. Three anterior pairs of coxal plates rather narrow, tapering to a point. Fourth pair considerably larger and securiform in shape, outer part triangularly pointed. Two succeeding pairs moderate in size, with posterior lobe deeper than anterior. Eyes comparatively small. Superior antennæ with peduncle rather elongated. Anterior lip narrowly prolonged and minutely incised at tip. Posterior lip with lobes narrowly produced. Mandibles rather elongated, cutting part narrowly projected, very narrow accessory lamella on both mandibles, molar expansion obsolete, and palp slender. First pair of maxillæ with masticatory lobe very obliquely truncated at tip, armed with short denticles, basal lobe triangularly pointed and with numerous short setæ on inner edge, palp comparatively small. Second pair of maxillæ with outer lobe much larger than inner, obliquely truncated at tip. Maxillipeds with broad basal part laminar, basal lobes nearly of same size as masticatory

ones, palp comparatively small and dactylus very minute. Anterior gnathopoda extremely slender and attenuated, monodactylous. Posterior gnathopoda shorter and stouter than anterior, not subcheliform. Peræopoda comparatively strong, basal joint of three posterior pairs moderately expanded, more or less produced at infero-posteal corner. Last pair of uropoda with inner ramus longer than outer. Telson oblong-oval in form, with apical incision rather narrow.

Species about four. The only one assigned to this genus, from our limits, is here allowed on the suggestion of Bate.

Acanthonotozoma sayi (Bate).

Acanthonotus sayi Bate, Cat. Amph. Crust. Brit. Mus., 1862, p. 128 (name based on Say).

Ampithoe serrata (nec *Oniscus serratus* Fabricius 1792) Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 383. *Egg Harbor, New Jersey.*

Ampithoe serrata De Kay, N. Y. Fauna, Crust., VI, 1844, p. 38 (on Say).

Description.—Rostrum acute. Eyes large, black, oval, placed at outer base of first antennæ, and approximated above. Antennæ equal, short and stout, reach base of sixth segment of body. Hands with about three equidistant prominent spinose teeth on inferior edge of palm, nail or thumb curved, acute and reaching third tooth. Eight, ninth and tenth segments of body serrated, last more conspicuously so. Length two-fifths of an inch. (Say.)

Remarks.—Only known from Say's account. He adds further on that the species is remarkable for its large eyes, short and stout antennæ, and serrated appearance of hind part of back, occasioned by elevation of tip of each of those segments above the base of the succeeding one. The species has not been rediscovered since Say's time, when it was secured in Great Egg Harbor.

Family ORCHESTIIDÆ.

Body rather tumid, more or less compressed, metasome and urosome comparatively short and stout. Coxal plates rather large, fourth pair not emarginated posteriorly, and fifth pair

deeply bilobed. Cephalon truncated anteriorly, and buccal mass greatly projects inferiorly. Eyes comparatively small, situated near dorsal face of cephalon. Superior antennæ generally very much shorter than inferior, without any accessory appendage. Inferior antennæ more or less pediform, peduncle rather elongated and its basal joint coalesced with cephalon. Anterior lip large, rounded. Epistome applanated. Posterior lip membranous, with projecting lateral corners. Mandibles without palps, very powerful, cutting-edge divided into two superposed lamellæ which strongly denticulate on edges, molar expansion large and thick, and between both a series of curved setæ. First pair of maxillæ with palp obsolete or nearly so, masticatory lobe well developed and furnished at tip with several strong denticulated spines, basal lobe very narrow, with two short and densely ciliated curved setæ at tip. Second pair of maxillæ with lobes rather broad and densely setiferous on inner edge. Maxillipeds with masticatory lobes very small and rounded, basal lobes much larger and armed at tip with short teeth and bristles. Palp rather large, joints complanated and short hairs at edges. Gnathopoda of various structure, second pair more generally different in two sexes. Peræopoda rather strong, edged with tufts of short spines, three posterior pairs successively increasing in length and having basal joint broad and laminar. Branchial lamellæ generally very small and vesicular in form. Pleopoda poorly developed. First two pairs of uropoda strong, with both rami, as also basal part, denticulated. Last pair very small, with only a single minute ramus. Telson short and thick.

The members of this family are more or less adapted to a terrestrial life, and when out of the water progress by quick leaps or abrupt hops. Genera several. Of the genus *Hyalella*, *Hyalella knickerbockeri* (Bate) was based on specimens in the British Museum received from Say and ascribed to North America, "in brooks, under stones." Similarly another species, *Hyalella sayi* (Bate), was also described from North America. Their admission to the fauna of New Jersey has never yet been demonstrated.

Key to the Genera.

- a. First gnathopods subchelate in both sexes; size moderate. ORCHESTIA
 aa. First gnathopods simple in female; size large. TALITRUS

Genus ORCHESTIA Leach.

Orchestia Leach, Edinburgh Encyclop., XI, 1813, p. 326. Type *Cancer Gammarus littoreus* Montagu, monotypic.¹ (Not consulted.)

? *Psammylla* Rafinesque, Amer. Month. Mag. Crit. Rev., II, November, 1817, p. 41. Type *Psammylla littoralis* Rafinesque, monotypic.

? *Psammopsylla* Rafinesque, nom. orig.

Orchestes, auct.

Body more slender and compressed than in *Talitrus*. First pair of coxal plates rather small, fifth pair almost as deep as preceding and deeply bilobed. Cephalon, antennæ and oral parts almost exactly as in *Talitrus*. Anterior gnathopoda small, subcheliform in both sexes, propodus with distinctly defined palmar border. Posterior gnathopoda very dissimilar in two sexes, in female about as in *Talitrus*, in male very strongly developed, terminating with very large and powerful subcheliform hand. Peræopoda about as in *Talitrus*, but last pair somewhat more elongated, and often peculiarly modified in male. Branchial lamellæ small. Incubatory lamellæ of same structure as in *Talitrus*, but considerably larger. Appendages of metasome and urosome almost as in *Talitrus*.

Species numerous, mostly terrestrial. I do not know if *Orchestes* is the original spelling adopted by Leach. If not, and *Orchestia* is given, it must be used. Leach uses *Orchestia* in 1815.

Key to the species.

- a. First antennæ not quite reaching tip of penultimate segment of second; hand of second gnathopods of male with notch near posterior end of palm; carpus of posterior peræopods in adult male much swollen; common under masses of seaweed near the shore. *agilis*

¹ Leach, Edinburgh Encyclop., Am. Ed., 1815, p. 241.

- aa. First antennæ reaching slightly beyond tip of penultimate joint of second; hand of second gnathopods of male oval, palm regularly curved, with slight prominence at hind end but not notched; common around salt marshes. *palustris*

Orchestia agilis S. I. Smith.

PLATE 61.

Beach Flea.

- Orchestia agilis* (S. I. Smith) Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 314. The shores.
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873, p. 555, Pl. 4, fig. 14. *Bay of Fundy to New Jersey.*
- R. Rathbun, Fisher. Ind. U. S., I, 1884, p. 824. All the shores.
- Kingsley, Standard Nat. Hist., II, 1884, p. 77, fig. 106. Our shores.
- Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, N. J.
- Heilprin, An. Life of Our Sea Shore, 1888, p. 95, Pl. 7, fig. 6. N. J. and southern shore of Long Island.
- Holmes, Am. Nat., XXXVII, 1903, p. 274. Arctic America to Florida.
- Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 469, figs. Bay of Fundy to N. J.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 53. Bay of Fundy to Connecticut.
- Mayer, Sea Shore Life, 1906, p. 97, fig. 66. Long Island Sound.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1906), p. 154, fig. 21. New York City.
- ? *Talitrus gryllus* Bosc, Hist. Nat. Crust., II, 1802, p. —, Pl. 15, figs. 1-2. *Carolina.* (Not consulted.)
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 36, Pl. 7, fig. 19. Along sandy beaches, New York.
- Talitrus gryllus* Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 386. Inhabits sandy beaches.
- Orchestia gryllus* White, Cat. Crust. Brit. Mus., XXV, 1847, p. 86. United States (sandy beaches, on Say's material).
- Bate, Cat. Amph. Crust. Brit. Mus., 1862, p. 19, Pl. 3, fig. 2 (Say's material).
- ? *Psammylla littoralis* Rafinesque, Amer. Month. Mag. Crit. Rev., II, November, 1817, p. 41. *Long Island shores, New York, Hudson River.*

Description.—Body moderately long, rather slender. Eyes conspicuous. First antennæ scarcely extend to penultimate joint of second antennæ, and flagellum shorter than peduncle. Second antennæ scarcely half body length, stout peduncle in male with last joint little longer than preceding one, though

flagellum shorter and of ten to fifteen short compressed joints. First gnathopods in male with carpus produced below into rounded large lobe, distally broadened propodus shorter than carpus, and hind lower angle produced as large rounded lobe, with distal edge formed as palm against which dactyl closes, also deep notch between this lobe and base of dactyl. Second gnathopods in male with very large stout propodus, convex palm very oblique and notched short distance within little produced hind angle. In female carpus and propodus without lobes, though hind edge of former somewhat produced below middle. Second gnathopods of female with oblong propodus rounded below, and minute dactyl on front edge not reaching lower end. Merus and carpus in posterior peræopods swollen in adult male. Rami of first uropods distinctly shorter than peduncle. Rami of second uropods subequal with peduncle. Rami of third uropods much narrower than thick peduncle, and about as long. Telson more or less pointed, narrowly rounded behind, spinulose. Color olive-brown generally. Antennæ reddish or reddish-brown. Legs, coxal plates and hind portions of body tinged bluish. Length 10 mm.

Remarks.—Distributed along the eastern coast of North America from New Jersey (though it likely ranges southward also) to the Bay of Fundy on the north. It is very common among seaweed, where cast in masses, near the shore or above high-water mark. It appears to seldom occur as far up on the beach as *Talitrus*, and in the daytime it is more active. It is truly a remarkable leaper, hopping with very great rapidity for a great distance, as compared with its size. In disturbing masses of the seaweed perfect swarms of these beach fleas skip about in all directions. It feeds largely on seaweeds, though will not reject animal food. They are seldom found under masses of drift or seaweeds unless damp, or, if so, is usually buried some distance in the sand. It is a perfectly good swimmer if the occasion necessitates, and is also sometimes strongly attracted to the light. Interesting accounts of this and other species and their phototactic habits are given by Holmes.¹

¹ Amer. Journ. Physiology, V, p. 211.

Very many examples examined from Point Pleasant, Seaside Park, Holly Beach, and Highland Beach above Cape May. Outside the State examples were found at Long Beach on Long Island, and on Dewey Beach in Delaware. Mr. W. T. Davis collected specimens at Staten Island and at Center Island, on Long Island, New York, which I also examined.

Orchestia palustris S. I. Smith.

PLATE 62.

- Orchestia palustris* (S. I. Smith) Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 468. Salt marshes.
 — S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 555 (261), *Cape Cod to New Jersey*.
 — Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, N. J.
 — Holmes, Am. Nat., XXXVII, 1903, p. 274. Arctic America to Florida.
 — Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 471, figs. Cape Cod to New Jersey.
 — M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 53. Cape Cod southward.
 — Smallwood, Cold Spring Harbor Monogr., III, 1905, pp. 1-21, Pls. 1-3. Cold Spring Harbor, Long Island, N. Y.
 — Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1906), p. 154, fig. 22. New York City.

Description.—Body moderately long, compressed. Eye prominent. First antennæ reach slightly beyond end of penultimate basal joint to second antennæ, and three basal joints subequally long, flagellum nearly or quite equaling peduncle in length. Second antennæ with penultimate basal joint two-thirds length of last one, and flagellum longer than peduncle. Second, third and fourth epimera quadrate, somewhat wider than deep. First gnathopods of male with carpus having large rounded lobe below, distally broadened propodus formed into rounded lobe at lower hind angle. Second gnathopods of male with oval hand, evenly convex and very oblique palm spinous, and hind end defined by small prominence within which dactyl tip closes. Palm otherwise forms an even curve with hind edge of hand, dactyl fitting closely. First gnathopods in female without lobe to carpus or propodus, though carpus somewhat rounded and produced at

lower hind angle. Second gnathopods of female with oblong propodus rounded below, and second joint rather broad, also somewhat strongly and evenly convex in front. Lower hind angles of second and third abdominal segments produced into acute triangular points. Rami of first uropods shorter than peduncle. Rami of second uropods subequal to peduncle. Rami of third uropods equal or exceed peduncle, rather large. Telson notched behind, lobes rounded, spinulose. Color olive-brown to olive-green, sometimes reddish-brown. Antennæ reddish-brown. Length 18 mm.

Remarks.—The distribution is from Cape Cod to Texas. I have New Jersey examples from Point Pleasant and the Manasquan River banks, secured by Mr. Wilmer Stone. It differs from *Orchestia agilis* chiefly in its larger size, longer first antennæ, less robust hand of the second pair of gnathopods of the male, of which palm not lobed, and differently shaped second joint in female gnathopods. It also has a different habitat, living usually around the salt marshes, frequently not near the shore. In such localities it is found among grass and weeds, or under various objects affording refuge for concealment. It also runs or crawls more than *Orchestia agilis*, and hops less frequently. It is said to live nearly or quite up to the fresh-water, sometimes occurring in almost dry places above high-water marks.

Genus TALITRUS Latreille.

Talitrus Latreille, Hist. Nat. Crust., III, 1802, p. 38. Type *Oniscus locusta* Pallas, first species, designated by Boeck, Skand. Ark. Amphipoder, 1872, p. 104.

Talitrus, auct.

Talorchestia Dana, Amer. Journ. Sci. Art., (2) XIV, 1853, p. 310. Atypic. (Type *Talitrus gracilis* Dana, first species, in Proc. Amer. Assoc. Adv. Sci., II, 1852, p. 201.)

Body less compressed, with broadly rounded back. First pair of coxal plates smaller than second, fifth pair rather large, regularly bilobed. Superior antennæ very small, much shorter than peduncle of inferior, and latter elongated, subpediform,

much stronger in male than in female, and two basal joints more or less completely coalesced with cephalon. No olfactory spine. First pair of maxillæ with only slight rudiment of palp. Maxillipeds with palp rather short and broad, terminal joint or dactylus quite wanting. Anterior gnathopods simple, not subcheliform, somewhat stronger in male, and carpal joint elongated and linear in form. Posterior gnathopoda in both sexes of similar structure, rather feeble and almost bare, terminating with an imperfectly cheliform hand, dactylus being quite rudimentary. Branchial lamellæ very small. Incubatory lamellæ likewise small, lanceolate, with only few marginal setæ. Telson rather broad, rounded at tip.

Species few, distinguished from *Orchestia* chiefly by the anterior simple gnathopoda, the posterior ones exactly alike in both sexes, and the less compressed body. The American species all belong to the subgenus *Talorchestia*, which is defined by Dana as having the first pair of gnathopods of the male as in *Talitrus*, though the female has them furnished with a very small hand, the latter absent in the female of *Talitrus*. Provisionally I have allowed *Talitrus* to supersede *Talorchestia*.

Key to the species.

- a.* Eye moderate; second antennæ in male about long as body; hand of second gnathopods in male oblong, palm with large lobe near middle and large prominence at hind end. *longicornis*
- aa.* Eye very large; second antennæ in male about one-third long as body; hand of second gnathopods of male subovate, distally widened, palm evenly convex with no lobe near middle, but defined posteriorly with prominence. *megalophthalmus*

Talitrus longicornis Say.

PLATES 63, AND 150, FIGURE 8.

Talitrus longicornis Say, Journ. Acad. Nat. Sci. Phila., I, pt. 2, 1818, p. 384.
The seabeach of New Jersey.

Orchestia longicornis DeKay, N. Y. Fauna, Crust., VI, 1844, p. 36, Pl. 9, figs. 28-28a (♀). Long Island shores.

—— White, Cat. Crust. Brit. Mus., XXV, 1847, p. 86. New Jersey (Say's material).

—— Bate, Cat. Amp. Crust. Brit. Mus., 1862, p. 18, Pl. 3, fig. 1 (Say's example).

- Talorchestia longicornis* Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 336. Sandy shores.
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 556. Cape Cod to New Jersey.
- R. Rathbun, Rep. Fisher. Ind. U. S., 1884, p. 825. Great Egg Harbor to Labrador.
- Holmes, Am. Nat., XXXVII, 1903, p. 274. Arctic America to Hatteras.
- Smallwood, Cold Spring Harbor Monogr., I, 1903, pp. 1-27, Pls. 1-3. Cold Spring Harbor, Long Island, N. Y.
- Holmes, Bull. Bur. Fish., XXIV, 1904 (1905), p. 468, figs. Cape Cod to N. J.
- Mayer, Sea Shore Life, 1906, p. 97, fig. 66. Atlantic coast, near New York.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1906), p. 155, fig. 23. New York City.
- Talorchestia longirostris* Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, New Jersey. (Lapsus specifically.)

Description.—Body elongate, robust, moderately compressed. Cephalon small, convex, not prominent. Eye large. First antennæ small, but little larger than penultimate joint of peduncle of second, flagellum of about six segments and about long as preceding basal joint. Second antennæ long, in males sometimes long as body, last joint of peduncle armed with short spinules and longer than all preceding joints, and flagellum longer than peduncle. Epimera shorter than their segments, lower edges short, setose. First gnathopods in male with fifth joint produced at lower distal angle as long rounded lobe, and sixth joint distally widened, lower distal angle produced and rounded. Transverse palm with dactyl much protruded. Second gnathopods in male with large thick oblong hand, front edge rounded evenly, and hind edge nearly straight. Oblique palm with hind angle produced, medianly with broad convex lobe, and short dactyl strongly curved at tip closes on inner side of prominence at outer end of palm. First gnathopods of female as in male, but without prominent lobe on fifth joint, and sixth joint not distally broadened or produced as lobe at lower distal angle. Second gnathopods weak, with second joint much broadened and well convex anteriorly. Oblong hand with lower end rounded, and minute dactyl on edge some distance above end of hand. Third peræopods very short, second joint wide as long. Mesosome with

seven segments, more robust than metasome. Latter consists of three large segments, becoming more constricted posteriorly. Urosome smallest of body segments. First uropods reach slightly beyond second, subequal rami about equal to peduncle. Second uropods with rami longer than peduncle, and inner considerably longer than outer. Third uropods with rami about long as peduncle, much narrower. Telson triangular, fleshy, with median dorsal groove, and tip triangular. Color whitish, and sometimes a median series of brown spots dorsally. Antennæ reddish or pink basally, flagella blue. Propodi of posterior pereopods blue. Length 20 mm.

Remarks.—Distributed from Cape Cod to New Jersey, where it is abundant on sandy beaches along the seashore. They lie quiet in burrows, indicated by small holes in the sand, all of which are usually found well above the high tide mark. A large example before me is from Spray Beach in Ocean county, and I have also seen others at Cape May and Point Pleasant. They are capable of swimming actively when so forced by high tides. Many undoubtedly fall a prey to the shore birds, fishes and ghost crabs. Mr. W. T. Davis found it on Staten Island, and at Amagansett, Rockaway Beach and at Fire Island on Long Island, New York.

Holmes says the burrows they make in the sand are only a few inches deep, and the depth depends on how far the animal has to dig in order to reach moist sand. When dug out in the daylight they are rather sluggish, and apparently dazed. It often curls up and lies quiet as if feigning death, and may even be picked up and handled in some cases without betraying signs of animation. When aroused it cunningly makes a few leaps, when, especially if it alights upon loose sand, it lies quiet for a short time and then begins to burrow. At night it comes out of its burrows and may be seen in large numbers running over the seaweed recently washed ashore, which affords its principal food. Then it is very alert and is able to detect one's approach at a distance of several yards. It is strongly attracted to light and gathers around a lantern in swarms. In fact the easiest way to procure a large number of this species is to take a lantern into their midst at

night, placing it in the middle of a large blanket or sheet. Those that gather about the lantern may then be collected in quantity and preserved.

Talitrus megalophthalmus (Bate).

PLATES 64, 65, AND 150, FIGURE 7.

Orchestia megalophthalma Bate, Cat. Amph. Crust. Brit. Mus., 1862, p. 22.

Locality unknown (based on Leach MS.).

Talorchestia megalophthalma Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 336. Sandy shores.

——— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 556. Cape Cod to New Jersey.

——— R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 825. Great Egg Harbor, New Jersey.

——— Holmes, Amer. Nat., XXXVII, 1903, p. 275. Cape Cod to Cape Hatteras region.

——— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 469, figs. Cape Cod to New Jersey.

——— Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1906), p. 156, fig. 24. New York City.

?*Talitrus quadridis* De Kay, N. Y. Fauna, Crust., VI, 1844, p. 36, Pl. 9, fig. 27. Under stones and seaweed (N. Y.).

Talorchestia macropthalma Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, New Jersey. (Lapsus specifically.)

Description.—Eyes very large, covering most of head. First antennæ with three joints of peduncle subequal in length, though flagellum much shorter than peduncle. Second antennæ rather short, less than half of body in length. First gnathopods in male with fifth joint furnished with prominent lower lobe, and sixth joint narrowing somewhat from base to within short distance from distal end, where broadened into rounded posterior lobe. Second gnathopods of male with large more or less ovate hand, front edge evenly convex and hind edge shorter, nearly straight. Palm oblique, spinulose, evenly convex, and prominence with spine at hind end. First gnathopods in female without prominent lower lobe and sixth joint tapers distally, not produced at lower end. Second gnathopods of female weak, much broadened second joint well convex in front, oblong hand with lower end rounded, and minute dactyl on edge some distance above end of hand. Second abdominal

segment produced into small acute triangular process at lower distal angle. First uropods with equal rami, about equal to peduncle. Second uropods with rami longer than peduncle, and inner ramus longer. Third uropods with ramus slightly longer than peduncle. Color whitish. Length 15 mm.

Remarks.—Distributed from Maine to New Jersey and found along sandy beaches. I have examined numerous examples from the banks of the Manasquan River, Point Pleasant, Holly Beach, Seaside Park and Highland Beach. It is much less common than *Talitrus longicornis*, and may be distinguished by its very large eyes and the shape of the second gnathopods in the male. I have also met with it at Chincoteague Island, Virginia. Mr. T. D. Keim has collected it at Sheepshead Bay and Long Beach, on Long Island.

Sub-Order ISOPODA.

The Isopods.

Body flattened dorso-ventrally and composed of three divisions, *i. e.*, a head, a thorax formed of seven segments, and an abdomen of six segments. Sometimes one or two thoracic segments united with head. Eyes usually present, paired, sessile and compound, contiguous or distant. Head appendages two pairs of antennæ, pair of maxillipeds, two pairs of maxillæ and pair of mandibles. Maxillipeds often provided with an epignath on outside. In parasitic forms mouth-parts strongly modified, some parts entirely disappeared. Appendages of thorax seven pairs of legs, last pair sometimes wanting. Legs of uniform structure and appearance in terrestrial forms, frequently first pair in many forms, and even second, third and fourth pairs differ conspicuously in structure, length and function from succeeding pairs. Six pairs of abdominal appendages, usually five pairs of pleopods and a pair of uropods. Pleopoda sometimes natatory, but their function respiratory mostly. Some or all of abdominal segments united. Telson rarely free. Marsupial plates developed in the female, form an incubating pouch.

Key to the super-families.

- a. Legs of first pair not cheliform.
- b. Uropoda terminal.
- c. Pleopoda fitted for air-breathing. ONISCOIDEA.
- cc. Pleopoda not fitted for air-breathing, entirely branchial.
- f. Pleopoda generally covered by thin opercular plate (modified first pair); free-swimming. ASELOIDEA.
- ff. Pleopoda never covered by opercular plate: parasitic. BOPYROIDEA.
- bb. Uropoda lateral.
- g. Uropoda valve-like, inflexed, arching over pleopoda, latter largely branchial. IDOTHEOIDEA.
- gg. Uropoda form together with terminal segment of abdomen caudal fan; pleopoda for most part natatory. CYMOTHOIDEA.
- aa. Legs of first pair cheliform; uropoda terminal; pleopoda, when distinct, exclusively natatory. TANAIODEA.

Super-Family ONISCOIDEA.*The Wood Lice.*

Body more or less depressed, oval or oblong in form, and sometimes capable of being rolled into a ball. Cephalon generally small, more or less sunk into first segment of mesosome, showing no true rostral projection, and lateral parts may be more or less expanded. Mesosome formed of seven well-defined and rather uniform segments, with their lateral parts generally expanded to thin fornicate plates. Metasome usually divided into six well-defined segments, lateral plates or epimeræ, of which some may be expanded similarly to those of mesosome. Usually this not the case with the last, and two anterior segments, which are also usually smaller than three middle ones. First pair of antennæ always very small, placed inside second pair, never with more than three joints, and last of which often rudimentary. Second pair of antennæ normal, formed by a five-articulated peduncle and a flagellum generally divided into a restricted number of articulations. Length of second antennæ moderate, seldom more than half of body length. Buccal mass more or less prominent, and oral parts adapted to biting and

tritulating food. Mandibles strong, always without palps. Anterior maxillæ normal, with two masticatory lobes, inner of which with two or three brush-like setæ at tip. Posterior maxillæ peculiar, laminar, with only very slight indication of subdivision into lobes. Maxillipeds not completely covering oral parts, and terminal part more or less reduced. Marsupial pouch in female formed of four pairs of broad lamellæ issuing from bases of second to fifth pairs of legs. Appendages of metasome six pairs, five anterior respiratory in character, inner plate of very delicate spongy structure and outer more strongly chitinized, covers inner like an operculum. Sometimes opercular plate has on two anterior pairs, more seldom on all pairs, air-cavities or pseudo-tracheæ. In male inner plate of second and often of first pair, modified to serve for copulative purposes. Last pair of appendages represent uropoda, usually biramose, with rami uniarticulate, and project more or less behind.

Sars says "The forms of this tribe are generally found in damp situations, beneath leaves, stones or timber, often in great numbers, and feeding, it would seem, on both animal and vegetable matter. They all seem to avoid the full light of day, and some forms even lead a true subterranean existence, in which case the eyes are often rudimentary or wholly absent. As to the respiration, it cannot properly be said to be exclusively air-breathing in the same sense as in insects. It is in fact to some extent branchial, and therefore a certain amount of atmospheric moisture is indispensable to their existence. It is for this reason that in very dry weather these animals seem almost wholly to disappear, retiring more or less deeply into crevices and hollows, where some moisture remains."¹

The following interesting extract, showing to some extent the part these animals played in early therapeutics, was kindly forwarded by Dr. Richard J. Phillips:

Small beds of this thyme (*Thymus citridorus*) together with mint are cultivated at Penzance in which to rear millepedes, or

¹Crust. Norway, II, 1899, p. 154.

hoglice, administered as pills for several forms of scrofulous disease. The woodlouse, sowpig, or hoglouse, abounds with a nitrous salt which has long found favour for curing scrofulous disease and inveterate struma, as also against some kinds of stone in the bladder. The hoglouse, or millepede, was the primitive medicinal pill. It is found in dry gardens under stones, etc., and rolls itself up into a ball when touched. These are also called chiselbobs, and cudworms. From three to twelve were formerly given in Rhenish wine for a hundred days together to cure all kinds of cancers; or they were sometimes worn round the neck in a small bag (which was absurd!). In the Eastern counties they are known as "old sows" or "St. Anthony's hogs." Their Latin name is *Porcellus scaber*. The Welsh call this small creature the "withered old woman of the wood," "the little pig of the wood," and "the little grey hog," also "grammar sows." Their word "gurach" like "grammar," means a dried up old dame. (W. T. Fernie, in Herbal Samples.)

Key to the Families.

- a. Maxillipeds with large lamellar terminal joints, much longer than acutely produced masticatory lobe. SCYPHACIDÆ.
- aa. Maxillipeds with small and almost rudimentary terminal joints, hardly longer than truncate masticatory lobe.
- b. External antennæ generally short, with small antennal openings; body able to be contracted into a ball; head immersed in first thoracic segment; lateral parts of head undifferentiated; clypeus perpendicular; legs generally short; uropoda short, not reaching beyond terminal segment of abdomen or preceding segment; terminal segment short and broad. ARMADILLIDIDÆ.
- bb. External antennæ generally long, close together, with large antennal openings; body usually not capable of contracting into a ball; head less manifestly immersed in first thoracic segment; lateral parts of head separated by vertical marginal and inframarginal line; clypeus arched; legs generally long; uropoda produced, reach beyond terminal segment of abdomen and preceding segment; terminal segment narrower than preceding ones, usually conically produced at end.

ONISCIDÆ.

Family SCYPHACIDÆ.

Head without median or antero-lateral lobes. Front not margined, but continuous with epistome. Second pair of antennæ

with flagellum composed of four articulations. First maxillæ with inner lobe furnished with two plumose setæ, and outer lobe furnished with teeth. Second maxillæ furnished with hairs. Mandibles without molar process. Maxilliped with masticatory lobe acutely produced, elongated palp much longer than masticatory lobe and its articulations not distinctly defined. Large abdomen not abruptly narrower than thorax. Uropoda extend beyond tip of abdomen, and inner branch inserted at upper angle of basal article.

Genus **SCYPHACELLA** S. I. Smith.

Scyphacella S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 567 (273).
Type *Scyphacella arenicola* S. I. Smith, monotypic.

Antennæ of eight distinct segments, with geniculation at articulation of fourth with fifth segment. Terminal portion or flagellum, formed of three closely articulated segments, besides minute apical one. Mandibles slender. Outer lobe of first maxillæ with recurved spines along distal half of inner edge. Inner lobe with two widely separate plumose processes, one at tip and other on inner edge. Second maxillæ with hairs at tip. Both first and second maxillæ long and slender. Epignath of maxillipeds long, narrow, acutely produced at tip. Eyes large, composed of many ocelli. Abdomen not narrower than thorax. Uropoda exposed, both branches styliform.

Scyphacella arenicola S. I. Smith.

PLATE 66.

- Scyphacella arenicola* S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 568 (545). *Somers and Beesley's Points, New Jersey*.
— (S. I. Smith) Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 337. New Jersey (reference to habits).
— Harger, Proc. U. S. Nat. Mus., II, 1879, p. 157. Great Egg Harbor, N. J. (Nantucket, Mass.)
— Harger, Rep. U. S. F. Com., VI, 1878 (1880), pp. 307, 433, Pl. 1, fig. 2. Great Egg Harbor, N. J.
— Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 363. New Jersey. (Massachusetts.)
— Stebbing, Hist. Recent Crust., (Int. Sci. Series LXXIV), 1893, p. 422. United States (reference).

- H. Richardson, Amer. Nat., XXXIV, 1900, p. 307. Atlantic coast south to Cape Cod.
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 576. Egg Harbor, N. J.
- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 671, figs. 710-713. Egg Harbor, N. J. Mouth of Choptank River, Dorchester county, Md.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 47. (Massachusetts.)

Description.—Body elliptical. Abdomen not abruptly narrower than thorax. Whole dorsal surface, except end of abdomen, covered with small, depressed tubercles, which give rise to minute spinules. Eyes round, prominent. Antennæ little longer than body breadth, first and second segments short and equal, third, fourth and fifth successively longer and fifth rather longer than terminal portion. Latter more slender than fifth segment, tapers regularly to tip, formed of three successively much shorter segments and very short somewhat spiniform obtuse terminal one. All segments, except minute terminal one, scatteringly beset with spinules. Legs beset with small spines. Ischial, meral, carpal and propodal segments subequal. Terminal process of last segment of abdomen narrow, triangular, apex slightly rounded, and dorsal surface a little concave. Posterior caudal appendages much shorter than abdomen, rami slightly subequal, outer stout and spinulose and inner a little shorter and much more slender. Color nearly white, with chalky-white spots and scattered blackish dots arranged irregularly. Eyes black. Length, 3 to 4 mm. (S. I. Smith.)

Remarks.—This species was originally described from Somers and Beesley's Points, where it was discovered in April of 1871. It burrows in the sand of the beaches, just above ordinary high-water mark, in company with *Talitrus longicornis*, and several species of beetles. It makes a little conical mound of sand around the aperture to the burrow. Its distribution is from Massachusetts to Maryland.

Family ARMADILLIDIDÆ.

The Pill Bugs.

Body convex, contractile into a ball, integuments strongly incrustated. Cephalon flanked by side-plates of first segment of

mesosome, front sub-truncate, marginate, lateral lobes distinct, median lobe obsolete, epistome vertical. Metasome not abruptly contracted, terminal segment short and broad. Antennæ comparatively small, with flagellum biarticulate or triarticulate. Oral parts of similar structure to Oniscidæ. Legs comparatively short. Opercular plates of all pleopoda, or only of two anterior pairs, provided with air-cavities. Copulative appendages about as in Oniscidæ. Uropoda short, not extending beyond limits of last segment and epimeral plates of penultimate one. Young, on leaving mother, all with seven segments of mesosome distinctly defined.

Genera about ten.

Genus **ARMADILLIDIUM** Brandt and Ratzeburg.

The Pill Bugs.

Armadillidium (Brandt) Brandt and Ratzeburg, Med. Zoöl., II, 1830-34, p. 81.

Type *Armadillidium commutatum* (Brandt) Brandt and Ratzeburg, first species.

Armadillo (nec Brisson 1756) Latreille, Hist. Nat. Crust. Inest., VII, 1804, p. 47. Type *Armadillo vulgaris* Latreille, first species.

Body oblong or elliptical in form, very convex, and capable of being rolled up into a perfect ball. Cephalon with front distinctly marginate, lateral lobes rounded and sharply defined at base. Epistome vertical, forming above a triangular shield, advancing more or less beyond frontal edge. Side plates of first segment of mesosome large, securiform, not incised behind. Metasome semicircular, with edges continuous throughout. Last segment lamellar, quadrangular or triangular in form, not extending beyond limits of epimeral plates of penultimate segment. Eyes distinct, lateral. Antennulæ with terminal joint but little produced. Antennæ usually attains half body length, penultimate peduncular joint scarcely longer than second, flagellum biarticulate. Opercular plates of only first two pairs of pleopoda with air-cavities. Uropoda very short, basal part broad, lamellar, outer ramus spatulate, inner narrow, cylindrical.

Armadillidium vulgare (Latreille).

PLATES 67 AND 68.

Pill-bug.

- Armadillo vulgaris* Latreille, Hist. Nat. Crust., VII, 1804, p. 48. "*Il est tres-commun.*" (France.)
- Armadillidium vulgare* Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 435. World-wide (reference).
- H. Richardson, Amer. Nat., XXXIV, 1900, p. 305. North America.
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 574. World-wide.
- Stoller, 54th Rep. N. Y. State Mus., I, 1900 (1902), p. 213r. Syracuse, N. Y.
- Paulmier, 58th Rep. N. Y. State Mus., IV, 1904, p. 184, fig. 58. Bay Shore, Long Island, and probably within New York City limits.
- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 666, fig. 706. World-wide. (Washington, D. C.; Syracuse, N. Y.; Bay Shore, Long Island; Woodside, Md.)
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 47. (Massachusetts and Rhode Island.)
- Armadillo pilularis* Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 432. *North America.*
- Armadillo pillularis* De Kay, N. Y. Fauna, Crust., VI, 1844, p. 52. (Evidently New York.)
- Armadillidium pillulare* White, Cat. Crust. Brit. Mus., XXV, 1847, p. 101. United States (Say's material).
- Budde-Lund, Crust. Isopod. Terr., 1885, p. 66. New York.
- Armadillidium pilulare* Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 360. New York and Pennsylvania.

Description.—Body well convex, oblong, ovate, length twice its width, and capable of being rolled up into a ball. Head broader than long, with straight front, and epistome projecting but slightly beyond it. Eyes composite, rounded, small, and placed on anterior angles of head laterally. First antennæ rudimentary, of three segments, obscure. Second antennæ with first segment short, second segment about four times length of second, third segment about half length of second, fourth segment one and one-half times longer than third, and fifth seg-

ment twice length of fourth. Flagellum of two subequal segments. Second antennæ reach to hind edge of first thoracic segment. Maxillipeds with a palp formed of three segments. No palp to mandibles. Thoracic segments subequal, and no epimera separated off on any of segments. Abdomen broad as thorax, first two segments covered laterally by seventh thoracic segment, and sixth or terminal segment broader than long, tapering to truncate end. Uropoda not longer than terminal body segment, peduncle not visible as viewed dorsally, and broad outer branch fills space between sixth abdominal segment and lateral part of fifth segment, truncate at its posterior end. Inner branch of uropoda narrow, elongate, not extending beyond end of abdomen. Legs all ambulatory. Color varies from gray to almost black. In some specimens back varied with pale blotches, often arranged as three longitudinal series. Often between these rows of pale spots group of pale streaks. Length 16 mm.

Remarks.—The “pill bug” is of world-wide distribution, living mostly in moist places, as under stones or logs, in crevices or under rocks, about greenhouses, cellars, under boards, etc. It has also been found on floating sea-weed. It is unfortunately classed as injurious to the garden, destroying vegetables grown in greenhouses. It is also said to injure various plants, and be one of the most destructive pests with which the mushroom grower is forced to contend. My examples from South Dennis and Dias Creek, in Cape May county. In Pennsylvania I have found it about Philadelphia, as at Holmesburg, Bustleton, Torresdale and Bristol. Mr. W. T. Davis found it at Lakehurst and Staten Island.

Family ONISCIDÆ.

The Wood Lice.

Body oval or oblong, with lateral parts of segments more or less expanded. Metasome with two anterior segments rather small, and with epimeral plates concealed. Last segment much narrower than preceding ones, conically produced at end. Eyes compound, generally well developed. Antennulæ very small.

with apical sensory appendages short, papilliform. Antennæ usually slender, with flagellum pauciarticulate. Buccal mass not very prominent below. Mandibles with cutting part highly chitinized and as usual of two superposed dentate lamellæ, behind which a membranous hairy lappet and varying number of pencils, molar expansion obsolete, without any triturating surface, it replaced by brush-like recurved seta. Anterior maxillæ with outer masticatory lobe very strong and coarsely spinous at tip, inner lobe much narrower, with only two hairy bristles. Posterior maxillæ distinctly bilobed at tip, with outer edge angularly produced near base. Maxillipeds with basal part broad and laminar, though scarcely expanded distally, terminal part poorly developed and never composed of more than three joints, last very narrow. Masticatory lobe short, truncate near tip. Epignath large, flanking basal part. Legs usually slender, increasing in length posteriorly. Sexual appendage of male simple, conic, generally connected with inner rami of first pair of pleopoda. Latter very largely developed, ending each in highly chitinized conical joint, obliquely grooved below, for conducting evacuated sperm. Inner ramus of second pair of pleopoda in male end in slender lash finely pointed at tip. Uropoda with outer ramus more or less flattened, lanceolate, inner much smaller, sublinear, and usually attached far in front of outer.

Key to the genera.

- a. External opercular ramus of first and second pairs of abdominal appendages furnished with tracheæ, flagellum of external antennæ biarticulate. PORCELLIO.
- aa. External opercular ramus of abdominal appendages contains no special respiratory organ; flagellum of external antennæ triarticulate.
- b. Epimera of thoracic segments small; abdomen abruptly narrower than thorax; first two segments generally equal in length those following, and very small epimera manifest. PHILOSOCIA.
- bb. Epimera of thoracic segments large, with all posterior angles acute; abdomen not abruptly narrower than thorax; first two abdominal segments very short, three following ones large, with large acute epimera. ONISCUS.

Genus **PORCELLIO** Latreille.*Sow Bugs.*

Porcellio Latreille, Hist. Nat. Crust., VII, 1804, p. 45. Type *Porcellio scaber* Latreille, first species.

Body oval, more or less depressed, with lateral parts lamellarly expanded. Cephalon partly flanked by side-plates of first segment of metasome, lateral lobes well developed, frontal lobe more or less projecting and distinctly defined from epistome. Metasome not abruptly contracted, epimeral plates of third to fifth segments prominent and recurved, and last segment conically produced. Eyes usually well developed, subdorsal. Antennæ moderately slender, flagellum of two articulations only. Oral parts normal. Legs gradually increasing in length posteriorly, last pair in male sometimes differing from that in female. Opercular plates of two anterior pairs of pleopoda, and sometimes also of three succeeding pairs, provided with distinct air-cavities. Copulative organs of male similar in structure to *Oniscus*. Uropoda distinctly projecting, outer ramus lanceolate, inner much smaller, linear, originating far in front of former.

Key to the species.

- | | |
|--|----------------|
| a. Surface of body roughly granulate or tuberculate. | <i>scaber.</i> |
| aa. Surface of body smooth or minutely granular. | <i>lævis.</i> |

Porcellio scaber Latreille.

PLATE 69.

Porcellio scaber Latreille, Hist. Nat. Crust., VII, 1804, p. 45. "*Trouve plus particulièrement sur les murs.*" (France.)

— Budde-Lund, Crust. Isopod. Terr., 1885, p. 129. New York, Niagara.

— Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 427. Europe and North America.

— H. Richardson, Proc. U. S. Nat. Mus., XXI, 1899, p. 863. Worldwide.

— H. Richardson, Amer. Nat., XXXIV, 1900, p. 304. North America.

— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 568. Ocean Grove, New Jersey. (Niagara; New York; Woodside, Md.)

- Stoller, 54th Rep. N. Y. State Mus., I, 1900 (1902), p. 213r. Schemnectady, N. Y.
- Paulmier, 58th Rep. N. Y. State Mus., IV, 1904, p. 183, fig. 56. All over New York City.
- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 621, fig. 671. Ocean Grove, New Jersey. (Niagara; Westfield and New York City, N. Y.; Woodside, Md.; world-wide.)
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 46. (New England.)
- Porcellio nigra* Say, Journ. Acad. Nat. Sci. Phila., I, 1817, p. 432. *Pennsylvania*.
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 52 (on Say).
- Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 362. *Pennsylvania*.
- Porcellio niger* White, Cat. Crust. Brit. Mus., XXV, 1847, p. 99. *Pennsylvania* (Say's material).

Description.—Body not capable of being rolled up into a ball, ovate, and length less than twice width. Head width twice its length, front edge trilobate, has a median and lateral lobe each side. Median frontal lobe triangular, though apex obtuse, and rounded lateral lobes extend as far forward as median lobe. Eyes rounded, composite, small, and placed at base of expansions extending laterally and in front. First antennæ rudimentary, formed of three segments, obsolete. Second antennæ with short basal segment, second segment about one and one-half times length of first, third segment long as second, fourth segment nearly twice length of third, and fifth segment nearly twice length of fourth. Flagellum formed of two unequal segments, of which first shorter. Second antennæ reach middle of third thoracic segment. Maxillipeds with a palp formed of three segments. Mandibles without palps. Thoracic segments subequal, and without indication of epimera on any of segments. Abdomen broad as thorax, first two segments covered laterally by lateral parts of seventh thoracic segments. Sixth or terminal segment produced in narrow triangle, rounded behind, base greater than length. Uropoda longer than terminal abdominal segment, outer branch extending slightly beyond and inner branch just reaches tip of last body segment. Legs all ambulatory. Surfaces of body segments all covered with small tubercles. Color varies from nearly uniform gray-black to paler or brownish, varied with dark to blackish spots of irregular

form, and marginal border formed by lateral portions of segments being light yellow. Length 10 mm.

Remarks.—World-wide in distribution, living under boards, logs, bricks, stones, leaves, stumps, drift along the shore, and in greenhouses and cellars. When disturbed, as by lifting up objects under which it may be hidden, it runs away with considerable speed, seeking dark crevices. My examples from Point Pleasant, Spray Beach, Swift City on Long Beach, Ventnor, Crooked Creek, Highland Beach, Dias Creek, South Dennis and Trenton. In Pennsylvania I have it from Bethlehem, Falsington, Holmesburg, Gladwynne and Paper Mills. In Maryland it was common at Elkton, Northeast, Cedar Island in the Chop-tank River, Baltimore, and along the Big Bohemia Creek. Very abundant at Chincoteague, Virginia. Mr. W. T. Davis found it on Staten Island, New York.

Porcellio lævis Latreille.

PLATE 70.

Porcellio lævis Latreille, Hist. Nat. Crust., VII, 1804, p. 46. "*Sous les pierres.*" (France.)

—— De Kay, N. Y. Fauna, Crust., VI, 1844, p. 52. New York.

—— Stebbing, Hist. Recent Crust. (Intern. Sci. Ser. LXXIV), 1893, p. 427. World-wide.

—— H. Richardson, Proc. U. S. Nat. Mus., XXI, 1899, p. 862. World-wide.

—— H. Richardson, Am. Nat., XXXIV, 1900, p. 304. North America.

—— H. Richardson, Proc. U. S. Nat. Mus., XXI, 1901, p. 566. World-wide.

—— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 614, fig 666. World-wide. (Washington, D. C.)

Description.—Body with length nearly twice its width, oblong, ovate. Head broader than long, front edge trilobate, median lobe triangulate and larger lateral lobes rounded. Eyes composite, small, placed at bases of anterior lateral expansions. First pair of antennæ small, obsolete, formed of two segments. Second antennæ with first segment short, second segment one and one-half longer than first, third segment long as second, fourth segment almost twice length of third, and fifth segment one

and one-half length of fourth. Flagellum formed of two segments, first little longer than second. Second antennæ reach middle of third thoracic segment. Thoracic segments mostly equal, first with anterior lateral angles protruding to surround head and extend as far front as bases of anterior lateral lobes of head. Epimera perfectly united with segments. All six abdominal segments distinct, first two with lateral parts concealed by seventh thoracic segment. Third, fourth and fifth abdominal segments with lateral portions produced to continue oval contour of body. Sixth or terminal segment is broader than long, widely triangular, with a produced attenuate apex, and latter furnished with a shallow groove its whole extent. Uropoda with basal segment reaching tip of hind angles of lateral parts of fifth abdominal segment. Inner ramus of uropoda partly concealed above by apical process of sixth abdominal segment, and extending half its own length beyond latter. Outer rami of uropoda extend almost their entire length beyond apical process of sixth abdominal segment. Legs all ambulatory and spinulose. Color dark gray. Along each side of median line dorsally, two bands of paler color formed as longitudinal bands made up of waved streaks. Length 15 mm.

Remarks.—World-wide in distribution. It lives in similar locations to that of the preceding species, as cellars, under logs and stones, etc. It is said to be injurious to cotton and sugar beets. Also like the preceding species it has been described under numerous different specific names, from different parts of the world. I have an example from South Summerville.

Genus PHILOSCIA Latreille.

Philoscia Latreille, Hist. Nat. Crust., VII, 1804, p. 44. Type *Oniscus sylvestris* Fabricius, monotypic.

Body oval, slightly convex, with rather thin integuments. Cephalon rounded in front, without any projecting lateral lobes. Side plates of mesosome but slightly prominent. Metasome abruptly contracted, with epimeral plates small and appressed. Last segment not much produced. Eyes lateral, well developed.

Antennæ very slender, with flagellum composed of three articulations. Mandibles with only single pencil behind cutting part. Legs very slender and greatly increasing in length posteriorly. Opercular plates of uropoda without any air-cavities and scarcely bilobed. Uropoda not much produced, with inner ramus not attached so far in front as usual.

Philoscia vittata Say.

PLATE 66.

Philoscia vittata Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 429. *United States*.

—— De Kay, N. Y. Fauna, Crust., VI, 1844, p. 50. (New York.)

—— Harger, Rep. U. S. F. Com., I, 1871-72 (1873), p. 569. Connecticut to New Jersey.

—— Harger, Proc. U. S. Nat. Mus., II, 1879, p. 157. Far north as Barnstable, Massachusetts.

—— Harger, Rep. U. S. F. Com., VI, 1879 (1880), pp. 306, 433. Pl. 1, fig. 1. Somers Point and Beesley's Point, New Jersey.

—— Budde-Lund, Crust. Isopod. Terr., 1885, p. 209 (compiled).

—— Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 361. New Jersey. (Connecticut and Massachusetts.)

—— H. Richardson, Amer. Nat., XXXIV, 1900, p. 305. North America.

—— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 565. Great Egg Harbor, New Jersey, to Massachusetts.

—— Paulmier, 58th Rep. N. Y. State Mus., IV, 1904, p. 181, fig. 53. Freeport, Long Island.

—— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 605, figs. 661 to 663. Great Egg Harbor, New Jersey, to Massachusetts. (Freeport, Long Island.)

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 45. (Massachusetts and Connecticut.)

Description.—Body a trifle over twice as long as broad. Head broader than long, front edge convex, not lobate. Anterior lateral angles of head rounded, not formed into lobes. Eyes composite, small, rounded, and placed on the anterior lateral angles of head. First antennæ small, rudimentary, obsolete. Second antennæ long, first segment short and robust, second and third segments subequally long with each more than double length of first, fourth segment nearly twice length of either two preceding, and fifth segment one and one-half longer than

fourth. Flagellum formed of three nearly subequal segments, third little longer than second. Second antennæ reach hind edge of third thoracic segment. Maxillipeds with palp formed of three segments. No palps to mandibles. Thoracic segments subequal, first slightly longer than others. No epimera separated from any of segments. Abdomen abruptly narrower than thorax. First two abdominal segments covered at sides by seventh thoracic segment. Lateral portions of segments not developed. Sixth or terminal abdominal segment of triangular form, and apex not produced or rounded. Uropoda with basal segment extending to end of abdomen, inner rami extend slightly beyond terminal abdominal segment, and outer rami but very slightly longer than inner. Legs all ambulatory. Color brown, with light lateral edges and narrow longitudinal light area or band in middle of dorsal surface, separating two wide dark bands. Length 6.5 mm. (H. Richardson.)

Remarks.—The range of this species is quite restricted, extending only from Massachusetts to our present limits, having been originally described from Great Egg Harbor by Say. It lives under wood, stones, logs, etc., in moist places. Along the shore it occurs under rubbish, and on the underside of boards above high water.

Genus ONISCUS Linnæus.

Wood Lice.

Oniscus Linnæus, Syst. Nat., Ed. 10, 1758, p. 636. Type *Oniscus asellus* Linnæus, ninth species.

Body broad and depressed, with lateral parts of segments lamellarly expanded. Cephalon with well defined lateral lobes, front imperfectly defined from epistome. Metasome not abruptly contracted, last segment considerably produced. Eyes large, sublateral. Antennulæ with terminal joint well developed. Antennæ slender and elongated, with flagellum composed of three articulations. Mandibles with numerous pencils behind cutting part. Legs moderately slender, generally increasing

posteriorly. Opercular plates of uropoda without any air-cavities, those of two anterior pairs deeply bilobed. Uropoda rather produced, with inner ramus originating far in front of outer.

Oniscus asellus Linnæus.

PLATE 71.

Oniscus asellus Linnæus, Syst. Nat., Ed. 10, 1758, p. 637. "*In Domibus. Muris, Hybernaculis, lignis putrides.*"

— De Kay, N. Y. Fauna, Crust., VI, 1844, p. 51, Pl. 6, fig. 12. New York.

— Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 430. Throughout Europe and North America.

— H. Richardson, Amer. Nat., XXXIV, 1900, p. 305. North America.

— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 562. (Greenland, Massachusetts and Rhode Island.)

— Stoller, 54th Rep. N. Y. State Mus., I, 1900 (1902), p. 213r. Schenectady, N. Y.

— Paulmier, 58th Rep. N. Y. State Mus., IV, 1904, p. 180, fig. 52. All over N. Y. City.

— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 600, fig. 657. Pennsylvania, New York City, Schenectady, Syracuse.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 45. (Maine, Massachusetts and Rhode Island.)

Oniscus affinis Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 430. *North America.*

— White, Cat. Crust. Brit. Mus., XXV, 1847, p. 98. United States.

— Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 361. Pennsylvania.

— H. Richardson, Amer. Nat., XXXIV, 1900, p. 305. North America.

— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 563. North America.

Oniscus murarius Budde-Lund, Crust. Isopod. Terr., 1885, p. 207. New York and New Jersey.

Description.—Body about one and one-half times longer than broad, oblong, ovate. Head broader than long, with frontal edge slightly curved convexly, and pronounced anterior lateral lobes narrowly elongate and rounded anteriorly. Eyes composite, small, placed at sides of head at bases of anterior lateral lobes. First antennæ small, formed of two segments, obsolete. Second antennæ with short basal segment, second segment twice length of first, third segment equals length of second, fourth segment nearly twice length of third, and fifth segment one and one-half times length of fourth. Flagellum formed of three seg-

ments. Retracted second antennæ reach hind edge of third thoracic segment. Thoracic segments subequally long. First segment with anterior lateral angles produced to surround head and extending almost to end of anterior lateral lobes of head. Lateral parts of all segments expanded, without any indication of epimera, and lateral edges straight. Abdominal segments all distinct, first two somewhat shorter with their lateral parts entirely concealed by seventh thoracic segment. Lateral parts of third, fourth and fifth segments expanded and produced to continue oval contour of body. Lateral parts of fifth segment extend posteriorly far as end of sixth or terminal segment. Latter triangular, with a long produced apex, pointed posteriorly. Uropoda with basal segment reaching to middle of produced portion of terminal abdominal segment. Inner rami of uropoda reach to end of process of terminal segment and concealed by it except at lower portion. Outer rami of uropoda extend well beyond end of process of terminal segment. Legs all ambulatory. Color above dark brown. Longitudinal row of light yellow spots on either side of thorax, about at point of junction of epimera with segments. Lateral edges of body light yellowish. Dorsal portion of carapace slightly granular. Length 16 mm.

Remarks.—A species of very wide distribution, common in greenhouses, under logs, dead leaves, stones, etc. In New Jersey I have found it very abundant in several localities, as at Cape May, South Dennis, Cape May Court House, Camden, Florence and Trenton. It is not very rapid or agile in its movements, though running away deliberately to conceal itself when disturbed. In Pennsylvania I have it in Fairmount Park in Philadelphia, Holmesburg, Bristol and Gladwynne. Mr. W. T. Davis secured it on Staten Island, New York.

These animals were at one time used medicinally, according to the American Homœopathic Pharmacopœia.¹ The live animals were crushed and covered with five parts by weight of alcohol, and the mixture allowed to remain eight days in a well-stoppered bottle, in a dark, cool place, being shaken twice a day. The tincture was then poured off, strained and filtered, being then ready for use.

¹ See J. T. Connor, Ed. 2, 1883, p. 350.

Super-Family ASELOIDEA.

The Asels.

All segments of metasome fused together to form more or less broad shield-like plate, the caudal segment. Pleopoda wholly without swimming-power, exclusively branchial in character, and in considerably reduced number. Usually first pair transformed to single opercular plate, and to protect extremely delicate succeeding pairs this operculum in male peculiar. Uropoda terminal, never form part of caudal fan, or being of valvular character. Though appendages of metasome quite unserviceable for locomotion, some forms are expert swimmers. This is effected by aid of three posterior pairs of legs being modified as oar-like swimming implements, by strokes of which the animal is propelled backwards. Form of body greatly variable, sometimes very broad and depressed, sometimes slender and elongated, approaching to a cylindrical shape. Cephalon always well defined, mesosome showing normal number of segments which sometimes form into two rather distinct sets by means of a median constriction. Coxal plates very small or quite obsolete, never forming marginal area. Superior antennæ generally smaller than inferior, which sometimes attain an excessive length. Oral parts normal. Only first pair of legs assume a subcheliform structure.

*Family ASELLIDÆ.**The Asels.*

Body more or less broad, depressed, with lateral parts of segments lamellar. Cephalon of moderate size, without any rostrum, lateral parts scarcely expanded. Caudal segment large. Shield-like eyes, when present, small and lateral. Both pairs of antennæ with multiarticulate flagella, superior ones much smaller than inferior and issuing close together. Oral parts normal. Legs ambulatory, except first pair, which distinctly subcheliform.

Pleopoda in female in four pairs, first very small, not operculiform, consisting each of single rounded lamella. Three succeeding pairs biramous, with both rami lamelliform, outer lamella of second pair very large and incrustated, and forming together with corresponding lamella of other side sort of operculum, completely covering two succeeding pairs. Pleopoda in male of five pairs, an additional very small pair, forming copulative appendages, interposed between first and second. Uropoda comparatively large, biramous, rami styliform or lamellar.

Genera about four, and most of them entirely fresh-water in habitat.

Genus ASELLUS G. St. Hilaire.

The Asels.

Asellus G. St. Hilaire, Hist. Insect., II, 1764, p. 671. (Type *Oniscus aquaticus* Linnæus, monotypic, though species polynomial.)

? *Lirceus* Rafinesque, Annals of Nature, 1820, p. 7. Type *Lirceus fontinalis* Rafinesque, monotypic.

Abacura S. F. Baird, Iconographic Encyclop., II, 1851, p. 112. Type *Asellus communis* Say, monotypic.

Body broad, depressed, with lateral parts of segments simple, not laciniate. Cephalon not very large, rounded, truncated in front, lateral faces convex. Caudal segment very broad, slightly produced at tip. Eyes, if present, very small, consist of limited number of usual elements. Superior antennæ scarcely longer than peduncle of inferior ones, latter slender, elongated, without any outer appendage on peduncle. Mandibles with well-developed palp, molar expansion thick, subcylindric in form. Second pair of maxillæ with outer lamellæ broad, laminæ edged with numerous curved and coarsely denticulated spines. Maxillipeds, in female, at base with posteriorly pointing setous lappet, epignath broad, edged with bristles. First pair of legs with carpus very small, propodus much larger and broader in male than in female. Succeeding pairs rapidly increase in length, carpal joint well developed, propodal one linear, dactylus spinulose inside. Uropoda with subequal rami, slender, styliform.

A single species in our limits, common throughout our fresh waters.

Asellus communis Say.

PLATE 72.

Water Asel.

- Asellus communis* Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 427. *Our fresh waters. Schuylkill water, Philadelphia.*
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 49. New York.
- White, Cat. Crust. Brit. Mus., XXV, 1847, p. 96. United States (Say's material).
- S. I. Smith, Rep. U. S. F. Com., II, 1872-73 (1874), p. 657, Pl. 1. fig. 4. (Philadelphia, Pennsylvania; Connecticut; Massachusetts; Michigan.)
- Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 358. New York and Pennsylvania.
- Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 377. (New England, on Harger).
- H. Richardson, Amer. Nat., XXXIV, 1900, p. 297. (Pennsylvania, Indiana, Illinois, Michigan, Mississippi.)
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 551. (Schuylkill River, Pa.; Massachusetts; Connecticut; Indiana; Illinois; Michigan; Mississippi; New York.)
- Paulmier, 58th Rep. N. Y. State Mus., IV, 1904, p. 178, fig. 50. New York City.
- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 420, figs. 472 to 473. (New York, Pennsylvania, Virginia.)
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 43. (New England.)

Description.—Body three times longer than wide, oblong, ovate, and sides nearly parallel. Head width twice its length, narrower in front than behind and with front emarginated slightly. Eyes composite, small, rounded, placed laterally or at sides of head midway between front and hind edges. First antennæ with basal segment wide, short, reaching end of second segment of second antennæ. Second segment of first antennæ one and one-half times longer than first segment, and third segment three-fourths length of second. Flagellum formed of fourteen segments, and reaches end of peduncle of second antennæ. Second antennæ with first three segments short, subequal, fourth segment long as combined length of first three, and fifth segment one and two-thirds longer than fourth. Flagellum formed of about ninety segments, and reaches hind edge of fifth thoracic segment.

Maxillipeds with palp of five segments. Mandibular palp formed of three segments. First thoracic segment slightly longer than others, which latter subequal. All segments with small epimera at anterior lateral angles of segments. Abdomen formed of two short segments, seen only in middle of dorsal surface, and large terminal segment, its hind lateral angles rounded and hind edge slightly produced as broad triangular process between uropoda. Latter about long as terminal abdominal segment, and peduncle about long as inner rami, which latter broad and tapering narrowly to acute end. Outer rami of uropoda about half width of inner, also tapering to narrow pointed end. Female with first pleopoda attached close together. First pair of legs prehensile, with propodus greatly expanded, and lower edge produced in one long and one short triangular process. All other legs ambulatory. Color brownish above, much paler below. Above spotted and mottled more or less in some specimens, with dull yellowish tints. Length (without uropoda and antennæ) 15 mm.

Remarks.—This usually abundant species in most of our fresh waters ranges from Massachusetts to Virginia, Mississippi and Michigan. It is most frequently found in quiet water, as pools, ponds and lakes, or slow-running streams, under stones. In this State I have found it common, sometimes in great numbers at various of the following places: Cold Spring Inlet, Nummy Town, Fishing Creek, Pond Creek, New England Creek, Coxe's Hall Creek, Goshen Creek, Crooked Creek at Cape May Court House, Dennis Creek near South Dennis, Dennisville, Dias Creek, Palermo, Cedar Swamp Creek, Bridgeton, Pitman, Mantua, Wenonah, Camden, Pensauken, Turnersville, Berlin, Atco, Hammonton, Speedwell, Delanco, Burlington, Florence, Trenton and Lake Hopatcong. Mr. W. T. Davis found it at Terrace Pond, and says it is common in most ponds and slow-flowing brooks of Staten Island, New York.

The following notes and associations which I have gathered may be interesting.

Abundant with *Gammarus fasciatus*, *Umbra pygmaea*, *Fundulus heteroclitus macrolepidotus* and *F. diaphanus* in Crooked Creek

at Cape May Court House, on January 5th, 1908. Later the same day we also found it abundant in Great Sound Creek with *Umbra*, *Fundulus heteroclitus macrolepidotus* and *Apeltes quadracus*.

Common in Repaupo Creek at Repaupo, April 19th, 1908, with *Anguilla chrisypa*, *Ameiurus nebulosus*, *Umbra pygmaea*, *Aphredoderus sayanus* and *Enneacanthus gloriosus*.

Abundant in Chestnut Branch at Pitman, Gloucester County, October 1st, 1909, with *Anguilla chrisypa*, *Semotilus bullaris*, *Notropis cornutus*, *Erimyzon succetta oblongus*, *Schilbeodes gyrinus*, *Umbra pygmaea*, *Fundulus heteroclitus macrolepidotus*, *F. diaphanus*, *Enneacanthus gloriosus*, *Eupomotis gibbosus* and *Boleosoma nigrum olmstedii*.

Abundant October 24th, 1909, at McPherson's Branch of Pond Creek, near Cape May, with *Gammarus fasciatus*, *Umbra pygmaea*, *Fundulus heteroclitus macrolepidotus* and *Gambusia gracilis*. We also found it the same day in New England Creek with *Gammarus*, *Gambusia* and *Eupomotis gibbosus*, and in Fishing Creek with *Gammarus*, *Abramis crysoleucas*, *Umbra pygmaea*, *Aphredoderus*, *Enneacanthus gloriosus* and *Eupomotis*.

On December 5th, 1909, Mr. T. D. Keim reports it abundant at Brookdale in Notch Creek, from where the Boonton Aqueduct crosses the Morris Canal till about one mile below. This is interesting as most of the following were dug out of leaves in the mud, though the upper end of the stream was coated with ice. Besides *Gammarus fasciatus*, the only other crustacean noted, the entire list of vertebrates was as follows: *Pctromyzon marinus*, *Abramis crysoleucas*, *Notropis bifrenatus*, *N. cornutus*, *Rhinichthys atronasmus*, *Catostomus commersonnii*, *Erimyzon succetta oblongus*, *Ameiurus nebulosus*, *Schilbeodes gyrinus*, *Esox reticulatus*, *Umbra pygmaea*, *Acantharchus pomotis*, *Ambloplites rupestris*, *Lepomis auritus*, *Eupomotis gibbosus*, *Perca flavescens*, *Boleosoma nigrum olmstedii*, *Desmognathus fusca*, *Acris gryllus crepitans*, *Rana clamata*, *R. palustris* and *Thamnophis sirtalis*.

On October 13th, 1911, it was very abundant with *Gammarus fasciatus*, *Anguilla chrisypa*, *Fundulus heteroclitus macrolepidotus*, *F. diaphanus* and *Apeltes quadracus* in Crooked Creek at

Cape May Court House. On October 14th it was exceedingly abundant, associated with *Gammarus fasciatus* and *Notonectes*, in the fresh-water ditches tributary to Dias Creek near the village of the same name.

On December 2d, 1911, it was common at Bridgeton with *Palæmonetes vulgaris*, *Gammarus fasciatus*, *Planorbis trivolvis*, *Physa heterostropha*, *Somatogyrus altilis*, *Unio complanata* and *Anodonta cataraactæ*, the mollusca identified by Mr. E. G. Vanatta.

Super-Family BOPYROIDEA.

Female.—Often conspicuously asymmetrical, even when body segmentation is apparent. In latter case three chief divisions, as cephalon, mesosome and metasome may be distinguished, though each not very sharply defined. Cephalon generally carries in front two pairs of rudimentary antennæ, and produced below to conic prominence exhibiting on tip of oral aperture. Oral parts much reduced, only mandibles and maxillipeds distinctly developed, with former styliform and converging to oral orifice, and latter lamelliform. Legs, when present, all alike, prehensile, terminating in a minute hand. Pleopoda sometimes rather large, all branchial in character, while in larvæ natatory. Uropoda, when present, always very small and simple, not forming with last segment a caudal fan.

Male.—Of diminutive size, and generally found clinging to genital region of female like a parasite. Appearance also very different from that of female, retaining several larval characters, and sometimes not differing from last larval stage except by presence of generative organs.

Remarks.—Parasitic forms, found on other crustacea of different orders. They represent the most degraded isopods, sometimes the fully-grown female being a simple sac filled with ova, without any trace of segmentation or of limbs. All forms show a more or less pronounced regressive metamorphosis, comprising at least two distinct larval stages, very dissimilar in both general appearance and in structure of the several appendages, and equally

different from adult animals. Probably in most forms even a third intermediate larval stage (the microniscus stage) occurs. Sexual dimorphism very pronounced in all forms. Sometimes the parasite penetrates to the inner organs of its host, looking merely like an endoparasite, and in all such cases the body of the female is found to be greatly deformed.

The resemblance of certain of the Cymothoidea to these animals was thought by some to express relationship. As now generally contended, their similarity is more likely due to parasitic habits, their structural characters indicating them of but remote relation, and no trace of annectant forms has been discovered.

No less than seven families have been proposed, but as several of these are said to represent only different transitory larval stages, thus only four families are all Sars admits. These families were framed originally more with reference to the host on which the bopyroid was parasitic, as Microniscidæ on Copepoda, Cyproniscidæ on Ostracoda, Dajidæ on Schizopoda, Cabiropsidæ on Isopoda and Amphipoda, Cryptoniscidæ on Cirripedia, Entoniscidæ on Brachyura and Bopyridæ on decapodous crustacea.

Family BOPYRIDÆ.

Body of female distinctly segmented, more or less asymmetrical, twisted now to right, now to left, and dorsal face flattened. Cephalon deeply sunk into mesosome, carries in front two pairs of rudimentary antennæ. Eyes, when present, dorsal. Maxillipeds lamellar, biarticulate, obtecting oral area below, more frequently showing small terminal joint, and at base two curved lanceolate appendages (epignaths). Legs seven pairs, sometimes obsolete on one side, and all of same structure, short, prehensile. Coxal plates obsolete or distinctly defined. Incubatory plates five pairs, more or less arching over ventral face of mesosome. First pair usually concealed by second and divided by transversal fold into two segments, of which distal one projects freely within incubatory cavity. Metasome more or less distinctly segmented, pleopoda, forming simple or double

lamellæ, all of same structure, rarely obsolete. Uropoda, when present, simple, lanceolate. Male more or less slender, perfectly symmetrical, with cephalon evenly rounded in front, and all segments of mesosome sharply defined, those of metasome sometimes distinct, sometimes confluent. Last larval stage with mouth simple, conic. Posterior antennæ with flagellum quadri-articulate. Legs of uniform structure. Uropoda with inner ramus shorter than outer. Parasitic on decapodous crustacea.

A number of genera have been described. The greater number of species live as parasites in the branchial cavities of higher crustaceans.

Key to the Genera.

- a. Abdomen of female with lateral parts or pleural lamellæ not elongated or digitate, but rudimentary or absent. PROBOPYRUS
 aa. Abdomen of female with lateral parts or pleural lamellæ elongated, digitate. LEIDYA

Genus PROBOPYRUS Giard and Bonnier.

Probopyrus Giard and Bonnier, Bull. Scient. France Belg., (3) XIX, 1888, p. 53. Type *Bopyrus ascendens* Semper, monotypic.

Female.—Body with neither side swollen. Abdomen with six distinct segments, lateral parts of pleural lamellæ not elongate or digitate, but rudimentary or absent. Pleopoda present, all biramous. All legs of both sides present. Uropoda wanting.

Male.—Abdomen with segments fused dorsally, but defined on lateral margin. Five pairs of small tuberculiform pleopods present. Uropoda absent.

Remarks.—Branchial parasites. One species in our region, parasitic on the common prawn.

Probopyrus pandalicola (Packard).

PLATES 73, 74 and 75.

Prawn Louse.

Bopyrus pandalicola Packard, Zoöl. Students Gen. Readers, 1879, p. 308, text fig. 262. *No locality.*

- Probopyrus pandalicola* H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 554, figs. 599 to 601. Atlantic City, New Jersey. (Brooklyn, New York; New Hampshire to Florida and Mississippi.)
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 49. (Massachusetts and Rhode Island.)
- Bopyrus Leidy*, Proc. Acad. Nat. Sci. Phila., 1879, p. 198. Atlantic City, New Jersey.
- Harger, Rep. U. S. F. Com., VI, 1878 (1880), pp. 312, 433 (on Leidy).
- Bopyrus palæmoneticola* Packard, Zoöl. High School. Colleges, 1881, p. 289.
- Gissler, Amer. Nat., XVI, 1882, p. 6, figs. 1-2, Pl. 1-2. Our shores.
- Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, New Jersey.
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 578. Atlantic City, New Jersey.
- Probopyrus palæmonticola* H. Richardson, Proc. U. S. Nat. Mus., XXVII, 1904, p. 66, figs. 41-43. Atlantic City. (New Hampshire to Florida and Mississippi.)
- Probopyrus palæmoneticola* Paulmier, 58th Rep. N. Y. State Mus., IV, 1904, p. 185, fig. 59. Along the shore (of New York).
- Bopyrus manhattensis* Gissler, Sci. American, XLV, September 3d, 1881, p. 151. New York.
- Gissler, Amer. Nat., XV, 1882, p. 6 (reference).

Description of female.—Head deeply set in thorax, front edge straight, and hind edge rounded. Eyes wanting. Ovarian bosses occur on first four thoracic segments at anterior portion of sublateral edge. Epimera appear as narrow plates lateral to ovarian bosses, and occupy entire lateral edges on last three segments. Abdominal segments distinct, and broad terminal segment more or less bilobed. Pleopoda formed of five pairs of double-branched lamellar appendages, closely crowded together on ventral side of abdomen. Five pairs of incubatory lamellæ surround large open area normally containing eggs. Of these pairs first with terminal lobe of distal segment large, well defined, incurved. All legs with high quadrangularly shaped expansion or carina on basis. Color white, with blackish blotches on lateral edges of all thoracic segments on both sides of body. Head and abdomen also with some few scattered black marks. Legs, on both sides of body, white, and patches of black on ventral side of lateral edges of both sides of thorax. Incubatory lamellæ with patches of black on all plates of both sides. Length 5 mm.

Description of malc.—All thoracic segments distinct, and lateral edges contiguous. First four abdominal segments well defined laterally, but fused in middle of dorsal surface. Last two segments form single large piece, and fused terminal segment indicated only by small median point on hind edge. Body length a trifle more than twice its width. Eyes present. Rudimentary pleopoda pairs of small oval processes, one pair on each abdominal segment. Abdomen about one and one-half times wide as long. Length 2.5 mm.

Remarks.—Parasitic on our common prawn, *Palæmonetes vulgaris* and found from New Hampshire to Florida and Mississippi. I have secured a number of examples at Cape May and Ocean City. Interesting specimens are those secured at Red Bank, in Monmouth county, many years ago, by T. R. Peale, and others at Beach Haven by Dr. Joseph Leidy. I have also found prawns in the Elk River (fresh water), near Elk Neck, infested with this parasite.

Genus LEIDYA Cornalia and Panceri.

Leidya (Cornalia) Cornalia and Panceri,¹ Mem. R. Acad. Sci. Torino, (2) XIX, 1858-61 (1858), pp. 111, 114. Type *Cepon distortus* Leidy, monotypic.

Female.—Body with neither side swollen. Abdomen distinctly segmented. Pleural lamellæ or lateral parts of first five abdominal segments lanceolate, finely fringed. No median dorsal tubercles on sixth and seventh segments of thorax. All legs of both sides present, each ends in short blunt claw. Exopods present and nearly equal on all seven pairs of legs. Pleopods lanceolate and fringed.

Malc.—Abdomen distinctly segmented, and lateral parts of segments not elongated. Five pairs of simple rudimentary pleopods. Uropoda simple, as two filiform or long appendages attached to sixth abdominal segment.

Remarks.—Branchial parasites.

¹ These authors credit the genus to Cornalia 1857, and if published then I have been unable to locate it.

Leidya distorta (Leidy).

PLATE 76.

Cepon distortus Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 150, Pl. II, figs. 26-32. *Atlantic City, New Jersey* (in branchial cavity of *Gelasimus pugilator*).

——— Harger, Rep. U. S. F. Com., I, 1871-72 (1873), p. 573 (on Leidy).

——— Harger, Proc. U. S. Nat. Mus., II, 1879, p. 157. *Atlantic City, New Jersey*.

——— H. Richardson, Amer. Nat., XXXIV, 1900, p. 309. *Cape Cod to North Carolina*.

Leidya distorta Cornalia and Panceri, Mem. R. Acad. Sci. Torino, (2) XIX, 1856-61 (1858), p. 114. *Atlantic City, New Jersey*.

——— Giard and Bonnier, Trav. Labor. Wimereux, V, 1887, p. 68, fig. 12 (from Leidy). *Atlantic City, New Jersey*.

——— Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 412 (reference).

——— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 579. *Atlantic City, New Jersey*.

——— H. Richardson, l. c., XXVII, 1904, p. 74. *Atlantic City, N. J.*

——— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 511, figs. 559-560. *Atlantic City, N. J.*

Description of female.—Body compressed, distorted, ovoid. Abdominal scales completely concealing pinkish-white ova. Head prominent, provided with a pair of large oval disks situated posteriorly. Mouth minute, at summit of a trilobate papilla. Antennæ very small and indistinct. Divisions of thorax posteriorly strongly costate. Feet in seven pairs, curved forward and downward, ending in a short recurved abortive hooklet. Abdomen deeply segmented. Branchial appendages lanceolate, fringed. Color white. Length about 6 mm.

Description of male.—Body long and slender, divided into fourteen segments. Head subrotund. Internal antennæ short and robust, three-jointed, and joints spinous. External antennæ long, seven-jointed, with first two joints spinous and others bristled. First joint of thorax transversely oblong, remainder depressed, pyriform in outline. Feet in seven pairs, antepenultimate joint spinous, and broad penultimate joint with recurved claw. Abdominal segments depressed, pyriform in outline, each provided with a pair of peculiar ventral appendages, and, except

fifth one, with a lateral irregular pigment cell. Caudal segment round, with a pair of divergent appendages. Length ($1\frac{1}{4}$ lines) 2.3 mm. (Leidy.)

Remarks.—Known only from Atlantic City, where it was discovered by Dr. Joseph Leidy in 1855. He says it is not a very abundant parasite, and after having accidentally found a specimen, fifty fiddler crabs were destroyed in a search for other examples, without any more having been found. The parasite produces no deformity, visible externally, of the animal it infests. The male was found in the embrace of the female. So far it seems to occur only in the fiddler crab, *Uca pugilator*.

Super-Family IDOTHEOIDEA.

Uropoda lateral, valve-like, ventrally placed, closing over five pairs of branchial pleopoda attached on outer edges to sides of terminal segment and opening and closing like folding doors. Legs of first pair not cheliform.

These animals differ from all the known isopods in the above characters. Three families are generally admitted, though but one represented in New Jersey.

Family IDOTHEIDÆ

Body more or less depressed, with segments of mesosome of uniform appearance. coxal plates sometimes distinctly defined, sometimes confluent with segments. Metasome with some or all segments consolidated to form large terminal piece, carrying normal number of pleopoda. Superior antennæ comparatively small, with flagellum uniarticulate. Inferior antennæ more or less elongated, originate outside superior from lateral corners of cephalon. Oral parts mostly normal, though no mandibular palps, and joints of maxillipeds often reduced in number. Legs rather strongly built, increasing in length posteriorly, three anterior pairs sometimes subcheliform. Anterior pairs of pleopoda with densely setiferous rami, second pair in male with usual stylet. Uropoda very large, lamellar, valve-like, closing over

lower face of metasome, and outer part cut off by transverse suture, forming separate plate, inside which sometimes occurs another much smaller plate. Incubatory pouch normal.

Genera about 10, represented by some of the largest known species.

Key to the genera.

- a. Sides of head as seen dorsally entire, not produced laterally; eyes lateral; legs nearly all alike, sixth segment of propodus not or but little expanded, and seventh segment prehensile.
- b. Flagellum of second pair of antennæ not multiarticulate; abdomen a single segment.
- c. Second pair of antennæ much longer than first pair; epimera distinct on all segments of thorax, including first; maxillipeds with palp of four articles; no lateral sutures at base of abdomen. ERICHSONELLA.
- cc. Second pair of antennæ shorter than first pair; epimera of all segments united with segments; maxillipeds with palp of three articles; lateral suture lines at base of abdomen. EDOZIA.
- bb. Flagellum of second pair of antennæ well developed, multiarticulate; abdomen (including terminal segment) of three segments with lateral sutures of another partly coalesced segment. IDOTEA.
- aa. Sides of head emarginate or cleft and laterally produced beyond eyes; eyes dorsal; first three pairs of legs with sixth segment of propodus dilated and with reflexible dactylus forms a subchelate hand; palp of maxillipeds of three segments. CHRIDOTEA.

Genus ERICHSONELLA H. Richardson.

Erichsonella (Benedict) Richardson, Amer. Nat., XXXIV, 1900, p. 228.

Type *Stenosoma filiformis* Say, second species.

Erichsonia (nec Westwood 1849) Dana, Amer. Journ. Sci. Art., (2) VIII, 1849, p. 427. Type *Stenosoma filiformis* Say, monotypic.

Sides of head in dorsal view entire, not laterally produced. Eyes lateral. Flagellum of second antennæ formed of a single clavate article. Second antennæ much longer than first pair. Maxillipeds with palp composed of four articles. Epimera of all segments of thorax, including first, distinctly separated from segments. Abdomen formed of a single segment, and no lateral sutures at its base. Legs nearly all alike, sixth article or propodus not expanded, or but little expanded, and seventh article prehensile.

Key to the species.

- a. Body surface tuberculated, its outline serrate; first pair of antennæ long; terminal segment of body with prominent lateral tooth near base on either side. *filiformis*
- aa. Body surface smooth throughout, its outline regular; first pair of antennæ short; terminal segment of body shows but slight traces of lateral tooth near its base on either side. *attenuata*.

Erichsonella filiformis (Say).

PLATE 77.

- Stenosoma filiformis* Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 424. Egg Harbor, New Jersey.
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 44 (on Say).
- Idotea filiformis* White, Cat. Crust. Brit. Mus., XXV, 1847, p. 96. Egg Harbor, New Jersey (Say's material).
- Erichsonia filiformis* Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 316 (habits).
- Harger, Rep. U. S. F. Com., I, 1871-72 (1873), p. 570, Pl. 6, fig. 26. Vineyard Sound to Great Egg Harbor, New Jersey.
- Harger, Proc. U. S. Nat. Mus., II, 1879, p. 160. South of Cape Cod.
- Harger, Rep. U. S. F. Com., IV, 1878 (1880), pp. 355, 434, Pl. 7, figs. 38-41. (Long Island Sound and Say's record.)
- Cleantis filiformis* Miers, Journ. Linn. Soc. London, XVI, 1883, p. 77. Egg Harbor, New Jersey (Say's example).
- Stebbing, Hist. Recent Crust. (Intern. Sci. Series, LXXIV), 1893, p. 375. United States (reference).
- Erichsonella filiformis* H. Richardson, Amer. Nat. XXXIV, 1900, p. 228. Cape Cod to North Carolina in 4½-7 fathoms.
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 543. Great Egg Harbor, New Jersey. (Massachusetts, Long Island Sound and Florida.)
- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 401, figs. 449-450. Great Egg Harbor, N. J. (Long Island Sound, Massachusetts, Florida, Bahamas.)
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 42. (Long Island Sound, Maine, Massachusetts.)

Description.—Body oblong, ovate, almost three times long as broad. Abdomen length equals little more than one-third length of entire body. Head about twice as wide as long, front deeply emarginate between anterior lateral angles, and latter conspicuous and acute. Eyes composite, large, rounded, placed medianly

on extreme lateral margins of head. Head above, from front to hind edges, with prominent elevation bearing two tubercles, one each side of median line, which appear, as viewed dorsally, to project forward beyond frontal excavation. First antennæ with basal segment large and somewhat expanded, second and third subequal segments only little shorter than first, and fourth segment little longer than third. First antennæ reach to end of second segment of second antennæ. First segment of second antennæ short, second long segment equals third and also equals first two segments of first pair of antennæ, fourth segment nearly twice length of third, and fifth segment shorter than fourth or only about one and one-half times longer than third. Flagellum of second antennæ about as long as fourth segment of same organ. Retracted second antennæ reach to hind edge of fifth thoracic segment. Maxillipeds with palp of four segments. Second, third and fourth thoracic segments trifle longer than others, which latter subequal. First two thoracic segments with lateral parts formed into very acute processes, as a single process on each side of segments. Acutely produced epimeron lies closely anterior to each of processes mentioned, though below lateral part of segment in a lower plane. Epimeron of second segment bilobate, and as seen dorsally conceals very acute lower lobe. Third and fourth thoracic segments with lateral portions produced on each side as two acute processes, as one larger and anterior, and a smaller posterior. Epimera of these segments inconspicuous, small, acute, placed just below lateral parts about middle of segment. Last three segments with anterior portions acutely produced, acute epimeron occupying rest of lateral edge, and posterior half of lateral portion of segment not produced. On each side of first four thoracic segments small tubercle near hind edge in median line. Abdomen formed of a single segment and about one-third distance from base to end each side of lateral edge, produced in acute triangular process. Also about two-thirds distance from base to end sides of abdomen angulate, and from this point lateral edges rapidly converge to triangulate end, which latter rounded posteriorly. Legs mostly of similar structure. Color usually dull neutral tint, and

though without bright markings, sometimes varied with brown or reddish tints which fade out in alcohol. Length 11 mm.

Remarks.—Originally described from Great Egg Harbor, where it was found with *Idotea balthica*. It ranges north to Massachusetts, and south to Florida and the Bahamas. It lives in tide-pools, among eel-grass or algæ, sand, gravel, etc. It has been taken from four and one-half to eighteen fathoms in depth. Verrill says it lives among the *Corallina* and other algæ in the tide-pools. Its colors are equally variable with those of the other species, and are often variously shaded brown, dull reddish or light red, colors well adapted to blend with the colors of the Corallines. Mr. Witmer Stone secured it at Point Pleasant.

Erichsonella attenuata (Harger).

PLATE 77.

- Erichsonia attenuata* Harger, Rep. U. S. F. Com., I, 1871-72 (1873), p. 570, Pl. 6, fig. 27. *Great Egg Harbor, New Jersey. New Haven, Connecticut.*
 — (Harger) Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 370 (habits).
 — Harger, Proc. U. S. Nat. Mus., II, 1879, p. 160. *Great Egg Harbor, N. J., and Connecticut.*
 — Harger, Rep. U. S. F. Com., IV, 1878 (1880), pp. 356, 434, Pls. 6-7, figs. 36-37. *Great Egg Harbor, N. J. and Connecticut.*
 — Leidy, Proc. Acad. Nat. Sci., Phila., 1888, p. 333. *Beach Haven, New Jersey.*
Cleantis attenuata Miers, Journ. Linn. Soc. London, XVI, 1883, p. 79. *Egg Harbor, New Jersey.*
Erichsonella attenuata H. Richardson, Amer. Nat., XXXIV, 1900, p. 228. *Cape Cod to North Carolina.*
 — H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 543. *Great Egg Harbor, N. J., and Connecticut.*
 — H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 400, figs. 447-448. *Great Egg Harbor, N. J. and Connecticut.*
 — M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 41. (*Connecticut.*)

Description.—Body elongated, narrow, length six times greater than width. Head broader than long, with front slightly emarginated between anterior lateral angles. Eyes composite, small, placed laterally or at sides of head, and midway between front and hind edges. A pronounced elevation on head between

eyes. First antennæ with basal segment large, somewhat expanded, second segment little shorter than first and about half its width, third and fourth equal segments, each one and one-half longer than second. First antennæ reach middle of third segment of peduncle of second antennæ. First segment of second antennæ short and inconspicuous as viewed dorsally, second segment long or about three times longer than first, third segment about one and one-half times longer than second, fourth segment about one and one-half times longer than third, and fifth segment a little less than fourth. Flagellum a little longer than fifth segment of second antennæ, and latter longer than half of entire body length. Maxillipeds with palp formed of four segments. First thoracic segment a little shorter than any of others except seventh. Second, third, fourth and fifth thoracic segments subequal. Epimera distinctly separate on all segments, including first, very small or almost inconspicuous and situated in first three segments on lateral edge anterior to median transverse line, though in fourth segment they occupy middle of lateral margin. In last four segments epimera placed below median transverse line, and give to all segments rather angular appearance. Abdomen formed of a single segment, and about one-third distance from base to posterior end, a small lateral process on either side. Below these processes sides of abdomen nearly parallel till close to end where they form rounded apex. Color (in alcohol) light yellowish-gray with minute blackish dots. Length 15 mm. (O. Harger and H. Richardson.)

Remarks.—Originally found in Great Egg Harbor Bay, in this State, and subsequently in Connecticut, the species is seen to have a restricted distribution. It does not appear to be common, and was found in the eel-grass. Leidy records it from Beach Haven.

Genus EDOTIA Guérin-Ménéville.

Edotia Guérin-Ménéville, Iconogr. Règne Animal Cuv., Crust., 1829-43, p. 34

Type *Edotia tuberculata* Guérin-Ménéville, monotypic.

Edotea, auct.

Sides of head in dorsal view entire, not laterally produced. Eyes lateral. Second pair of antennæ shorter than first pair,

with rudimentary flagellum. Maxillipeds with palp of three articles. Epimera of all segments of thorax firmly and perfectly united with segments. Abdomen formed of single segment, with lateral incisions or suture lines at base, indicating another partly coalesced segment. All legs prehensile, alike, sixth article or propodus not expanded or but little expanded.

Edotia triloba (Say).

PLATE 78.

- Idotea triloba* Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 425. Egg Harbor, New Jersey.
- De Kay, N. Y. Fauna. Crust., VI, 1844, p. 43 (on Say).
- Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 150. Great Egg Harbor, New Jersey.
- Jara triloba* White, Cat. Crust. Brit. Mus., XXV, 1847, p. 97. Egg Harbor, New Jersey (Say's material).
- Epelys trilobus* Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 370 (habits).
- Harger, Rep. U. S. F. Com., I, 1871-72 (1873), p. 571, Pl. 6, fig. 28. Great Egg Harbor, N. J. to Vineyard Sound.
- Harger, Proc. U. S. Nat. Mus., II, 1879, p. 160. Rare north of Cape Cod.
- Harger, Rep. U. S. F. Com., VI, 1878 (1880), pp. 358, 434, Pl. 7, figs. 42-43. Great Egg Harbor, N. J. (New England.)
- Edotia triloba* Miers, Journ. Linn. Soc. London, XVI, 1883, p. 70. Egg Harbor, New Jersey (Say's example).
- Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 374 (reference).
- Edotea triolba* H. Richardson, Amer. Nat., XXXIV, 1900, p. 228. Cape Cod to North Carolina.
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 545. Egg Harbor, New Jersey. (New England.)
- Paulmier, 58th Rep. N. Y. State Mus., IV, 1904, p. 177, fig. 49. (Eastern shore of Staten Island.)
- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 396, figs. 441-442. Egg Harbor, N. J. (Eastern shore of Staten Island, and Maine to Connecticut.)
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 42. (New England.)

Description.—Body ovate, and length little over twice width. Abdomen with length a little over two and one-half times total body length. Head produced in front medianly, with conspicuous tubercle each side of median line close together on anterior

edge. Anterior lateral angles of head pronounced, formed in rounded lobes and containing eyes. First antennæ with first and second segments equal in length, third segment twice length of second and fourth segment, about two-thirds length of third. First antennæ longer than second antennæ, latter only reaching to middle of fourth segment of first pair. First antennæ with short and subequal first, second and third segments, fourth segment one and one-half longer than third, and fifth segment a trifle longer than fourth. Flagellum minute, formed of one segment one-third length of fifth segment of first antennæ. Retracted first antennæ reach only to middle of lateral edge of first thoracic segment. Maxillipeds with palp of three segments. Third and fourth thoracic segments longer than any others, also broadest. Epimera of all segments united with segments. Lateral parts of segments laterally expanded, lateral edges almost straight. Two longitudinal rows of low tubercles, as a series along either side on lateral portions of segments, with two tubercles to each segment, one on each side. Abdomen formed of one segment, with suture lines at base to indicate another partly coalesced segment, and also slight incisions in lateral edges. Large rounded prominence in median line at base of abdomen, followed by a depression, so that as seen laterally abdomen formed of two elevations separated by a deep depression, and extremity also separated off from second elevation by another depression. Sides of abdomen converge rapidly from point little below middle to narrow pointed end. Color uniform, dull. Length 7 mm.

Remarks.—Originally described from Egg Harbor, it has been found to the north in Maine. It lives in eel-grass, on piles, in sand and in tide-pools. It is essentially a surface species, living in low muddy water, apparently not below one-half fathom in depth. I have examined Say's type, of which only half remains, and that dried and pinned.

Genus IDOTEA Fabricius.

Idotea Fabricius, Suppl. Entomol. Syst., 1798, p. 302. Type *Cymothoa emarginata* Fabricius, fifth species.

Idothea Fabricius, l. c., Index Alph., 1799, p. 27. Type *Cymothoa emarginata* Fabricius, fifth species.

Body oval or oblong, distinctly depressed, coxal plates beyond first segment well defined, laminar. Cephalon subquadrate, lateral parts not expanded. Metasome with three short segments exposed in front of terminal one, third segment less perfectly defined dorsally. Eyes lateral, distinct. Superior antennæ with short clavate flagella. Inferior antennæ with mostly elongated multiarticulated flagellum. Mandibles very strong, cutting-edge divided in two superposed dentated lamellæ, molar expansion large and thick. Both pairs of maxillæ quite normal. Maxillipeds with quadriarticulate palp, last joint lamellarly expanded, masticatory lobe well developed, epignath oblong, oval, turned in front. Legs of rather uniform structure, ambulatory, usually stronger in male than in female, sometimes approach to subcheli-form character, dactylus in all pairs strong, unguiform, unequally bidentate at tip. Uropoda end in single flattened joint, at base of this joint outside with strong ciliated seta. Male usually much larger than female.

Key to the species.

- | | |
|---|-------------------|
| a. Telson truncate at hind edge. | <i>metallica.</i> |
| aa. Telson double-concave at hind edge. | <i>balthica.</i> |

Idotea metallica Bosc.

PLATES 78 AND 150, FIGURE 2.

- Idotea metallica* Bosc, Hist. Nat. Crust., II, 1802, p. 179, Pl. 15, fig. 6. *High seas.*
- Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 373. Great range over the world.
- H. Richardson, Amer. Nat., XXXIV, 1900, p. 226. Atlantic coast south to Cape Cod and North Carolina regions.
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 541. Nova Scotia to North Carolina.
- Idothea metallica* H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 362, figs. 392-393. Nova Scotia to Florida, off Maryland, Chesapeake Bay.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 41. (Maine, Massachusetts, Rhode Island.)
- Idotea robusta* Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 439, Pl. 5, fig. 24 (note). Vineyard Sound.

- Harger, Rep. U. S. F. Com., I, 1871-72 (1873), p. 569, Pl. 5, fig. 24. South shore of Long Island to the Arctic Ocean.
- Harger, Proc. U. S. Nat. Mus., II, 1879, p. 160. Pelagic (New England).
- Harger, Rep. U. S. F. Com., VI, 1880, p. 349, Pl. 6, figs. 30-32. (Fire Island Beach, Long Island, Massachusetts to George's Bank and Nova Scotia.)

Description.—Body oblong, ovate, about two and one-quarter times longer than broad. Abdomen a little over two-fifths entire body length. Head broader than long, with front edge slightly emarginated, and hind edge somewhat broader than front. Eyes compound, large, round, placed at extreme lateral edges. First antennæ with basal joint not enlarged, and first and second joints of about equal length and width, though subequal third and fourth joints somewhat longer. First antennæ reach to end of second joint of peduncle of second pair. First joint of second antennæ very short, second and third joints subequal, fourth one and one-half times longer than third and fifth twice length of third. Flagellum formed of eight joints and reaches as retracted to front edge of third thoracic segment. Maxillipeds with palp of four joints. Thoracic segments subequal, and first extends little beyond lateral edges of head on each side, with lateral parts, also those following, bulging outward and somewhat upward, thus forming an angle with portion of segment to which adjacent. Epimera of all segments, from second to seventh included, reach entire length of segment. Epimera large, very wide, increase in width to seventh, which broader than long. Legs all more or less similar. Free edges of all joints and lower edge of propodus with hairs. Abdomen with two short segments and a long terminal one, with lateral rudiments at its base of another partly coalesced segment. Terminal segment with sides converging slightly to truncate end. Color bright green or blue above in life, to darker in alcohol. Often with metallic tints when seen in the water. Length 28 mm.

Remarks.—A pelagic species, and thus world-wide in distribution. It lives at the surface and to a depth of ninety-one fathoms, often occurring in masses of floating sea-weed. My

examples, several dry ones, obtained at Point Pleasant by Mr. Witmer Stone. This animal has never before been recorded in New Jersey.

Idotea balthica (Pallas).

PLATES 79 AND 150, FIGURE 3.

- Onicus balthicus* Pallas, Spic. Zoöl., I, 1772, p. 65, Pl. 4, fig. 6, a-d. "hol-satic."
- Idothea baltica* H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 364, figs. 394-395. Gulf of St. Lawrence to North Carolina.
- Stenosoma irrorata* Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 423. Egg Harbor, New Jersey.
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 43, Pl. 10, fig. 42. Boston Harbor to Cape May.
- Heilprin, An. Life of our Sea Shore, 1888, p. 97, Pl. 7, fig. 4. New Jersey coast and southern shore of Long Island.
- Idotea irrorata* White, Cat. Crust. Brit. Mus., XXV, 1847, p. 94. Egg Harbor, New Jersey (Say's material).
- Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 150. Absecon and Great Egg Harbor, New Jersey.
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 316 (habits).
- Harger, Rep. U. S. F. Com., I, 1871-72 (1873), p. 569, Pl. 5, fig. 23. Bay of Fundy to Great Egg Harbor, N. J.
- Harger, Proc. U. S. Nat. Mus., II, 1879, p. 60. New England and southward.
- Harger, Rep. U. S. F. Com., VI, 1878 (1880), pp. 343, 433, Pl. 5, figs. 24-26. Great Egg Harbor, N. J. (Fire Island Beach, Long Island, and New England.)
- Kingsley, Standard Nat. Hist., II, 1884, p. 71, fig. 94. (Coast of United States understood.)
- Benedict, Rep. U. S. F. Com., XI, 1883 (1885), p. 176. (Off Montauk Point, Long Island.)
- Heilprin, An. Life of our Sea Shore, 1888, Pl. 7, fig. 4. New Jersey coast and southern shore of Long Island.
- Idotea marina* (nec Linnæus) Miers, Journ. Linn. Soc. London, XVI, 1883, p. 25. Gulf of St. Lawrence to Egg Harbor, New Jersey.
- Idothea marina* H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 540. Gulf of St. Lawrence to North Carolina.
- Paulmier, 58th Rep. N. Y. State Mus., IV, 1904, p. 175, fig. 47. (Shore of New York City.)
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 40. (Bay of Fundy to western end of Long Island Sound.)

Description.—Body oblong, ovate, length almost three times width. Abdomen with length little over one-third entire body

length. Head broader than long, front slightly emarginate. Eyes compound, large, rounded, placed on extreme lateral edge just anterior to median transverse line on anterior portion of head. First antennæ with basal segment not dilated but equals length of second, third and fourth segments, slightly longer than either of preceding segments, and entire organ extends to end of third segment of second antennæ. Second antennæ with first segment short, second and third segments of about equal length, fourth segment very little longer than third, and fifth segment about twice length of third. Flagellum formed of fourteen segments. Retracted second antennæ reach middle of third thoracic segment. Maxillipeds with palp of four articles. Thoracic segments about equal, except first, which somewhat shorter. Epimera of all segments occupy entire lateral edges of segments, formed as large broad plates, gradually increased in width from first to sixth. Abdomen of two short segments and an elongate terminal segment with sutures basally. Abdominal sides converge to narrow extremity, and latter produced medianly in an acute apex some distance beyond other or lateral angle each side. Legs mostly uniform, with a few hairs on inferior edges. Color very variable, from uniform light or pale sandy-brown or gray, or even light green, to dark green or brown, and with a median longitudinal streak of light color or a marginal streak on either side frequently present. Sometimes only a single marginal streak present. Colors arranged in blotches or transverse bands occasionally. Length 20 mm.

Remarks.—Abundant on the New Jersey coast, and elsewhere very widely distributed, ranging along the Atlantic coast of North America from the Gulf of St. Lawrence to North Carolina, Bermuda, Barbadoes and South America. It also occurs in many regions of the Old World, if all the described forms are synonyms. Its known bathymetric range is from the surface to a depth of one hundred and nineteen fathoms. It lives on the surface of the sea among floating objects, as grass, seaweed, etc., and among eel-grass and algæ. Along the seashore it occurs in gravel and sand. It forms the food of some fishes, having been taken from the stomach of the smelt (*Osmerus eperlanus*).

I have met with it at Ocean City, Seaside Park, Sea Isle City, Stone Harbor, Anglesea and Cape May. Mr. Witmer Stone found it at Point Pleasant. It also occurs along the coast of Delaware at Lewes, Rehoboth and Indian River Inlet. In Virginia I found it at Assateague and Cedar Island. Mr. W. T. Davis notes it from Staten Island, New York.

Genus CHIRIDOTEA Harger.

Chiridotea Harger, Amer. Journ. Sci. Art., (3) XV, 1878, p. 374. Type *Idotea caeca* Say, first species, designated.

Head sides emarginate and produced laterally beyond eyes. Eyes dorsal. Second antennæ with multiarticulate flagellum. Epimera of all thoracic segments, except first, distinctly separated from the segments. Abdomen of four segments, with lateral sutures at base of terminal indicating another partly coalesced segment. Palp of maxillipeds of three segments. First three pairs of legs prehensile, with sixth segment of propodus dilated to form, with reflexible dactylus, the subchelate hand. Last four pairs of legs ambulatory. Inner branch of uropods half as long as outer branch.

Species of small size, represented by but one on our shores.

Chiridotea cœca (Say).

PLATE 80.

Idotea caeca Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 424. *Coast of the United States*.

— Kingsley, Standard Nat. Hist., II, 1884, p. 71. Our coast.

Idotea caeca De Kay, N. Y. Fauna, Crust., VI, 1844, p. 42. Massachusetts to Florida.

— White, Cat. Crust. Brit. Mus., XXV, 1847, p. 94. United States (Say's material).

— Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 340 (habits).

— Harger, Rep. U. S. F. Com., I, 1871-72 (1873), p. 569, Pl. 5, fig. 22. Massachusetts to Florida.

— Heilprin, An. Life of our Sea Shore, 1888, p. 97. New Jersey coast and southern shore of Long Island.

Chiridotea caeca Harger, Proc. U. S. Nat. Mus., II, 1879, p. 159. (Southern New England.)

- Harger, Rep. U. S. F. Com., VI, 1878 (1880), p. 338, Pl. 4, figs. 16-19.
(Off Nantucket, and New England.)
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 539. (Long
Island Sound, Nova Scotia to Florida.)
- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 353, figs. 380-381.
Nova Scotia to Florida.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 40.
(Massachusetts and Connecticut.)
- Chiridotea cacas* H. Richardson, Amer. Nat., XXXIV, 1900, p. 226. Cape
Cod to North Carolina.

Description.—Body broadly ovate, comparatively short or twice as long as broad, and tapering behind to pointed extremity. Abdomen length one-half entire body length. Head about twice as broad as long, front not emarginated between anterior lateral lobes but expanded beyond them. Lateral edges of head cleft, front lobe smaller than hind lobe, and latter projecting at sides beyond anterior one. Front with decided median excavation with median point in its center. Eyes compound, small, rounded, situated dorsally at base of post-lateral lobe. First antennæ with basal segment very short and not expanded, second segment little longer than first, and third and fourth equal segments about twice length of first. First antennæ reach little beyond end of peduncle of second antennæ. Second antennæ with basal segment not very evident in dorsal view, second, third and fourth segments subequal, and fifth segment little longer than fourth. Flagellum formed of five articles. Retracted second antennæ reach front edge of first thoracic segment. Maxillipeds with palp of three segments. Thoracic segments of equal length. Epimera separated dorsally from first three segments, not acutely produced behind. Epimera of last four segments also distinct, produced into acutely pointed processes. Abdomen formed of four segments, as three short ones followed by long-pointed terminal one, with lateral sutures of another partly coalesced segment. Apex of terminal segment acute, its lateral edges near end denticulated. Abdominal sides taper gradually to about middle, then converge more rapidly to apex, forming slight angles on either side half way from base to apex. First three pairs of legs subchelate, propodus expanded, short dactylus reflexed.

Last four pairs of legs ambulatory. All legs with spines and hairs along free edges. Opercular valves in two parts, small terminal part representing outer branch of uropoda. Inner branch represented on under side, attached to basal portion on exterior side.

Color variable, usually dark grayish, much like wet sand in which animal lives. Top of thorax usually dark leaden-gray, sometimes with central spot of bright pea-green, probably from contents of digestive tract showing through. This dark color continued in an arrow-shaped or halberd-shaped spot, occupying most of upper surface of head. All sides of head and body mottled light yellowish-gray, darker again on edge. Body below, including legs, uniformly pale. Colors usually fade uniform straw color in alcohol, with fine blackish dots, doubtless less conspicuous in life.

Length 12 to 15 mm. (O. Harger and H. Richardson.)

Remarks.—The range of this species is from New Brunswick to Florida. It occurs along the shores of sandy beaches below high tide, or burrows just under the surface. It is a good swimmer.

Super-Family CYMOTHOIDEA.

First pair of legs not cheliform. Uropoda lateral, not terminal, and forming, with last abdominal segment, a caudal fin or fan as in shrimps and lobsters. Pleopoda mostly natatory.

Isopods of various structure, and mostly parasitic, or semi-parasitic, and for this cause legs often more or less prehensile. Families about twelve.

Key to the families.

- a. Uropoda entirely lateral.
 - b. Abdomen of two segments.
 - c. Both branches of uropoda present. SPHÆROMIDÆ.
 - cc. Outer branch of uropoda entirely absent. ANCINIDÆ.
 - bb. Abdomen usually of six segments.
 - d. Uropoda with one of rami almost obsolete or rudimentary, not lamelliform. LIMNORIIDÆ.

dd. Uropoda with both branches well developed, mostly lamelliform.

e. Maxillipeds with palp embracing cone formed by distal parts of mouth-organs, inner upper edge and apex never setose, latter and sometimes inner upper edge (at least in males and females without eggs) with outward curved hooks.

CYMOTHOIDÆ.

ee. Maxillipeds with palp free, edges of last two articles more or less setose, never furnished with hooks.

CIROLANIDÆ.

aa. Uropoda lateral and superior, outer rami arching over telson base; body elongated, narrowly cylindrical.

ANTHURIDÆ.

Family SPHÆROMIDÆ.

Body short, oval, convex. Head transverse. First and second pairs of antennæ multiarticulate, with evident distinction into peduncle and flagellum. Mandibles with palps. Epimera united with thoracic segments. Anterior segments of abdomen united into single segment, together with large terminal segment forming biarticulate abdomen. Uropoda lateral, forming with terminal abdominal segment into caudal fan. Outer branch of uropoda, when present, movable, and inner fixed branch immovable.

Genera rather numerous, and three represented in our limits.

Key to the genera.

a. Outer branch of uropoda not rudimentary.

b. Outer branch of uropoda not capable of folding under inner branch, and branches unlike, though only outer one salient.

CILICÆA.

bb. Outer branch of uropoda capable of folding under inner branch, and both branches similar in shape and salient.

SPHÆROMA.

aa. Outer branch of uropoda small, rudimentary.

CASSIDISCA.

Genus CILICÆA Leach.

Cilicæa Leach, Dict. Sci. Nat., XII, 1818, p. 342. Type *Cilicæa latreillii* Leach, monotypic.

Maxillipeds with second, third and fourth segments of palp produced into lobes. Last two segments of thorax of equal length. Abdomen of two segments, first usually produced, at least in male, in form of long process directed backwards. Last

segment of abdomen with median posterior emargination, furnished with or without teeth. Legs all ambulatory. Both branches of uropoda present, outer branch not rudimentary, only inner branch salient. Branches of uropoda unlike in male, outer branch not capable of folding under inner branch.

Species rather numerous, and the males and females said to be quite unlike. The former are remarkable for the long median spine or process of the first abdominal segment.

Cilicæa caudata (Say).

PLATE 80.

Næsa caudata Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 482. *Egg Harbor, New Jersey.*

—— De Kay, N. Y. Fauna, Crust., VI, 1844, p. 45 (on Say).

—— White, Cat. Crust. Brit. Mus., XXV, 1847, p. 105. North America (Say's material).

Cilicæa caudata H. Richardson, Proc. U. S. Nat. Mus., XXI, 1899, p. 841 (references).

—— H. Richardson, Amer. Nat., XXXIV, 1900, p. 224. Cape Cod to North Carolina region.

—— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 536. Egg Harbor, New Jersey. (Florida and Mexico.)

—— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 314, figs. 343-348. Egg Harbor, New Jersey. (Florida, Bermuda, Bahama, Porto Rico, Mexico.)

Description of female.—Body ovate, length twice its width. Head width nearly twice its length, with frontal edge arising between eyes and produced in small median point. Eyes composite, small, round, placed in hind lateral angles of head. First antennæ with long stout basal segment, second segment less than half length of first and equally wide, third segment twice length of second and half as wide. Flagellum formed of ten segments. First antennæ reach almost to hind edge of first thoracic segment. Second antennæ with very short basal segment, second segment twice length of first, third segment one and one-half times longer than second, fourth segment little longer than third and fifth segment little longer than fourth. Flagellum formed of twelve segments. Second antennæ reach hind edge of second thoracic segment. Maxillipeds with palp

formed of five segments. Mandibles with palp formed of three segments. Frontal lamina large, conspicuous, with V-shaped raised edge pointing anteriorly. First thoracic segment twice length of others. Epimera not distinct from segments, but lighter area and slight depression marks place of coalescence. Lateral edges straight, with outer post-lateral angle slightly produced. Abdomen formed of two segments, first long as first thoracic segment, with three suture lines on either side to indicate as many coalesced segments. Terminal segment with anterior convex portion surmounted with transverse row of three tubercles, middle one being in median longitudinal line. Contour of terminal segment somewhat triangular, with bluntly rounded apex produced, sides of end folding under to form groove, latter incomplete on ventral side. Immobile inner branch of uropoda extend two-thirds length of terminal segment, and truncate at end. Movable outer branch of uropoda as wide and long as inner branch, its outer posterior angle slightly produced and acute, and inner angle rounded. Legs all ambulatory. Color in life red or pink. Length 4.8 mm.

Description of male.—Body very slightly increases in width from head to abdomen, length little over twice width as measured from front edge of head to end of abdomen. Head length thrice its width, with frontal edge arising between eyes to form small produced median point. Eyes composite, small, rounded, placed in hind lateral angles of head. First antennæ with basal segment long and stout, second segment half length of first though equally wide, and third segment one and one-half times long as second and about half as wide. Flagellum formed of eight segments. First antennæ reach to hind edge of first thoracic segment. Second antennæ with first or basal segment short, second segment about twice length of first, third and fourth segments about equal and each little longer than second, and fifth segment little longer than fourth. Flagellum formed of fifteen segments. Second antennæ reach little beyond hind edge of second thoracic segment. Maxillipeds with palp formed of five segments. Palp of mandible formed of three segments. Frontal lamina large, conspicuous, and hind portion forms thick raised edge in shape

of inverted V. First thoracic segment nearly twice length of any following. Lateral portions of all segments bent downward, forming an angle with dorsal part of segment. Epimera not distinct from segments, indicated by depression on either side of segment little distance within place where lateral part of segment bends downward. Posterior end of lateral edge or outer post-lateral angle slightly produced. Abdomen formed of two segments, first with two suture lines either side indicating partly coalesced segments, and its hind edges with five low tubercles, two either side of median one, also each with groove in center from which extends long movable spine-like bristle. Terminal segment with convex anterior half furnished with one large median tubercle with groove in center from which extends bunch of hairs. Either side of this median tubercle row of two large tubercles in longitudinal series, and lower one in each series in transverse line with median tubercle. Below this transverse row of three tubercles and almost hidden by them three small tubercles in transverse row and much closer together than those directly above them. Posterior half of terminal segment deeply excavate, posterior lateral angles very acute. Within this excavation four acute teeth, two either side of center. Post-lateral angles with small rudimentary tooth on inner side near end. Fixed movable branch of uropoda extends only half length of terminal segment. Outer movable branch long and narrow, curved inward, so that in folding its end meets that of opposite side in median line of body. Outer branch on outer edge with various bunches of hairs. Legs all ambulatory. Each thoracic segment with seven bunches of hairs, forming into seven longitudinal series on thorax. Color red or pink in life. Length 7.5 mm.

Remarks.—Originally found at Great Egg Harbor in this State, and though not yet known to the northward occurs south to Florida, Yucatan, Bermuda, the Bahamas and Porto Rico. It ranges from the surface to a depth of twelve feet, and has been recorded from twenty-five fathoms. It lives among coral reefs, and among grass and algæ below low tide. It does not appear to have been taken in New Jersey since Say's time.

Genus SPHÆROMA Latreille.

Sphæroma Latreille, Hist. Nat. Crust., VII, 1804, p. 11. Type *Oniscus volutator* Pallas, first species.

Body contractile, and able to be rolled into a complete ball. Abdomen of two segments, and first formed by fusion of several coalesced segments. Terminal segments of abdomen entire, rounded. Maxillipeds with second, third and fourth segments of palp not produced into lobes, and with very long hairs. Legs all ambulatory. Both branches of uropoda present, and outer not rudimentary. Latter denticulate along outer edge, movable, capable of folding under inner branch, and both branches similar in shape, salient. Inner branch of uropoda immovable, fixed to side of abdomen.

A single species in our limits.

Sphæroma quadridentatum Say.

PLATE 81.

- Sphæroma quadridentata* Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 400. *Coast of Georgia and East Florida.*
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 44 (on Say).
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 315 (habits).
- Harger, Rep. U. S. F. Com., I, 1871-72 (1873), p. 569, Pl. 5, fig. 21. Massachusetts to Florida.
- Harger, Proc. U. S. Nat. Mus., II, 1879, p. 161. Provincetown, southward.
- Harger, Rep. U. S. F. Com., VI, 1878 (1880), pp. 368, 434, Pl. 9, fig. 53. Great Egg Harbor, New Jersey. (Florida and Massachusetts.)
- H. Richardson, Amer. Nat., XXXIV, 1900, p. 223. Cape Cod to North Carolina region.
- Sphæroma quadridentatum* White, Cat. Crust. Brit. Mus., XXV, 1847, p. 102. (St. Catherine's Island, Georgia, on Say's material.)
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 533. Massachusetts to Florida.
- Paulmier, 58th Rep. N. Y. State Mus., IV, 1904, p. 174, fig. 46. (Bartow, City Island and Staten Island, N. Y.)
- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 281, figs. 292-293. New England to Florida.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 39. (Southern New England.)

Description.—Body ovate, length nearly twice its width. Head broad, width nearly twice its length, with frontal border arising between eyes and produced in small median point. Eyes composite, small, rounded, placed in hind lateral head angles. First antennæ with long first segment, second segment half length of first, and third segment twice length of second. Flagellum formed of twelve segments. First antennæ reach to middle of first thoracic segment. Second antennæ with first segment inconspicuous, second segment short, third segment twice length of second, and fourth and fifth subequal segments each little longer than third. Flagellum formed of fifteen segments. Second antennæ reach to hind edge of second thoracic segment. Maxillipeds with palp of five segments. Mandibles with palp of three segments. Frontal lamina large, conspicuous, with front edge broadly triangulate, and hind lateral edges produced. Thoracic segments of about equal length. Epimera not distinct from segments and point of coalescence indicated by light longitudinal area on either side of segment. Post-lateral angles of lateral parts of all segments forced into narrow and somewhat acute process, more pronounced in first four segments. Abdomen formed of two segments. First segment with three suture lines indicating several partly coalesced segments. Terminal segment long, widely rounded behind, and convex anteriorly. Uropoda with fixed inner branch extending slightly beyond end of last abdominal segment, and its edges smooth. Outer movable branch of uropoda long and wide as inner branch, with three or four teeth on its outer edge. Legs all ambulatory. Color variable, sometimes uniform slaty-gray, or often marked on dorsal surface with pale creamy or rosy blotch, edged more or less with dark or black. This blotch usually arranged in longitudinal symmetrical direction and broad or greatly constricted medianly. Length 10 mm.

Remarks.—This southern form was originally discovered on the coast of Georgia, and its range is now known to extend from southern Florida to Massachusetts. It lives among eel-grass or algæ, or rocks, often where the latter are dark and covered with barnacles. Say found it very numerous on the

beach of Saint Catherine's Island in Georgia. They concealed themselves under raised bark, and in the deserted holes of *Teredo*, etc., of such trees as are periodically immersed.

This species suggests the "pill-bugs" in form as well as habits. Verrill says it occurs in abundance under stones and rocks, or creeping slowly about among the branches and roots of seaweeds, on their sides and upper surfaces, from low-water mark nearly up to high-water mark. In color it is exceedingly variable, for no two can be found alike. The colors consist of irregular blotches and dashes of dark gray, light gray, slate, greenish and white, so blended as to imitate very closely the colors of the barnacles and gray surfaces of the rocks where they live. When disturbed they curl themselves up into a ball and drop to the bottom.

My examples from Cape May. Mr. W. T. Davis reports he found it at Center Island in Oyster Bay, Long Island, New York.

Genus CASSIDISCA H. Richardson.

Cassidisca H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 272. Type *Cassidina lunifrons* H. Richardson, first species.

Body oval, depressed. Abdomen of two segments, and first segment formed by fusion of several segments. Inner branch of uropoda large and well-developed, immovable and firmly fixed to side of abdomen. Outer branch of uropoda rudimentary, very short, not entirely separated from inner branch, and sometimes represented by small incision in exterior margin of inner branch. Maxillipeds with second, third and fourth joints of palp not produced into lobes. Legs all ambulatory.

Cassidisca lunifrons (H. Richardson).

PLATE 82.

Cassidina lunifrons H. Richardson, Amer. Nat., XXXIV, 1900, p. 222. *Great Egg Harbor, New Jersey*.

— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 533, fig. 14 (type).

— Paulmier, 58th Ann. Rep. N. Y. State Mus., IV, 1904 (1906), p. 174, fig. 45. Bartow and Fresh Kills, Staten Island, N. Y.

Cassidisca lunifrons H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 273, figs. 283-284 (type).

Description.—Body oval, broad, with smooth surface. Head broader in front than behind, and anterior lateral angles produced in lateral direction and form very acute angles. Eyes placed at posterior lateral corners of head. First antennæ reach two or three joints beyond antero-lateral angle of head, and flagellum with six joints. Second antennæ reach hind edge of first thoracic segment, and flagellum with about eight joints, of which first four large and last four small and setose. First thoracic segment well fitted to head, to form elliptical body contour. Segments subequal, with straight lateral edges. Epimera not-distinct from segments. First abdominal segment short, and subtriangular segment with truncate apex. Uropoda with inner branch pointed at end, and reaches tip of abdomen. Outer branch of uropoda rudimentary, about one-fourth length of inner branch. Color brownish above, paler below. Length 1 mm.

Remarks.—Known only from Great Egg Harbor, where it was collected by Dr. William Stimpson. It is closely related to *Cassidisca ovalis* (Say) from South Carolina, and may ultimately prove identical. Only the type and Paulmier's examples known until Mr. E. G. Vanatta secured numerous specimens at Chestertown in Maryland, in November, 1912. They were found along the banks of the Chester River.

Family ANCINIDÆ

Body oval, depressed, short, convex. Head broadly transverse. Abdomen formed of two segments, and first formed by fusion of several segments. First and second antennæ multiarticulate, with peduncle and flagellum distinct. Mandibles with palps. Uropoda lateral, and with terminal abdominal segment form caudal fan. Outer branch of uropoda entirely absent, and inner branch immovably fixed. Epimera united with thoracic segments. First and second pairs of legs subchelate, others ambulatory.

A single genus.

Genus ANCINUS Milne-Edwards.

Ancinus Milne-Edwards, Hist. Nat. Crust., III, 1840, p. 225. Type "*Nasa depressa* Leach" (though doubtless of Say), monotypic.

Characters included in those of the family.

A single species.

***Ancinus depressus* (Say).**

PLATE 81.

Nasa depressa Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 483. *Egg Harbor, New Jersey.*

—— De Kay, N. Y. Fauna, Crust., VI, 1844, p. 45 (on Say).

—— H. Richardson, Amer. Nat., XXXIV, 1900, p. 224. Cape Cod to North Carolina region.

—— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 537. Egg Harbor, New Jersey.

Ancinus depressus White, Cat. Crust. Brit. Mus., XXV, 1847, p. 105. North America (Say's material).

—— Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 366 (reference).

—— H. Richardson, Bull. U. S. Nat. Mus., No. 1905, p. 371, fig. 282. Egg Harbor, N. J. (Uropoda of type.)

—— H. Richardson, Proc. U. S. Nat. Mus., XXXVI, 1909, p. 175, fig. 1. (Wood's Holl, Massachusetts.)

Description.—Body about twice as long as broad, ovate. Head wide, short, with rounded lateral edges and angles, and front produced anteriorly in a median linguiform process extending forward over basal segments of first antennæ. First antennæ with first three segments dilated and of nearly equal length. Thoracic segments subequal. First abdominal segment almost entirely concealed, and second or terminal segment with length four-fifths basal width. Terminal segment of triangular form, apex funnel-shaped, with sides turned downward and inward. Uropoda single-branched, formed as a long narrow tapering branch each side, acute posteriorly, and reach to tip of terminal abdominal segment. Apparently each uropod firmly and immovably joined to abdomen, and without any vestiges of an outer branch. Length 12 mm.

Remarks.—This species, until quite recently, was known only from the type described above. The type is a dry specimen, formerly mounted on a pin and afterwards taken off and glued to a piece of paper.

Say's account is as follows: Body broad, depressed, linear, punctured, sides parallel. Segments subequal, anterior ones rather shorter. First segment of tail not visible, second equal, as long as three preceding visible ones and attenuated to an obtuse point, which carinated above and reached by lateral acute spiniform processes. Body below concave, effuse at tip. Eyes apparently lunated, really rounded, with distant granules, and reaching front segment of body. Hands of anterior feet dilated, ovate, thumb long as palm, nearly reaches carpus, and tip closes within prominent spinose tooth on base of palm. Anterior feet monodactyle. Hands of second pair of feet cylindric, incurved, with dentate process at tip place at inner base, armed with an equal incurved thumb not closing on hand, obtuse, and furnished with seta at tip. Remaining feet ciliated. Length half an inch, and width slightly more than one fifth of an inch. Inhabits Egg Harbor. Common.

Family LIMNORIIDÆ.

The Gribbles.

Body oblong, sub-depressed, contractile into a ball. Segments of thorax distinct, first longer than second. Metasome of six distinct segments, last very large, broad and flattened above. Head short, blunt in front. Cephalon short, very convex. Coxal plates behind first segment of mesosome well defined, laminar. Eyes lateral. Both pairs of antennæ small, subequal, flagella short. Mouth-parts normal, adapted for biting. Mandibles without molar expansion, with small three-jointed palp. Palp of maxillipeds formed of five articles. Epimera well defined on all segments of thorax, except first. Legs uniform, all ambulatory. Pleopods uniform in structure, both for swimming and respiration, inner plate of second pair in male with stylet. Uropoda

small, lateral, outer branch short, unguiform, almost obsolete and inner branch linear.

A single genus.

Genus **LIMNORIA** Leach.

Limnoria Leach. Edinburgh Encyclop., VII, 1813, p. 433. Type *Limnoria terebrans* Leach, monotypic. (Not consulted).¹

Body oblong, rather convex above, with segments sharply marked off from each other. Cephalon comparatively short, blunt in front, and buccal mass very prominent below. First segment of mesosome longer than other one, partly advancing over cephalon. Coxal plates on succeeding segments rather large, deflexed, and posterior ones triangularly produced. Five anterior segments of metasome with well developed laterally projecting epimera, and terminal segment broad, flattened above. Eyes lateral, wide apart. Antennæ with rather short flagellum. Mandibles very strong, cutting-edge ending in conically compressed chisel-shaped point, no molar expansion and palp rather small. Anterior maxillæ with masticatory lobe conically tapering and coarsely spinous at tip, basal lobe narrow, turned anteriorly, and with three short ciliated apical setæ. Posterior maxillæ end in three setiferous lobes, innermost representing masticatory lobe. Maxillipeds slender, with basal part rather elongated and narrow, masticatory lobe well developed, and palp of five flattened joints, lanceolate epignath turned anteriorly. Anterior pairs of legs somewhat shorter than posterior, dactylus in all pairs inside with a secondary claw-like projection. Pleopoda with lamellar rami, and excepting last pair fringed with setæ. Uropoda with outer ramus short and unguiform, and inner linear.

Species about three, and including peculiar boring isopods whose destruction of timber that has been submerged, and pile work, has long been known.

¹In Trans. Linn. Soc. London, XI, 1815, p. 354, the only species is *Limnoria terebrans* Leach.

Limnoria lignorum (Rathke).

PLATE 83.

Gribble.

Cymothoa lignorum Rathke, Skrivt. Natur. Selsk., V, 1799, pp. 101, 147. Pl. 3, fig. 14. (*Western coast of Norway from Bergen to Nordland.*)

Limnoria lignorum Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 379 (habits).

— Harger, Rep. U. S. F. Com., I, 1871-72 (1873), p. 571, Pl. 6, fig. 25. Great Egg Harbor, New Jersey (to Bay of Fundy and Europe).

— Harger, Proc. U. S. Nat. Mus., II, 1879, p. 161. (New England.)

— S. I. Smith, Proc. U. S. Nat. Mus., II, 1879, p. 232, fig. 2. (Wood's Holl, Massachusetts.)

— Harger, Rep. U. S. F. Com., VI, 1878 (1880), p. 372. Florida to Nova Scotia.

— Kingsley, Standard Nat. Hist., II, 1884, p. 71, fig. 93. Wherever wood is submerged beneath salt water.

— R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 826. Gulf of St. Lawrence to Florida.

— Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 367. Widely distributed.

— H. Richardson, Amer. Nat., XXXIV, 1900, p. 222. Cape Cod to North Carolina region.

— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 532. Gulf of St. Lawrence to Florida.

— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 269, figs. 279-281. Gulf of St. Lawrence to Florida.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 39. (Bay of Fundy to west end of Long Island Sound.)

Limnorea lignorum Mayer, Sea Shore Life, 1906, p. 17. (New York to Nova Scotia and northern Europe.)

Limnoria tenebrans De Kay, N. Y. Fauna, Crust., VI, 1844, p. 48, Pl. 9, fig. 33. (New York understood.)

Limnoria terebrans Leidy, Journ. Acad. Nat. Sci. Phila. (2), III, 1855, p. 150. Absecon, New Jersey.

— Heilprin, An. Life of Our Sea Shore, 1888, p. 97, Pl. 7, fig. 2. New Jersey coast and south shore of Long Island.

Description.—Body oblong, ovate, width one-third its length. Head broader than long, width about twice its length, and front edge slightly emarginated. Eyes distinct, small, placed at sides of head. First antennæ with first two segments subequal, and third segment little longer than second. Fourth or first flagellar segment half length of third, and fifth or second flagellar seg-

ment minute. First antennæ reach to end of fourth segment of second antennæ. Latter with first segment large, second segment not long as first, third and fourth subequal segments each about long as first, and fifth segment about long as fourth. Flagellum formed of two or three indistinctly defined segments. Maxillipeds with palp of five segments. Mandible palp of three segments. First thoracic segment longer than any following by almost twice their length, and latter subequal. Except first, epimera distinctly separated on all segments. Abdomen formed of six distinct segments, of which first five short and subequal, and sixth or terminal segment with hind edge widely rounded. Uropoda situated laterally, outer branch small and rudimentary and inner branch reaches end of abdomen. All legs ambulatory. Color light gray. Length 4.5 mm.

Remarks.—This species is well known on account of its destructiveness to submerged timber. It has a wide distribution from Florida to Nova Scotia, Europe, and in the Pacific Ocean. Harger says much has been written upon its destructive habits and the means of preventing its attacks on woodwork, for which the reader may consult especially the publications of Leach, Coldstream, Hope, Thompson, Moore, Gould, Bate and Westwood, Verrill, and Andrews, who has observed it attacking the gutta percha of submarine telegraph cables. It lives above low-water mark, though usually not far below, having been taken in at least ten fathoms. In New Jersey it is recorded from Great Egg Harbor and Absecon.

Family CYMOTHOIDÆ.

Antennæ greatly reduced, without clear distinction between peduncle and flagellum. Mandibles with palps. Maxillipeds with palp formed of two joints, and terminal joint with hooks. First maxillæ with masticatory lobe formed of single tapering joint, provided with four spines at tip. Second maxillæ bilobed at tips, and furnished with numerous spines. Epimera distinct on all segments, except first. All seven pairs of legs prehensile, ending in strong hooked fingers. Pleopods not ciliated. Ter-

minimal segment of abdomen and uropods usually not ciliated.

A large family, with numerous genera, and all parasitic, mostly on fishes.

Key to the genera.

- a. Ends of uropods in adults with fringe of setæ. ÆGATHOA.
- aa. Ends of uropods in adults without fringe of setæ.
- b. Head not produced behind into three lobes, more or less immersed in first thoracic segment; front edge of first thoracic segment not trisinate.
- c. Antennæ not compressed, not dilated, and first pair widely separated at bases. LIVONECA.
- cc. Antennæ greatly dilated, and first pair contiguous at base. CERATOTHOA.
- bb. Head produced behind into three lobes, usually as large median one and two smaller laterally; head not immersed in first thoracic segment; front edge of first thoracic segment distinctly trisinate.
- d. Posterior angles of first six segments of body scarcely or not at all prominent, those of seventh segment produced; epimera of first segments very often almost reach, or not, by short distance, hind angle of segment. OLENCIRA.
- dd. Posterior angles of first segment of body prominent or produced, frequently acute; hind angles of following segments increase gradually in length, first very often scarcely produced, hind ones, often produced, abruptly longer than first; epimera of first segments extend beyond hind angles of segment, and hind ones produced, acute. NEROCILA.

Genus ÆGATHOA Dana.

Ægathoa Dana, Amer. J. Sci. Art., (2) XIV, 1852, p. 304. Atypic. (Type *Ægathoa macrophthalma* Dana, Crust. U. S. Expl. Exped., 1852, pp. 747, 763, first species.)

Body elongate, oval. Eyes large, oval, compound. Hind edge of head produced in three lobes. Front edge of first thoracic segment also results in three lobes. Hind lateral angles of thoracic segments not produced. Epimera distinct on all segments of thorax, except first, extend full length of segments, and not acutely produced behind. Abdomen not narrower than thorax, continues outline of body. Segments of abdomen not shorter than last thoracic segments. Pleopods not ciliated. Uropods and terminal segment of abdomen with hairs.

A single species from our shores, remarkable for the very large compound eyes. This genus is apparently not well understood, and may be merged with *Livoneca*, of which it has been suggested as possibly the young.

Ægathoa oculata (Say).

PLATE 84.

Cymothoa oculata Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 398. *St. John's River, Florida* (on *Archosargus probatocephalus*).

Cymothoa (*Æga*) *oculata* De Kay, N. Y. Fauna, Crust., VI, 1844, p. 48. (on Say).

Ægathoa oculata H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 217, figs. 219-221. Connecticut to West Indies. Crisfield, Maryland.

Ægathoa lobiginca Harger, Am. Journ. Sci. Art., (3) XV, 1878, p. 376. *Savin Rock, near New Haven, from mouth of Loligo pealii*.

—— Harger, Proc. U. S. Nat. Mus., II, 1879, p. 161. New Haven, Connecticut (in mouth of squid).

—— Harger, Rep. U. S. F. Com., VI, 1878 (1880), p. 393, Pl. 10, fig. 66. New Haven and Fort Macon.

—— H. Richardson, Am. Nat., XXXIV, 1900, p. 220. Cape Cod to North Carolina.

—— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 526. Connecticut to Florida.

—— M. J. Rathbun, Occas. Papers Boston Soc. Nat. Hist., VII, 1905, p. 38 (Savin Rock).

Description.—Body elongated, nearly four times longer than wide. Head broad as long, a little narrower in front than behind, and front edge widely rounded. Hind edge of head formed in three slight equal lobes. Eyes very large, conspicuous, oval, compound, placed in hind lateral angles of head, and extend along sides of head almost to front lateral angles. First pair of antennæ formed of eight joints, and extend to hind edge of head. Second pair of antennæ formed of nine joints, and extend to middle of first thoracic segment. Basal joints of first antennæ not close, well separated. Maxillipeds with palp of two joints. Palp of mandibles with three joints. First segment of thorax longest, second and third equal, and four following segments all equally shorter. Epimera distinctly separated on all segments, except first, and extend full length of lateral edges. Abdomen wide as

thorax, and segments long as thoracic. Abdomen length nearly half that of entire body. Sixth or terminal abdominal segment long and rounded behind. Uropoda longer than terminal segment, outer branch longer and narrower than inner, which latter rounded behind. Inner branch broad behind and obliquely truncate. Uropoda and terminal abdominal segment fringed with hairs. All legs prehensile, end in long narrow curved dactyls. Propodus with five and carpus with two spines, in all the legs. In alcohol color pale yellowish-brown, dotted with dusky or blackish over each median portion of segments of upper surface. Eyes black. Reaches 13 mm. in length.

Remarks.—This species is found along the Atlantic coast of North America from Connecticut southward to Cozumel and the West Indies. Though I have no New Jersey specimens, it is included, as I have seen it at Cape May several years ago. Mr. T. D. Keim and myself seined numbers of small mullets (*Mugil cephalus* and *Mugil curema*) on the ocean beach just below Rehoboth, Delaware, on October 12th, 1910. After examining the fishes and selecting a number, the rest were turned adrift in the sea water. Then as we were about to lift our seine, numbers of these small isopods were found in the moist sands, left apparently by the receding water. They were all crawling about, and we scooped up a number of them, which are now before me. I mention this fact as the species is said to be parasitic on young mullet, though none of the great numbers of the latter contained any whatever. Possibly the disturbance caused by the capture of the fish had induced the parasites to let their hosts go? I have never seen them on the squids, though have often searched for them.

In the United States this species is only recorded from Connecticut, Maryland, North Carolina and Florida. The above notices, therefore would indicate its admission to New Jersey, as well as Delaware.

Genus LIVONECA Leach.

Livoneca Leach, Dict. Sci. Nat., XII, 1818, p. 351. Type *Livoneca redmanii* Leach, first species.

Body suboval, more or less twisted. Head most always deeply immersed in first thoracic segment, not produced posteriorly in three lobes. Thoracic segments either equal in length, or first one abruptly longer and last one abruptly shorter than others. Anterior edge of first thoracic segment not trisinate, widely sinuated in middle and more or less sinuated or incised at antero-lateral angles. Abdomen very little or scarcely immersed, continuous with thorax, not broader than latter. First pair of antennæ widely separated at base, rather compressed, not dilated.

Though only one species has been positively recorded from our limits, *Livoneca redmannii* Leach may also occur, as it ranges from New York to Brazil.

Livoneca ovalis (Say).

PLATE 85.

- Cymothoa ovalis* Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 394. *Within the mouths of salt-water fish in our markets.*
- De Kay, N. Y. Fauna. Crust., VI, 1844, p. 48. (New York, in mouth of *Tautoga* and *Harpe rufa*.)
- Livoneca ovalis* White, Cat. Crust. Brit. Mus., XXV, 1847, p. 109. North America (Say's material).
- Livoneca ovalis* Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. (457) 459. (Southern New England.)
- Harger, Rep. U. S. F. Com., I, 1871-72 (1873), p. 572. Pl. 6, fig. 29. (Vineyard Sound, etc.)
- Uhler, Ches. Z. Lab. J. Hopkins Univ., I, 1878, p. 27. (Fort Wool, Virginia, from Croaker.)
- Harger, Proc. U. S. Nat. Mus., II, 1879, p. 162. Cape Cod, southward.
- Harger, Rep. U. S. F. Com., VI, 1878 (1880), pp. 395, 434. Pl. 11, fig. 67. (Norfolk, Virginia and Long Island Sound.)
- Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, New Jersey.
- Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 352 (reference).
- H. Richardson, Amer. Nat., XXXIV, 1900, p. 222. Cape Cod to North Carolina.
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 531. (Long Island Sound, New York, Patapsco River, and Massachusetts to Florida.)
- Paulmier, 58th Rep. N. Y. State Mus., IV, 1904 (1906), p. 173, fig. 44. (New York City.)

—— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 263, figs. 276–277. Sandy Hook Bay, New Jersey (New York, Long Island Sound, Great South Bay, Patapsco River, Bonday's Wharf, Baltimore, Chesapeake Bay, Tolchester, and Massachusetts to Florida).

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 38. (Massachusetts and Connecticut.)

Cymothoa triloba De Kay, N. Y. Fauna, Crust., VI, 1844, p. 46, Pl. 10, fig. 40. New York (understood, from codfish).

?*Cymothoa olivacea* De Kay, l. c., p. 47, Pl. 10, figs. 41–41a. New York Harbor (from *Poronotus triacanthus*).

Description.—Body ovate, broad, about one and two-thirds longer than wide. Head broad as long, narrower in front than behind and front widely convex. Eyes indistinct, small, placed in hind lateral angles of head. Hind edge of head rounded. First antennæ formed of six or seven segments and reach front lateral angles of first thoracic segment, but not to hind edge of head. Second antennæ formed of eight or nine segments and reach hind edge of head. Maxillipeds with palp of two segments. First five thoracic segments subequal, and sixth and seventh also subequal, each a little shorter than any of preceding segments. Epimera distinctly separated on all segments except first, and comprise entire lateral edge in second, third, fourth and fifth segments. In sixth and seventh segments hind ends produced beyond hind edges of segments considerably. All six abdominal segments distinct. Abdomen not immersed or set in thorax, also not abruptly narrower than latter, and first abdominal segment wide as seventh thoracic segment, though segments gradually decreasing in width. Sixth or terminal abdominal segment rounded behind. Uropoda not reaching end of terminal abdominal segment, both branches of equal length and similar shape. Outer branch of uropoda rounded behind, about half width of inner, both branches of equal width throughout their length, and inner branch obliquely truncate with posterior lateral angles rounded. Legs all prehensile, with well curved dactyli. No carina on basis of any of legs. Color pale brown, and transverse yellowish band along posterior edges of all segments. Epimera also yellow. Length 21 mm.

Remarks.—A very familiar parasite on many of our larger fishes, and ranging from Mississippi and Florida north to

Massachusetts. It is usually found clinging to the gills, or under surface of the opercular region, in the gill-opening of its host. The hosts now given are *Pristis semisagittatus*, *Trachurops crumenophthalmus*, *Pomatomus saltatrix*, *Steinotomus chrysops*, *Cynoscion regalis?*, *Lagodon rhomboides* and *Micropogon undulatus*. Of all these it is most numerous in the gill-opening of young *Pomatomus*, and in some places along our shores these fish are sometimes angled by seashore excursionists for the amusement and excitement of locating as many "bugs" as possible. They are sometime present in most every individual taken, and a whole day's catch may reveal as many parasites as fish, sometimes two or three in rare instances on a single host. I have examined a number of specimens from Barnegat Pier, Atlantic City, Ocean City and Cape May. Mr. W. T. Davis secured one from *Tautoga onitis* near New York City, which I have also seen.

Genus CERATOTHOA Dana.

Ceratothoa Dana, U. S. Expl. Exped. Crust., XIV, 1853, p. 752. Type *Ceratothoa linearis* Dana, first species.

Body oblong. Head but little immersed or set in first thoracic segment, not produced posteriorly in three lobes. Epimera of first segment of thorax, in female, with carina produced in form of spoon or tubercle and directed anteriorly. Anterior epimera not reaching by great though gradually decreasing distance to hind angle of segment. Posterior epimera almost reach or extend a little beyond posterior angles of segments. Abdomen deeply immersed or set in thorax, and terminal segment transverse. Eyes small. Antennæ very much dilated, first pair dilated and contiguous at base, and second pair compressed. Front edge of first thoracic segment rounded. Legs rather long, except first and second pairs. Ungulæ long and strongly curved, of third pair in female longest of all, and also abruptly longer than those of second pair. High carina on basis of four posterior pairs of legs.

In this genus the male is smaller than the female. One species in our limits.

Ceratothoa impressa (Say).

PLATE 83.

- Cymothoa impressa* Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 397. *Cape May, New Jersey*.
- De Kay, N. Y. Fauna., Crust., VI, 1844, p. 48 (on Say).
- Ceratothoa impressa* H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 234, figs. 236-240. Lat. 42° N. to Rio Janeiro, Brazil.
- Ceratothoa linearis* Dana, U. S. Expl. Exped. Crust., XVI, 1853, p. 752, Pl. 50, figs. 1a-1d. *Gulf Stream*.
- Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 354 (reference).
- H. Richardson, Amer. Nat., XXXIV, 1900, p. 221. Cape Cod to North Carolina region.
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 529. Cape May, New Jersey. N. Lat. 42°-21° W. Long. 40°-50°. Gulf Stream everywhere.

Description.—Body elongate, little over three times longer than broad. Head little broader than long, not deeply set in thorax, with front emarginate on each side of broad elongate median process, apex of which obtusely pointed. Antennæ fit in these excavations. Front lateral angles of head acutely pointed. Eyes small, about twice as broad as long, somewhat obliquely placed at sides of head, and also about half way between front lateral and hind lateral angles. First antennæ formed of seven segments, and basal segments in each antennæ adjacent on ventral side. First antennæ reach just below eyes. Second antennæ formed of eleven segments, last three very minute. Segments of both pairs of antennæ greatly expanded and flattened. Second antennæ reach to hind edge of head. Maxillipeds with palp of two segments. Mandibular palp very large, conspicuous, formed of three segments. Second or hind maxillæ very large, conspicuous, bilobed at tip, and both lobes with small hooks. First four thoracic segments large, about equal in length, fifth segment half as long as any four preceding segments, and sixth and seventh segments very short in median dorsal line and each about one-half length of fifth. First thoracic segment with front lateral expansion produced in carinated process produced outward and forward, and ends acutely little anterior to front lateral

expansion of segment. Epimera distinctly separated on all following six segments, in second directed forward and project in anteriorly acute process. Those in third, fourth and fifth segments narrow elongated plates comprising front half of segments, and those of last two segments also narrow, elongate and comprise nearly entire length of segments. Abdomen abruptly narrower than thorax, first segment much narrower and deeply set in thorax. Four following segments wide as seventh thoracic segment, gradually increasing in width to sixth segment, which very wide. Terminal or abdominal segment nearly twice as broad as long, posterior lateral angles rounded, and posterior edge deeply emarginate. Uropoda long as terminal abdominal segment, equal in width, rounded at ends, and outer branch very slightly shorter than inner. All legs prehensile, with long narrow curved dactyli, and those of fourth pair longest. High carina on basis of last four pairs of legs, its height increasing from fourth to seventh pair, where extremely high. Length 4 mm. (H. Richardson.)

Remarks.—This species was originally described from Cape May and has since been found in the Gulf Stream north to latitude 40°. Southward it ranges to Brazil. It is parasitic on species of flying fish, as *Exonantes exiliens* and *Exonantes rondeletii*, also on the dolphin, *Coryphæna*. It has not been secured in New Jersey since the type was found in 1818, though is doubtless very abundant off shore.

Genus OLENCIRA Leach.

Olencira Leach, Dict. Sci. Nat., XII, 1818, p. 351. Type *Olencira lamarkii* Leach, monotypic.

Body rather stout, relaxed, more or less distorted. Head constricted basally, not immersed in thoracic segment. First antennæ separated at base, rather compressed. Second antennæ compressed. Eyes present. Front edge of first thoracic segment trisinate. Hind angles or first thoracic segments not produced, though those of seventh segment produced. Epimera almost reach hind angles of segments. Terminal ab-

dominal segments subtriangular or subchordate, not ciliated. Uropoda not ciliated, much shorter than terminal abdominal segment, inner branch scarcely shorter than outer. Legs long, first six pairs gradually increasing in length, and seventh pair abruptly very much longer than others. Basis of four posterior pairs of legs with carina. Ungulæ long, those of first pair shorter than others, and those of seventh pair longer than others.

A single species in our limits.

Olencira prægustator (Latrobe).

PLATE 86.

- Oniscus prægustator* Latrobe, Trans. Amer. Philos. Soc. Phila., V, 1802, p. 77. Pl. 1. *York River, Virginia* (in mouth of *Brevoortia tyrannus*).
- Cymothoa prægustator* Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 395. United States (in mouths of menhaden).
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 47 (in mouth of menhaden). New York.
- Olencira prægustator* Schioedte and Meinert, Naturh. Tidsskr., (3) XIII, 1881-83, p. 152, Pl. 10, figs. 6-9. Eastern North America.
- Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 353. America.
- H. Richardson, Amer. Nat., XXXIV, 1900, p. 221. Middle States region to Gulf of Mexico.
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 528. (Potomac river, St. George's Island, off Great Wicomico, Dividing Cove, Fort Monroe, York Spit, head of Cockrell creek, Hampton creek, Lower Chesapeake Bay, Cape Charles; Florida.)
- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 231. (Besides above localities: Crisfield in Maryland; Washington; Alabama; South Carolina.)

Description.—Body elongate, narrow, gradually wider to seventh thoracic segment, or width about one-fourth in length. Head as broad basally as long, and gradually becomes narrower to front end, which broadly convex and half as wide as its base. Eyes composite, large, oblong, twice as long as broad, and placed in hind half of head at posterior lateral angles. First antennæ formed of eight segments, and reach to seventh segment of second pair. Basal segments of first antennæ well

separated. Second antennæ formed of ten segments and reach to hind edge of head. Maxillipeds with palp of two segments. Mandible with palp of three segments. First and fourth thoracic segments longest, subequal, second and third segments subequally shorter, fifth and sixth segments still subequally shorter, and seventh segment shortest. Epimera distinctly separated on all segments, except first, as narrow elongated plates not reaching hind edges of segments, except seventh pair. Abdomen abruptly narrower than thorax, first segment deeply set in thorax and covered at sides by seventh thoracic segment. Following first segment others but slightly increasing in breadth. Sixth or terminal abdominal segment little longer than broad, triangularly produced to narrowly rounded apex. All legs prehensile, with long, narrow curved dactyls. Legs increase slightly in length to seventh pair, which abruptly much larger and longer than sixth pair, being greatly lengthened. Last three pairs of legs have basis furnished with low carina. Color grayish. Length 26 mm.

Remarks.—Historically, as well as otherwise in many ways, this is a most interesting isopod. It was originally the subject of a memoir by Latrobe, who was also the first to make known its host, *Brevortia tyannus*. So impressed was Latrobe with the habit of this parasite of living in the mouth of its host, that with graceful fancy he coined the specific names in the same vein for both. The parasite he names with reference to the old Roman *prægustatores* whose duty it was to taste of the food for their rulers, the *Tyranni*, and thus insure against poison. The parasite is certainly a remarkable creature, as seen clasped to the tongue of its host and surrounded by the myriad of fine gill-rakers. It no doubt finds an ample food supply in the minute herbivorous food of its host.

In New Jersey it has only been seen occasionally in the mouths of menhaden taken about Cape May, though it doubtless occurs in many other places along the coast, or in fact wherever its host may roam. I have examined a large old dried example received from Thomas Say, likely from our shores?

Genus **NEROCILA** Leach.

Nerocila Leach, Dict. Sci. Nat., XII, 1818, p. 35. Type *Nerocila blainvillii* Leach, monotypic.

Ichthyophilus Latreille, Règne Animal Cuv., Ed. 2, IV, 1829, p. 133. Type *Nerocila blainvillii* Leach, virtually, as this name proposed to replace *Nerocila*.

Emphyilia Koelbel, Sitz. Ak. Wiss. Wien, LXXVIII, 1878, p. 413. Type *Emphyilia ctenophora* Koelbel, monotypic.

Body relaxed, usually flattened. Head produced behind in three lobes, not immersed. First pair of antennæ almost contiguous at base. First segment of thorax with front edge deeply trilobed. Hind angles of segments from second to last increase gradually in length, first often but little produced, and posterior most always produced, often abruptly longer than first ones. Anterior epimera almost always extend to or beyond hind angle of segment. Posterior epimera produced, acute, not reaching hind angle of segment. Abdomen free, rarely covered at base or sides. Legs rather long.

Species rather numerous, and parasitic on various fishes. One occurs on our coast.

Nerocila munda Harger.

PLATE 87.

Nerocila munda Harger, Rep. U. S. F. Com., I, 1871-72 (1873), p. 571. *Vineyard Sound*.

——— Harger, l. c., VI, 1879 (1880), p. 392, Pl. 10, figure 65 (types).

? *Cymothoa pallida* Rafinesque, Amer. Month. Mag. Crit. Rev., II, Nov. 1817, p. 42. *Near New York* (in gills of fishes, shads, herrings, perches, minnows, etc.).

Description.—Body oblong, ovate, length a little over twice width. Head large, partly quadrate, or about wide as long, hind edge with three lobes, of which median largest. Front edge of head somewhat triangulate, and apex obtusely rounded. Eyes small, round, compound, placed in hind lateral angles of head. First pair of antennæ composed of eight joints, reach to middle of first thoracic segment. Second pair of antennæ formed of

twelve joints, extends one or two joints beyond first antennæ, last four joints very slender and gradually diminishing in size and length. Maxilliped with palp of two joints. Mandible with palp of three joints. Thorax widest at fifth and sixth segments, which also longer than others. Hind lateral angles of three last segments acutely produced, and extend beyond epimera. Latter distinct on all segments, except first. First three small, first two with hind edges rounded. Last four acutely produced, epimera extending to hind edges of segments, but not to end of hind lateral angles in last three segments. All segments of abdomen distinct, sixth or terminal rounded behind. Inner branch of uropoda broad, end obliquely truncate and extends little beyond tip of terminal abdominal segment. Outer branch of uropod one-fourth longer than inner branch, slightly narrower, and produced to narrow rounded end. Legs all prehensile, with long curved dactyls. Color brownish or olivaceous, with two narrow lengthwise bands of paler tint, separated by median dark line, and both usually more distinct on head and telson. Reaches 25 mm. in length.

Remarks.—This species was previously only known from Wood's Holl and Vineyard Sound, if *Nerocila lanceolata* (Say) is really distinct, as contended. If the latter proves identical, however, the southern range would extend to Georgia. At present *Nerocila munda* Harger is now known for the first time south of New England, as well as an addition to the fauna of New Jersey. Previously it appears to only have been found on the dorsal fin of the file fish (*Alutera schæpfi*).

I have a single example from New Jersey, taken from the dorsal fin of a rock fish (*Roccus lineatus*), on September 12th, 1910, by my friend, Dr. R. J. Phillips.

Family CIROLANIDÆ.

Body more or less semi-cylindrical in form. Abdomen usually composed of six distinct segments. Eyes usually small, lateral. Antennæ usually of unequal length, multiarticulate, with well-developed peduncle and flagellum. Labrum large, two or three

times wider than long. Clypeus large, wide, short, triangular. Mandibles wide throughout their entire length, hind part seen in position turned a little inward, distal part directed inward and wide but long, also covered for most part. Cutting part of mandible large, more or less trifid, hind apex always larger than other apices, large movable lacinia with many spines, molar part elongate, triangular and with triangular processes on front edge. First pair of maxillæ robust, lacinia of first article inflated at apex and with three plumose processes, lacinia of third article wide or very wide at apex and with many robust spines. Second maxillæ well developed, lacinia of second article wide, free, short with many setæ, lacinia of third and fourth articles much longer than wide, with inner edge furnished with long setæ. Maxillipeds well developed, edges of articles of palp furnished with many setæ, never with hooks. Epimera well defined on all segments of thorax except first. First three pairs of legs usually prehensile, last four pairs ambulatory. Pleopods well developed, adapted for swimming and breathing. Second pair of pleopods in male with stylet and inside inner plate. Uropoda lateral, form with last segment of abdomen into caudal fan. Incubatory pouch formed of five pairs of plates issuing from bases of first five pairs of legs.

Genera about five, of which one represented in our limits. Not parasitic, but living a free existence, and in these respects they differ from the *Ægidæ*, with which they were formerly included.

Genus *CIROLANA* Leach.

Cirolana Leach, Dict. Sci. Nat., XII, 1818, p. 347. Type *Cirolana cranchii* Leach, monotypic.

Body more or less elongated, with dorsal face strongly vaulted and perfectly smooth. Cephalon semi-circular, frontal edge evenly arched. First segment of mesosome forms on each side linguiform expansion advancing over sides of cephalon. Coxal plates of succeeding segments well-defined, laminar, turned downwards. Penultimate segment of metasome without projecting epimera, and large terminal segment more or less narrowed

distally, ciliated at tip. Eyes placed widely apart on sides of cephalon. Superior antennæ very small, with subfusiform flagellum, and formed of numerous very short articulations clothed with delicate sensory filaments. Inferior antennæ with slender elongated flagellum. Epistomal plate very narrow. Anterior and posterior lips normally developed. Mandibles very strong, cutting-edge divided into limited number of coarse teeth, and inside a distinct denticulated secondary lamella, narrow ensiform molar expansion with regular series of small denticles along anterior edge, and palp not very large. Anterior maxillæ with masticatory lobe very large and broad, coarsely spinous at tip, basal lobe small, carries three densely plumose setæ. Posterior maxillæ ends in two narrow setiferous lobes, and inside short densely setous masticatory expansion. Maxillipeds with quite short basal part, epignath linguiform, points outwards, small masticatory lobe distinct with two curved hooks inside, fine articulate palp large, joints complicated and densely setous. Legs with more or less expanded joints, edged with spines and bristles, dactylus comparatively short and not hook-shaped. Three anterior pairs of legs much shorter than posterior, turned forwards. First pair of pleopoda not differing much from others. Uropoda with basal part produced inside, outer plate narrower than inner.

Species numerous, and about thirty generally accepted.

Cirolana concharum (Stimpson).

PLATE 88.

Æga concharum Stimpson, Smithson. Contrib. Knowl., VI, 1853, p. 42. Charleston Harbor, South Carolina.

Conilera concharum Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 459. (Vineyard Sound.)

——— Harger, Rep. U. S. F. Com., I, 1871-72 (1873), p. 572. Vineyard Sound to South Carolina.

Cirolana concharum Harger, Proc. U. S. Nat. Mus., II, 1879, p. 161. Cape Cod southward.

——— Harger, Rep. U. S. F. Com., VI, 1878 (1880), p. 378, Pls. 9-10, figs. 58-63. (Off southern New England.)

——— Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 80. Beach Haven, New Jersey.

- Leidy, l. c., p. 125. Atlantic City, New Jersey.
- Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 343. United States.
- H. Richardson, Amer. Nat., XXXIV, 1900, p. 216, fig. 4. Cape Cod to Florida.
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 513. Nova Scotia to South Carolina (Long Island Sound).
- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 95, figs. 75-77. Nova Scotia to South Carolina.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 36. (Massachusetts and Rhode Island.)

Description.—Body oblong, ovate, about three times longer than wide. Head broader than long, front edge rounded and produced in small median point. Eyes formed of numerous ocelli, small, of irregular contour, and placed in anterior lateral angles of head. First antennæ with first segments short and subequal, and third segment long as first two combined. Flagellum formed of seventeen segments and extends to front lateral angles of first thoracic segment. Second antennæ with first two segments short and subequal, third and fourth subequal segments each long as first and second combined, and fifth segment little longer than fourth. Flagellum formed of sixteen segments and reaches to hind edge of first thoracic segment. Maxillipeds formed of seven segments. Mandible with palp of three segments. First, fourth, fifth and sixth thoracic segments subequal in length. Second, third and seventh thoracic segments subequal. Epimera distinctly separated from segments on all but first segment. In epimera of sixth and seventh segments outer posterior lateral angle acutely produced beyond hind edge of segments. All six abdominal segments distinct. Last abdominal segment triangular, and apex notched. Uropods not extending beyond end of terminal abdominal segment, both equal in length, and outer branch only one-third width of inner. Notch on outer edge of inner branch of uropods near posterior end. Inner angle of basal segment of uropoda produced and reaches two-thirds length of terminal abdominal segment. First three pairs of legs prehensile, and last four ambulatory. Color yellowish, reddish-brown on front edge of head

and on hind edges of segments, especially dorsally, where segments also marked with black dots. Thinner portions of body somewhat translucent in life, though becoming nearly uniform buff or yellowish, with black dots, in alcohol. Length 32 mm.

Remarks.—Found from North Carolina to Nova Scotia, ranging from the surface to a depth of forty-five fathoms. It prefers muddy and sandy bottoms, swimming in shallow water. It has been found in the stomach of a skate and under the eye of *Pseudotriacis microdon*, taken on Long Island. Its food is often the common blue crab, *Callinectes sapidus*, and from a single crab over one hundred specimens have been taken. It may be captured in a dip-net and is found in lobster-pots. It is abundant in Vineyard Sound, and is especially common during the winter. My examples from Atlantic City and Beach Haven, the latter a large series obtained by Dr. Leidy.

Family ANTHURIDÆ.

Body long, slender, subcylindric, rather flexible. Head comparatively small. Segments of mesosome all well defined, without distinct coxal plates. Metasome comparatively short, with anterior segments sometimes coalesced. Telson generally well defined, linguiform. Both pairs of antennæ, at least in female, short and subequal in length, originate close together, one pair beneath the other. Oral parts modified for perforation and suction. Legs with normal number of joints, basal and ischial rather slender, form together a genicular bend. First pair usually much stronger than others and subcheliform. Two succeeding pairs also subcheliform, much more feeble. Four posterior pairs of legs ambulatory. Pleopoda chiefly branchial, first pair large and more or less covering others. Uropoda with outer ramus extending upwards, so as generally to arch over base of telson. Incubatory pouch apparently not formed by distinctly defined lamellæ.

Genera about ten.

Genus CYATHURA Norman and Stebbing.

Cyathura Norman and Stebbing, Trans. Zoöl. Soc. London, XII, 1886, pt. 4, p. 121. Type *Anthura carinata* Kröyer, monotypic.

First five segments of abdomen coalesced into a single segment in female. Flagella of both pairs of antennæ rudimentary in both sexes, and that of first pair not greatly developed in male. Labium ends in two rounded lobes. Mandibles with cutting-edge of two or three blunt teeth. First maxillæ simple, ends in conspicuous and well-developed teeth. Maxillipeds with palp formed of two segments.

A single species on our shores.

Cyathura carinata (Kröyer).

PLATE 89.

Anthura carinata Kröyer, Naturh. Tidsskr., (2) II, 1846-49, p. 402. *Oresundet ved Kjobenhavn (Kallebod-Strand)*.

Cyathura carinata Norman and Stebbing, Trans. Zoöl. Soc. London, XIII, 1886, p. 124, Pl. 27, fig. 3. New Jersey to Greenland and Denmark.

—— Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 333. United States.

—— H. Richardson, Amer. Nat., XXXIV, 1900, p. 215. Cape Cod to North Carolina region.

—— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 508. Great Egg Harbor, New Jersey. (Norfolk, Virginia and Long Island Sound.)

—— Paulmier, 58th Rep. N. Y. State Mus., IV, 1904, p. 172, fig. 42. (Bergen Beach, New York.)

—— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 63, figs. 47-50. Great Egg Harbor, New Jersey. (Greenland to Virginia, Denmark and Germany.)

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 36. (Massachusetts, Rhode Island and Connecticut.)

Anthura gracilis (nec Montagu) De Kay, N. Y. Fauna, Crust., VI, 1844, p. 44, Pl. 11, fig. 34. *New York* (understood).

Anthura brunnea Harger, Rep. U. S. F. Com., I, 1871-72 (1873), p. 572. *Great Egg Harbor, New Jersey and Vineyard Sound*.

—— Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 426. (Vineyard Sound.)

Anthura polita Harger, Proc. U. S. Nat. Mus., II, 1879, p. 162. Gloucester, Massachusetts, southward.

—— Harger, Rep. U. S. F. Com., VI, 1878 (1880), pp. 398, 434, Pl. 11, figs. 68-69. Great Egg Harbor, New Jersey. (Connecticut and Massachusetts.)

Description.—Body elongate, slender, slightly over seven times longer than broad. Head little broader than long, front edge emarginate each side of small median point. Eyes distinct,

small. First antennæ with first two segments about equal in length, third segment little less than second, and fourth or flagellar segment about half length of third. First antennæ reach end of fourth segment of second antennæ. Latter with short basal segment, second segment about twice length of first, third segment half length of second, fourth segment little shorter than third, fifth segment one and one-half longer than fourth, and sixth or flagellar segment very short and about half length of fifth. Maxillipeds with palp of two segments. Mandibles with palp of three segments. First, fourth and fifth thoracic segments equal in length. Second, third, sixth and seventh segments equal, and three-fourths length of former. Epimera long and extremely narrow plates extending entire length of segments, not separated off by distinct sutures. Abdominal length a little less than one-fifth entire body length, and first six segments fused into single segment equal to second thoracic segment in length and without any trace of suture lines. Seventh abdominal segment, or telson, narrow, elongated, and rounded posteriorly. Uropoda with basal segment long as upper branch and reaches two-thirds length of telson. Inner lateral branch of uropoda placed at hind end of basal segment, rounded behind, extends remaining third in telson length and reaches end of that segment. Dorsal or upper branch of uropoda not arching over telson, but lies directly upon its dorsal surface, and extends to end of peduncle, somewhat triangular in form, narrow, elongate and with acute apex. First three pairs of legs prehensile, all others ambulatory. First pair of legs larger and stronger than two following pairs, and tooth on lower edge of propodus. Brownish above, mottled with yellowish, and paler below. Length 18 mm. (H. Richardson.)

Remarks.—Found along the Atlantic coast from Virginia to Greenland, and eastward to Europe. It lives in the sea, from the surface to a depth of nineteen and one-half fathoms, in mud, sand, shells, eel-grass and algæ. In New Jersey it was originally described as *Anthura brunnea*, by Harger, from Great Egg Harbor.

Super-Family TANAIIOIDEA.

Body usually slender, nearly cylindrical. Cephalon fused with first, also sometimes second, segment of thorax, to form carapace, and latter with small branchial cavity on each side. Other six segments of mesosome well defined, with small or inconspicuous coxal plates. Metasome generally of four segments, first five short, subequal, and last much largest. Eyes distinct or absent. First antennæ generally simple, sometimes with one or two flagella. Second antennæ smaller than first, issue immediately below. Mandibles with or without palps. First maxillæ with reflexed setiferous palp, placed in hind part of carapace. Second maxillæ very small, often rudimentary. Maxillipeds mostly coalesced at base, with four-jointed palp and large backwardly directed membranous epignath which passes into branchial cavity. First pair of legs very strong, curving anteriorly, and each ends in cheliform hand. Second pair sometimes unlike succeeding pairs, which latter simple and ambulatory. Pleopoda, when present, comparatively small, natatory, and rami lamelliform. Uropoda terminal, of four short basal segments and one or two filamentary branches. Sexual differences frequently pronounced.

A single family within our limits. The Apseudidæ is the only other family belonging to this group, known sometimes also as the Chelifera.

Family TANAIIDÆ.

Body sublinear, cylindrical, scarcely attenuated behind. Cephalosome not very broad, scarcely depressed, and front usually narrowly truncate. Ocular lobes sometimes well defined, sometimes obsolete. Free segments of mesosome perfectly smooth, and middle ones generally the longer. Coxal plates inconspicuous. Metasome comparatively short, scarcely narrower than mesosome. Eyes present or absent. First antennæ issue close together from frontal part, simple. In female first antennæ com-

paratively short, conical, of only three or four articulations, and in male usually much more fully developed. No secondary filament or flagellum to first antennæ. Single flagellum sometimes absent, generally rudimentary, rarely well developed in female and multiarticulate in male. Second antennæ generally smaller than first, without scale, flagellum usually rudimentary, short, only biarticulate. Mandibles various, without palps. First maxillæ with only single slender masticatory lobe. Second maxillæ rudimentary, as simple rounded lobes. Maxillipeds coalesced at base, with generally narrow falciform epignath. Chelipeds usually strong, closely applied to oral area, issue from hind part of cephalosome with broad base, carpus usually broad and compressed, and hand sometimes rather dissimilar in sexes. Second pair of legs not very different from succeeding ones, rather small and ambulatory. Pleopoda usually very small, with lamelliform incurved rami, sometimes rudimentary or quite absent in female. Uropoda not much elongated, simple or biramous.

Rather a large family, with about fifteen genera. Most of the species appear to live in tubes, which they form of mud and into which they may entirely draw in their bodies. On reaching the surface of the water they remain floating, without being capable of reimmerging their bodies.

Key to the genera.

- a. Five pairs of pleopoda present; uropoda double-branched. LEPTOCHELIA
 aa. Three pairs of pleopoda present; uropoda simple, short, single-branched,
 of three to seven joints. TANAIS

Genus LEPTOCHELIA Dana.

Leptochelia Dana, Amer. Journ. Sci. Art., (2) VIII, 1849, p. 425. Type
Leptochelia minuta Dana, monotypic.

Paratanais Dana, Amer. Journ. Sci. Art., (2) XIV, 1852, p. 306. Atypic.
 (Type *Tanais elongatus* Dana, Crust. U. S. Expl. Exped., 1852, p. 768,
 monotypic.)

Dolichocheilia Stebbing, Ann. Mag. N. Hist. London, (6) XVII, 1896, p. 49.
 Type *Dolichocheilia forresti* Stebbing, monotypic.

Eyes present. First pair of antennæ in female composed of three articles and a rudimentary flagellum. First antennæ in male much more elongated and with a multiarticulate flagellum. Gnathopods in male with chelæ fully developed, very much elongated, fingers elongate and curved, immovable one strongly tuberculate within. Gnathopods in female strong. Marsupium of female composed of eight large lamellæ issuing from first four free segments. Five pairs of pleopoda present. Uropoda double-branched, inner branch multiarticulate, outer branch of one or two articles.

Species several, one on our coast.

Leptochelia savignyi (Kröyer).

PLATE 89.

Tanais savignyi Kröyer, Naturhist. Tidsskr., IV, 1842, p. 168, Pl. 21, figs. 1-12 (female). *Maderia* (about 15 fathoms).

— Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 326 (remarks).

?— H. F. Moore, Proc. Acad. Nat. Sci. Phila., 1894, p. 93. Great Egg Harbor Bay, New Jersey.

— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 503. Great Egg Harbor, New Jersey.

— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 26, figs. 26-28. Great Egg Harbor, New Jersey. (Long Island Sound, Massachusetts and Europe.)

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 35. (Massachusetts and Connecticut.)

?*Leptochelia dubia* (nec Kröyer) H. F. Moore, l. c., 1894, p. 93. Great Egg Harbor Bay, New Jersey.

Leptochila dubia Paulmier, 58th Rep. N. Y. State Mus., VI, 1904, p. 171, fig. 40. Bayshore.

?*Tanais vittatus* H. F. Moore, l. c. Great Egg Harbor Bay, New Jersey.

Description of female.—Body narrowly long, about five times longer than broad. Head longer than broad, gradually narrowed from base to front end, and latter very slightly produced in an obtuse point. Eyes composite, small, round, placed at anterior lateral angles of head. First antennæ with first segment long and robust, second segment less than half length of first, third segment a little longer than second, in some cases subdivided.

Second antennæ shorter than first, basal segment long, second segment less than half length of first, third segment twice length of second, and fourth segment half length of third. First thoracic segment joined with head to form carapace, and following six segments free. First free segment, or second thoracic segment, little shorter than two following, which subequal. Fourth and fifth free thoracic segments a little longer than either of two preceding ones. Last thoracic segment little shorter than any of four preceding segments, but long as first segment. Abdomen formed of six segments, five short, subequally long ones anterior to terminal segment, which has posterior edge rounded. Uropoda formed of peduncle with two branches, inner of which formed of six segments and outer of but one segment. Five pairs of well-developed pleopods. First pair of legs chelate, and other six pairs ambulatory. Dactyl of second pair longer than those following, but not as long as propodus. Length 2.5 mm.

Description of male.—Body elongated, narrow, width one-fourth its length. Head trifle longer than broad, becoming narrowed anteriorly. Eyes distinct, large. First antennæ much elongated, long narrow basal segment about equals head in length, second segment little more than one-third length of basal, third segment one-half length of second, and flagellum formed of seven or eight segments. Second antennæ short, not reaching end of basal segment of first antennæ. First thoracic segment coalesced with head, second or first free segment shortest, third and fourth or second and third segments subequal, and each little longer than first, fifth and sixth or fourth and fifth free segments longest and subequal, or nearly twice length of first segment, and seventh or sixth free segment shorter than either two preceding segments, and about equals third free segment in length. Abdomen formed of six segments, five subequal ones before terminal segment, which triangular behind with rounded apex. Uropoda biramous, inner branch formed of six segments, and outer branch formed of only one short segment. Five pairs of well-developed pleopods. First pair of legs greatly elongate, reach some distance before head, long narrow carpus reaches to end of basal segment of first antennæ.

Propodus with distal end produced in long narrow strongly curved process or thumb, which latter armed within on inner side with two teeth. Dactylus long, narrow, strongly curved, and with stiff hairs on inner edge. All other legs ambulatory. Color nearly white. Length 2 mm. (H. Richardson.)

Remarks.—This species, though known in North America along the Atlantic coast from New Jersey to Massachusetts, occurs in Europe and Africa, indicating a very wide range of distribution. It lives on the surface, in algæ and eel-grass. In New Jersey it has been obtained in Egg Harbor Bay. I have not any New Jersey examples.

Genus TANAIS Audouin and Milne-Edwards.

Tanais Audouin and Milne-Edwards, Précis d'Entomologie, I, 1829, Pl. 29, fig. 1. Type *Tanais cavolinii* Audouin and Milne-Edwards. (Not consulted.¹)

Crossurus Rathke, Nov. Act. Acad. Cæsar Leop. Carol. Nat. Cur., XX, 1843, p. 39. Type *Crossurus vittatus* Rathke, monotypic.

Body not much elongated, with cephalosome rather tumid and having distinctly defined ocular lobes. Metasome of only five segments. Eyes well developed. Superior antennæ of similar structure in both sexes, triarticulate, with very small knob-like terminal flagellum. Inferior antennæ little smaller than superior, flagellum three to four articulate. Mandibles rather strong, molar expansion well developed. Palp of anterior maxillæ biarticulate, with several slender setæ at tip. Epignath of maxillipeds rather well developed, forms semilunar ciliated plate ending in digitiform lappet. Chelipeds very robust, especially in male, hand of latter much larger than in female, and fingers subforcipate. Second pair of legs slightly differing from succeeding ones, dactylus very much elongated and setiform. Dactyli of other pairs strongly hooked, and in three posterior

¹ *Tanais* is mentioned by Audouin and Milne-Edwards, in Résumé d'Entomologie, I, 1829, pp. 182 (252), though atypic. Later in Iconogr. Ann. Crust., 1829, p. 15, Pl. 29, fig. 1, it is also mentioned with "*Tanais* de'Costa" as the monotype. I cannot find any reference to *Tanais* as given by Agassiz for Ann. Sci. Nat. Zoöl. Paris, n. XIII, 1828.

pairs armed with comb-like teeth. Only three pairs of pleopoda present, all rather fully developed, with densely setiferous lamelliform rami. Uropoda simple, not much elongated, formed of a limited number of articulations. Incubatory pouch formed by two lamellæ only, issuing from base of fifth pair of legs.

Species rather few.

Tanais robustus H. F. Moore.

PLATE 90.

Tanais robustus H. F. Moore, Proc. Acad. Nat. Sci. Phila., 1894, p. 90, Pl. 5. *Sea Isle City, New Jersey* (on *Caretta caretta*).

— H. Richardson, Amer. Nat., XXXIV, 1900, p. 211. Cape Cod to North Carolina region.

— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 501. New Jersey.

— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 11 (copied Moore).

Description.—Body elongated, robust, width little over three times its length. Head widest portion of body, narrowed in front, posterior edge slightly concave medianly, as seen above anterior lateral edges concave, and front edge ends in minute rostrum. Eyes and lobes large, latter placed in deep recesses in anterior lateral portion of head.

First antennæ of three segments, basal segment somewhat longer than combined length of others and small knob or rudimentary flagellum terminal. Male with first antennæ usually about equal to head length with first free thoracic segment, but sometimes considerably longer. Female with first antennæ about equal to head length alone. Second antennæ lie close beneath first antennæ, by which slightly exceeded in length both in male and female. Second antennæ five-jointed, fourth joint longest or slightly exceeding second, with fifth, third and first following in order named, and last mentioned very short. Each second antenna ended by densely setiferous rudimentary flagellum, considerably longer than that of first antennæ and sometimes imperfectly articulated. Mandibles of usual form, curved inward at tip where a pair of horny.

U-shaped teeth. First maxillæ formed of stout forwardly directed column and posteriorly directed palp, with tuft of seven or eight long setæ at end, anterior ramus stout and curved toward median line, with group of about eight stout curved spines at tip and each with two series of fine apically directed denticuli. Brush of stiff setæ lies near base to side of spines, and small group of spines on one face near tip, and not denticulate or with brown color of those in apical group. Maxillipeds adherent basally by short stout hooks, and basal joints prolonged on anterior or oral aspects into plate-like processes, which coupled together in median line. Each basal joint with flattened palp of four joints, and terminal three with long setæ. Somewhat falciform branchial epipod attached to maxilliped at base by means of slender stalks. First gnathopods strongly chelate in both sexes, but especially in males. Thumb terminates by horny tooth, and external to and just within this a sharp-edged tubercle, with tooth of dactylopodite biting between the two.

Limbs of first free segment of peræon long and slender, terminal claws but slightly curved. Two succeeding pairs stouter, with dactylopodite and claw shorter than in first pair. Last three pairs still stouter, dactylopodite bearing strongly hooked claw with comb-like series of minute curved teeth on each side, and distal end of propodite with row of stout setæ. All limbs, except those of first free segment, with distal end of carpopodite crowned with few stout bifid or serrulate spines. Only anterior three segments of pleon with pleopods, each consisting of flat basal piece (protopodite) with two one-jointed blades attached, furnished on outer edges with long pinnate setæ, exopodite bearing about thirty-five and endopodite about fifteen. Both protopodite and endopodite bear long stout seta on inner edges. Uropods four-jointed, joints cylindrical and increase in length from base to tip. Behind head body width becomes gradually less with each successive segment. Fourth free segment of peræon longest, slightly exceeding third, which in turn longer than fifth. Pleon formed of six distinct segments, fourth and fifth much shorter than others and sixth terminates behind by blunt median projection. Dorsal surface

furnished laterally with few setæ, which on first and second segments of pleon form short row on each side, but never form transverse band crossing segment. Marsupia of female thin-walled pouches attached to ventral wall of sixth thoracic segment, increase with the development of the eggs, and in some specimens, extend over fifth to seventh segments, to which not attached, however.

Color (in alcohol) pale yellow, mottled with brownish on head, excepting over about thirty elliptical and sub-elliptical areolæ symmetrically arranged toward middle line. Dorsal surfaces of chelæ similarly marked. Body and limbs behind head much paler, as usually concealed in tubular dwelling. Length 4.7 mm. (H. F. Moore.)

Remarks.—This interesting animal is only known from Sea Isle City in this State. It was found by Dr. H. F. Moore, in 1894, living in minute tubes in crevices between the scales of the carapace of the loggerhead turtle (*Caretta caretta*). According to their describer they were seen crawling carefully about among their fellow voyagers or lying at the mouths of their domiciles with only the head and chelæ projecting, when undisturbed, otherwise they promptly retreated out of sight.

Order STOMATOPODA.

The Mantis Shrimps.

Stalked eyes and first pair of antennæ borne upon distinct movable segments. Rostrum of adult separated by movable joint from carapace. Latter small, not covering last four distinct thoracic segments. First five of eight pairs of thoracic limbs not biramous, but adapted to serve as accessory mouth-parts, second pair being strongly developed into large raptorial limbs in which, as in three following pairs, terminal segment (dactylus) closes upon next segment (manus) like blade of pen-knife. Last three pairs of thoracic limbs biramous, with lateral appendages upon penultimate segments and adapted for walking. Abdomen very strongly developed. Tufted gills carried on exopodites of first five abdominal appendages and sixth pair (uro-

Pods), which act with telson as powerful tail fin, and strengthened by stout process from basal segment ending in one or two spines.

This order embraces a single family.

Family CHLORIDELLIDÆ.

The Mantis Shrimps.

Abdomen larger than cephalothorax, gills attached to its under surface, last joint and appendages of joint next, greatly developed. Carapace more or less quadrilateral, with two longitudinal grooves above leaving exposed two first head segments and several body segments. Frontal plate mobile, separated from carapace by suture. Internal antennæ with three flagella. External antennæ short, bearing large oval scale. Second pair of maxillipeds large, prehensile, with inferior edge of last two joints usually armed with spines. Three first pairs of thoracic legs shorter, prehensile, applied to buccal cavity, with last joint but one expanded. Succeeding pairs of thoracic legs slender.

Remarkable crustaceans, strongly suggestive of the orthopterous insects known as the Mantis or Praying Horse. They range through most seas in shallow water, and may be found sometimes in holes, tide-pools and holes in the sand at low tide. The young are said to occur on the surface of the sea.

Genus CHLORIDELLA Miers.

The Squills.

Chloridella Miers, Ann. Mag. N. Hist. London (5) V, 1880, p. 13. Type *Chlorida latreillii* Eydoux and Souleyet, virtually third species. (Proposed to replace *Clorida*.)

Squilla (nec Müller 1776 and 1788, Scopoli 1777, O. Fabricius 1780) J. C. Fabricius, Entomol. Syst., II, 1793, p. 511. Type *Squilla maculata* J. C. Fabricius, first species.

Clorida (nec *Chlorida* Serv. 1834) Eydoux and Souleyet, Voy. Bonite, Zoöl., I, 1841, p. 264. Type *Clorida latreillii* Eydoux and Souleyet, monotypic. *Chlorida*, auct.

Hind body depressed and broad. Sixth abdominal somite separated from telson by flexible joint. Lateral edges of abdominal somites not greatly expanded, about one-fourth width of median portion. Ophthalmic segment not greatly elongated. Telson usually longer than wide, with six marginal spines and usually more than four intermediate denticles. Inner basal spine of uropod longer of the two. Dactylus of raptorial claw usually not, or very slightly, dilated at base, with six or less teeth, and manus with minute pectinations on inner edge.

This is the largest and most diverse of all the stomatopod genera, and including many species, is widely distributed.

Chloridella empusa (Say).

PLATES 91 and 95, FIGURE 2.

Squill.

- Squilla empusa* Say, Journ. Acad. Nat. Sci. Phila., I, pt. 2, 1818, p. 250. Rhode Island and the coast as far south as East Florida.
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 32. Pl. 13, fig. 54. Rhode Island to Florida.
- White, Cat. Crust. Brit. Mus., XXV, 1847, p. 84. (Rhode Island, on Say's material.)
- Gibbes, Proc. Amer. Assoc. Adv. Sci., 1850, p. 199. R. I. to Florida.
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), pp. 369, 536. Pl. 8, fig. 36 (Young).
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 551, Pl. 8, fig. 36. Florida to Cape Cod.
- Brooks, Ches. Z. Lab. J. Hopkins Univ., I, 1878, p. 143. Fort Wool and Old Point Comfort, Va.
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 823. Cape Cod to Florida.
- Kingsley, Standard Nat. Hist., II, 1884, p. 66, fig. 82. United States north to Newport, R. I.
- Bigelow, Proc. U. S. Nat. Mus., XVII, 1891, p. 525. Between Wood's Holl and Pensacola.
- Sharp, Proc. Acad. Nat. Sci. Phila., 1893, p. 107. Rhode Island (probably type). New Bedford, Massachusetts, to South America.
- Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 283. United States.
- Mayer, Sea Shore Life, 1906, p. 95, fig. 65. Florida to Cape Cod.
- Paulmier, 58th Rep. N. Y. State Mus., VI, 1904, p. 149, fig. 17. Cold Spring Harbor, Long Island, N. Y.

Chloridella empusa M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 29. (Massachusetts to Connecticut.)
 ——— Fowler, Proc. Acad. Nat. Sci. Phila., 1913, p. 64. Wailops I., Va.

Description.—Carapace narrowed anteriorly, dilated behind, and well emarginated on hind edge. Upper surface of carapace with median bifurcated ridge longitudinally, and two on each lateral lobe, of which internal short and external ends abruptly before reaching hind rounded end. Lateral ridges produced into large anterior lateral spines and posterior lateral edges angled. Fifth thoracic segment with separate ventral and lateral spines, latter slightly curved forward and acute. Lateral processes on next two segments strongly produced and acute or mucronate. First five abdominal segments with eight distinct carinæ. Telson with crest and curved line of pits, six marginal spines and eight basal carinæ, and on each side three to four sub-median, six to nine intermediate, and one lateral denticle. Sub-median spines of telson with immovable tips. Carinæ and elevations at bases of denticles always distinct. Margin of telson or of abdomen never thickened in males. Eyes large, triangular, with oblique corneal axis equal to peduncular axis. Six teeth on dactylus of raptorial claw, and outer edge of dactylus sinuate. Rostrum variable, usually little longer than broad, sub-quadrate or hemiellipsoidal and with lateral and median carinæ. Color in life horny-brown, and abdominal segments blotched irregularly with dusky. Caudal plates yellowish, edged with blackish. Eyes green. Length 18 cm.

Remarks.—The squill ranges along the coast of North America from Massachusetts to Florida, and is sometimes met with in large numbers. It is valued as food in some places, and in others as bait, by the fishermen. It ranges from the beach down to twelve fathoms, and burrows in mud near low water, when it is often dragged ashore in hauling seines.

Verrill says it is often thrown on the beaches by the waves, and probably usually burrows in the mud below low-water mark, but in certain localities it has been found burrowing at or near low-water mark of spring-tides, forming large irregular holes.

The very curious free-swimming young were taken in towing nets. Large examples are eight to ten inches long and about two broad. By means of the strong raptorial claws the animal can hold its prey securely, and can give a severe wound to the human hand, if handled incautiously. It also uses the stout caudal appendages, which are armed with spines, very effectively. The colors are quite vivid, considering its mud-dwelling habits. The body is generally pale green or yellowish-green, each segment bordered behind with darker green and edged with bright yellow. The tail is tinged with rose and mottled with yellow and blackish. Outer caudal lamellæ with base and spines white, last joint yellow margined with black. Inner ones black, pale at base. Eyes bright emerald-green. Inner antennæ dark, with yellow band at base of each joint, and flagellum annulated with black and white.

I have seen this species several times in New Jersey, as at Corson's Inlet, Stone Harbor, Anglesea and Cape May. During 1911 Mr. Brown secured several at the latter locality, and these are the basis of the above description. During that season the species was abundant about Cape May. It has also been found near Point Pleasant.

During May of 1912 several large examples were seined in Chincoteague Inlet at Wallop's Beach, Virginia, with *Crago septempinosus*, *Callinectes sapidus*, *Ovalipes ocellatus* and *Palæmonetes vulgaris*.

Mr. W. T. Davis tells me has obtained it on two occasions on the south side of Staten Island, N. Y.

Order SCHIZOPODA.

The Schizopods.

Mandibular palp generally exceeds length of mandible itself. Maxillipeds sometimes quite pediform. First pair of legs developed as true gnathopoda, and others uniform, not cheliform or modified as prehensile organs. Exopods strongly developed on all limbs of trunk. Ova invariably placed below trunk and

usually contained in a pouch or marsupium, formed generally of certain number of lamelliform leaflets issuing from bases of legs. Incubatory lamellæ sometimes wanting. Young pass within marsupium of female through one or more so-called pupa states before hatching. Young also sometimes hatched in very immature condition, and not attaining, till after very complicated free metamorphosis, characteristic adult form.

Four families are admitted, as the Lophogastridæ, Eucopiidæ, Euphausiidæ, and the single remaining one represented, so far, in our limits.

Family MYSIDÆ.

The Opossum Shrimps.

Carapace usually rather small, its hind part only loosely covering trunk, segments of which distinctly defined, though very narrow and crowded together in dorsal part. Maxillipeds strong, exopodite well developed and natatory, epipodite lanceolate and projecting within branchial cavity. First pair of legs modified gnathopoda. Remaining legs uniform and generally rather feeble, terminal part usually subdivided into short setiferous articulations and dactylus usually small or absent. No true branchiæ present. Marsupium usually formed of only two or three pairs of incubatory lamellæ issuing from bases of hindmost pair of legs. Female caudal limbs quite rudimentary, not formed for swimming. In male caudal limbs either natatory or some modified to serve as copulative organs. Inner plate of uropod generally contains within its base peculiarly developed auditory apparatus. Development without any free metamorphosis.

Genera about twenty-eight.

Genus MYSIS Latreille.

PLATE 90, FIGURE 2.

Mysis Latreille, Hist. Nat. Crust., VI, 1803, p. 282. Type *Cancer pedatus* Latreille, first species.

Carapace covers only anterior part of thorax, both sides turned down and in to apply to base of feet. Carapace becomes very narrow anteriorly ending in short flattened rostrum. Abdomen slender, tapers, elongate, nearly cylindrical. Eyes large, short, bases hidden below front edge of carapace. First antennæ inserted above second pair below eye near median line, and with two terminal flagella to each one. Second antennæ longer, basal joint with elongated laminar appendage attached, and its inner edge ciliated. Two succeeding joints of peduncle slender and cylindrical, and flagellum filiform. Foot-jaws of two pairs, entirely pediform. First pair short, formed of three distinct branches. Of latter internal pediform portion five-jointed, hairy and doubled upon itself in front of mouth. Middle branch or palp elongated and formed of numerous articulations. Basilar joint very large, with ciliated strap-shaped process on each side. Third or external branch, or flabelliform appendage, represented by semimembranous scale directed upwards and lying under edge of carapace. Second pair of foot-jaws of similar formation, but without flabelliform appendage. Feet in six pairs, formed of corresponding elements with external pedipalps and five pairs of feet, as in Decapods. Each consists of two branches, decreasing in length from before backwards, and formed for swimming. First four pairs of feet without flabelliform appendage, though last two have it. This part very small in male, though greatly developed in female, and forms on each side broad plate bent under sternum, thus forming pouch in which eggs are first deposited and in which secluded young pass early period of their life.

Species rather numerous, though but one recorded from our shores.

***Mysis americana* S. I. Smith.**

Mysis americana S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 552. *Beesley's Point, New Jersey. New Haven, Connecticut. In 25 fathoms off Vineyard Sound.*

— (S. I. Smith) Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 396, among algæ; p. 519 (in *Paralichthys dentatus*); p. 520 (in *Alosa sapidissima* and *Lophopsetta maculata*, all from Great Egg Harbor Bay, New Jersey).

—— S. I. Smith, Trans. Conn. Acad., V, 1879, p. 106. Great Egg Harbor, New Jersey; Great South Bay, Long Island; New England.

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 27. (Connecticut to Maine.)

Mysis americanus Benedict, Rep. U. S. F. Com., XI, 1883 (1885), p. 176. Off Montauk Point, Long Island.

Mysis spinulosus De Kay, N. Y. Fauna, Crust., VI, 1844, p. 31. Pl. 7, fig. 20. New York coast.

Description.—Anterior edge distinctly rostrated, but only slightly projecting, evenly rounded, and inferior angle projecting into sharp tooth. Antennules of male with densely ciliated sexual appendage, outer flagellum nearly long as body and inner slightly shorter. Antennal scale about three-fourths long as carapace, about nine times long as broad, tapering regularly from base to very long acute tip and both edges ciliated. Appendages of fourth abdominal segment in male as usual in typical species. Outer ramus slender and naked, its pair of terminal stylets equal in length, slender, curved toward tip, and distal half armed with numerous short setæ. Ultimate segment of ramus itself little more than half long as stylets, and penultimate segment four or five times long as terminal. Inner lamella of appendages of sixth segment about long as telson, narrow, slightly broadened at base, and tapers to slender obtuse point. Outer lamella one and one-half as long as inner, eight times long as broad, slightly tapering, and end subtruncate. Telson triangular, broadened at base, lateral edges slightly convex posteriorly, and armed with stout spines alternating with intervals of several smaller ones. Telson tip very narrow, truncate, armed with stout spine each side, and two small ones filling space between their bases. Length 12 mm. (S. I. Smith.)

Remarks.—This species, originally found at Beesley's Point, ranges northward along the New England coast. Smith mentions having secured it in April, in pools upon the salt marshes. It has also been found below low water, as among sea-weeds, to a depth of thirty fathoms. It is found among algæ and in the stomachs of fishes. Verrill says it occurs in immense numbers among the algæ growing on rocks just below low-water mark, especially in spring. It is an important species, as it forms one

of the principal kinds of food for shad, spotted flounder and mackerel, besides other fishes. Adult examples are only about an inch in length. The animal is nearly transparent, whitish, with prominent black eyes, and a row of more or less pronounced dark stellate spots along body, both above and below, with similar specks often on tail. Spot of dark-brown or blackish often occurs on each side of carapace. The intestine shows through as greenish or brownish line.

Order DECAPODA.

The Stalk-Eyed Crustacea.

Thoracic segments united with head to form cephalothorax usually covered by carapace. Eyes on stalks, movable. Mouth armed with mandibles and jaws for mastication. Third maxillipeds leg-like. Three anterior pairs of thoracic lines biramous foot-jaws, and posterior five pairs walking-legs without exopodites. So-called gills generally present, thoracic.

This great group includes the larger and higher forms. Three divisions are here admitted as sub-orders, as the transition between the Macrurans and Brachyurans is gradual and indistinct.

Key to the Sub-Orders.

- a.* Abdomen usually shorter than cephalothorax, and commonly held in an extended position; usually distinct rostrum present; eyes not enclosed in orbits; antennules and antennæ large; antennules not sunk in pits; antennæ with an exopodite or squame.
- b.* Abdomen equally or better developed than cephalothorax, behind which more or less completely extended and beneath which never permanently flexed, ends in large symmetrical tail-fan with almost always foliaceous lateral lobes (caudal swimmerets); front not joined with epistome; thoracic sternum usually narrow, if broad last segment not independently movable, genital ducts never open on sternum; antennal peduncle commonly with a movable foliaceous exopodite, though not always present. MACRURA
- bb.* Abdomen less developed than cephalothorax, exceptionally elongate, symmetrical, extended in straight line behind cephalothorax when either rolled on itself or flexed against sternum or coiled spirally, in

last case mostly soft and asymmetrical; sixth abdominal somite seldom without appendages homologous with caudal swimmerets; front not united with epistome across ophthalmic somite; last thoracic segment independent, when not atrophied movable; genital ducts never open on sternum; antennal peduncle carries an exopodite, this never foliaceous.

ANOMURA

aa. Abdomen shorter than cephalothorax, beneath which it folds permanently; front joined with epistome across hidden ophthalmic somite to form an interantennular septum; eyes enclosed in orbits or tubular cavities of carapace; antennules and antennæ small; bases of antennules sunk in pits of carapace; antennæ without exopodite; third maxillipeds flattened, valve-like; thoracic sternum usually, not always, broad, last segment fused with others; sixth somite mostly without appendages, when rarely present (*Dromiida*) appearing as pair of small lateral plates intercalated between sixth and seventh somites; genital ducts of female usually, not always, open on sternum, and those of males sometimes also.

BRACHYURA

Sub-Order MACRURA.

The Macrurans.

Body elongate, cephalothorax less than half its total length. Front not fused with epistome. Carapace generally produced anteriorly into a rostrum and generally covers ophthalmic somite. Abdomen large and symmetrical, more or less completely extended behind cephalothorax, but never folded beneath it, ends in symmetrical tail-fan with foliaceous lateral lobes (caudal swimmerets). Thoracic sternum generally narrow. Abdominal pleura behind first generally well developed, and terga commonly overlap one another. Eyes seldom lodged in orbits. Antennular peduncle generally rigid or its joints not folded, usually shorter than flagella. Antennal peduncle commonly with all five joints distinct and movable. Its second joint often carries an exopodite, which usually large and foliaceous (antennal scale), sometimes spiniform. Antennal flagellum almost always very long. External maxillipeds mostly elongate and pediform. Epipodites often present on first four pairs of thoracic legs as well as on maxillipeds. First pair of thoracic legs usually enlarged and chelate, second pair also commonly chelate, and very often third pair. Usually all abdominal somites, except telson, carry pair of well-developed appendages. Commonly styliform appendix in-

ternal at base of endopodite. Genital ducts never open on sternum. Except in very few forms, those for most part small pelagic and nectic species, fourth and fifth pairs of thoracic legs not reduced in size, nor ever folded within branchial chambers.

A very large group, comprising familiar forms as shrimps, crawfish and lobsters, etc. The following classification is adopted largely from Alcock.

Key to the Tribes.

- a. Body and rostrum generally compressed; carapace not impinging upon epistome antero-laterally; abdomen usually dorsally elbowed or humped; pleura of first abdominal somite seldom reduced; antennal scale almost always large and foliaceous so as entirely concealing antennal peduncle.
- CARIDIDES
- aa. Body and rostrum not particularly compressed, sometimes decidedly depressed; carapace impinges on or articulates with, or fuses with, epistome antero-laterally; abdomen not humped; pleura of first abdominal somite reduced; antennal scale present or absent, in former case foliaceous or spiniform, and if foliaceous not concealing terminal joint of antennal peduncle entirely.
- ASTACIDES

Tribe CARIDIDES.

Body generally compressed. Rostrum generally compressed. Integument very rarely strongly calcified. Abdomen symmetrical, long, bent or humped. Telson usually acute, occasionally bluntly rounded. Pleura of last abdominal somite little or not reduced. Basal joint of antennular peduncle usually with spine or scale (stylocerite) at proximal end of outer margin. Olfactory setæ confined to proximal end of outer antennular flagellum. Antennal scale mostly large, entirely conceals and projects far beyond antennal peduncle. External maxillipeds pediform and mostly longer than first pair of thoracic legs. Thoracic legs consist usually of seven movable joints, first two or three pairs may be chelate and last two never truly so, all five pairs often very slender or first, second or third may be enlarged or massive, and fourth and fifth pairs occasionally (*Sergestidæ*) rudimentary or absent, but never folded in branchial chamber. Abdominal appendages well developed, first pair often biramous. Male

genital openings mostly always in articular membrane between sternum and coxa of fifth pair of thoracic legs. Branchiæ as dendrobranchiæ or phyllobranchiæ, only occasionally (Stenopidea) resembling trichobranchiæ.

Key to the Super-Families.

a. Mandibular palp large, foliaceous.

PENÆIDEA.

aa. Mandibular palp not large or foliaceous.

CARIDEA.

Super-Family PENÆIDEA.

The Edible Prawns.

Pleura of first abdominal somite overlap those of second. Incisor portion of mandibles separated from molar portion by groove. Endopodite (palp) of mandibles commonly very large and foliaceous or subfoliaceous. Coxopodite of second maxillæ cleft in two lobes, distal of which prominent and small proximal receding. Endopodite of first maxillipeds long and sometimes five-jointed. Last joint of second maxillipeds a distinct dactylus, articulating end-on with distal end of propodite. External maxillipeds distinctly seven-jointed. Third pair of thoracic legs chelate, often first and second pairs also. Endopodites of abdominal appendages from second to fifth without internal appendix at bases, except in second pair of male. Branchiæ as dendrobranchiæ.

Family PENÆIDÆ.

The Edible Prawns.

Rostrum usually well developed, laterally compressed. Ophthalmic somite little exposed. Basal joint of antennular peduncle dorsally concave for eye and strengthened at base on outer side by spine-like scale. Antennular flagella two. Antennal scale broadly foliaceous. First three pairs of thoracic legs chelate, fourth and fifth pairs well developed. Exopodites present on some or all thoracic legs, or entirely absent. Epipodite of second maxillipeds large. Branchiæ numerous.

Genus *PENÆUS* Fabricius.*The Edible Prawns.*

Penæus Fabricius, Ent. Syst. Suppl, 1798, p. 409. Type *Penæus monodon* Fabricius, first species, evidently designated by Stebbing, Hist. Recent Crust. (Int. Sci. Series LXXIV), 1893, p. 216.

Penæus, auct.

Xiphopenæus S. I. Smith, Trans. Conn. Acad., II, 1870, p. 27. Type *Xiphopenæus harttii* S. I. Smith, monotypic.

Parapenæus S. I. Smith, Proc. U. S. Nat. Mus., 1885, p. 170. Type *Penæus longirostris* Lucas, first species.

Parapenæus, auct.

Metapenæus Wood-Mason and Alcock, Ann. Mag. Nat. Hist., London, (6) VIII, 1891, p. 271. Type *Penæus affinis* Milne-Edwards, designated.

Metapenæus, auct.

Parapeneopsis (Wood-Mason) Alcock, Cat. Crust. Ind. Mus., 1901, p. 14. Type *Penæus styliferus* Milne-Edwards, designated, monotypic.

Trachypenæus Alcock, l. c., p. 15. Type *Penæus anchoralis* Bate, designated, monotypic.

Neopenæopsis Bouvier, Compt. Rend. Acad. Sci. Paris, CXXI, 1905, p. 747. Type *Neopenæopsis paradoxis* Bouvier, designated, monotypic.

Carapace with well developed rostrum, which may be toothed dorsally and ventrally or dorsally only. Abdomen long, some of hind somites compressed and carinated. Eyes large, subglobular. Basal joint of antennule hollowed dorsally for reception of eye, its outer edge produced anteriorly into a spine, and from proximal end of inner edge springs conspicuous twisted setose scale. Antennular flagella cylindrical, commonly subequal and either short or not very long (one occasionally much elongated in *Xiphopenæus*). Antennal scale large, outer edge rigid and anteriorly acute. Antennal flagellum long. Mandibular palp large and broadly foliaceous, second joint vastly larger than first. Palp of first maxillæ commonly ends in little distinctly articulated flagellum. Exopodite of external maxillipeds compressed stiffish joint, long as and similar to that of second maxillipeds. External maxillipeds pediform. First three pairs of thoracic legs chelate, first pair shortest and third pair longest. Last two pairs of legs monodactylous. Exopodites usually present on all, or all but last thoracic legs, or sometimes

entirely wanting. Abdominal appendages of moderate length, exopodite longer than endopodite, either foliaceous or slender. In first pair no endopodite present, but in male replaced by a "petasma" or "andricum" which usually well pleated and sometimes convoluted. In second pair endopodite in male carries little fleshy scale at its base. No podobranchiæ present on any legs. Pleurobranchiæ present on all, or all but last one or two of last seven thoracic somites.

Alcock restricts or indicates *Penæus caramote* Risso as the type of *Penæus*,¹ but this action is invalid as the only species included in the original account by Fabricius are: *monodon*, *monoceros* and *planicornis*. If no other action has been made the first species (*monodon*) may be considered the type, as suggested by Stebbing.

Penæus longirostris Lucas may be identical with *Penæus membranaceus* Heller, and therefore Alcock's designation of the latter as the type of *Parapenæus* is valid.

Unless *Penæus kroyeri* Heller is identical with *Xiphopenæus harttii* S. I. Smith, Alcock's designation is useless, as in any case *Xiphopenæus* is monotypic.

Key to the Species.

- a. Parallel grooves along each side of median keel usually persist nearly to hind end of carapace; flagella of antennæ long. *brasiliensis*
 aa. Parallel grooves along each side of median keel usually extend only to middle in length of carapace; flagella of antennæ usually short. *setiferus*

Penæus brasiliensis Latreille.

Brazilian Prawn.

Penæus brasiliensis Latreille, Nouv. Dict. Hist. Nat., XXV, 1817, p. 156.
Coasts of Brazil.

— Stimpson, Ann. Lyc. Nat. Hist. N. Y., X, 1871, p. 132. Somers Point, New Jersey. (Sing Sing, New York.)

— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 551. Croton River at Sing Sing, N. Y., to Brazil.

¹ Cat. Crust. Ind. Mus., 1901, p. 14.

- R, Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 822. Freshwater Creek, near Somers Point, New Jersey.
- M. J. Rathbun, Bull. U. S. F. Com., XX, 1900 (1902), p. 100. Porto Rico, and Katama Bay, Mass.
- Paulmier, 58th An. Rep. N. Y. State Mus., VI, 1904, p. 133. Great South Bay and Hudson River, N. Y.
- Penæus braziliensis* Kingsley, Bull. Essex Inst., X, 1878, p. 69. New York to Brazil.
- Kingsley, Amer. Nat., XXXIII, 1899, p. 719. Cape Cod to North Carolina and Florida regions.
- Penæus brasiliensis* Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 330. New York to Brazil.
- Penæus brasiliensis* M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 19. (Massachusetts southward.)
- Penæus braziliensis* Mayer, Sea Shore Life, 1906, p. 91. New York to Brazil.

Description.—Carapace moderate. Abdominal keel on fourth, fifth and sixth segments sharp, and groove either side of latter. High median keel reaches almost to hind edge of carapace, and with deep broad groove either side extending parallel, also nearly reaching hind edge of carapace. Posterior half of keel with groove forming into double ridge. Front half of keel arched, highest above orbit, with nine teeth, of which six on rostrum and last nearly half way back on carapace. Ophthalmopod moderate. Antennules with short stout hairy peduncles, which extend forward far as, or slightly beyond, rostrum tip, and biramous slender flagella equal or longer than peduncle. Antennæ with very long slender filamentous flagella, these often longer than body. Rostrum unarmed, becoming horizontal towards end, and two or three denticles on lower edge. Antennal spine, hepatic spine, carina and groove all well defined. Hepatic spine with partly horizontal suture below. Cervical suture extends only half way from hepatic spine to dorsal keel. Outer joint of mandibular palp much larger than inner, very broad and not extended as narrow tip. First maxilla with long endognath and also well segmented. First maxilliped with slender four-segmented endopod, and lamellar unsegmented exopod. First and second gnathopods with well-developed epipods, and exopods large. Peræopods all with small exopods, and only first, second and third with epipods. Pleopods all robust, well developed. Telson with deep median

groove and a pointed end. Color more or less translucent, becoming brownish in alcohol. Length 160 mm.

Remarks.—A species of wide distribution along our Atlantic Coast, ranging from Cape Cod southward to Florida and Brazil. It is also said to occur on the Pacific Coast. The bathymetrical range is nine hundred and fifty-five fathoms. It is, however, rather occasional on our coast, and though a few have been reported, it is apparently not common or regular. Stimpson found it in fresh water at Beesley's Point. Along the southern shores of the United States it is more or less common, though less frequent than the usually larger *Penæus setiferus*, with which it associates and is also exposed for sale in the markets. As these animals soon die after being removed from the water they cannot be transported any great distance in a fresh condition.

I have no New Jersey material at hand.

Penæus setiferus (Linnæus).

PLATE 92.

Southern Prawn.

Cancer setiferus Linnæus, Syst. Nat., Ed. XII, 1767, p. 1054. "*Habitat in Indiis.*"

Penæus setiferus Milne-Edwards, Hist. Nat. Crust., II, 1837, p. 414. Mouths of rivers in Florida.

— R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 821, Pl. 273. Has not been recorded from north of Norfolk, Virginia. (Southern Atlantic coast, and Gulf coast of Mexico.)

— Kingsley, Amer. Nat., XXXIII, 1899, p. 719. Middle Atlantic and Florida regions.

Description.—Carapace moderate, compressed, with convex surfaces. Abdominal keel well developed on fourth to sixth segments, sharp, and with slight basal groove along base of sixth on each side. High median keel reaches almost to hind edge of carapace, and with well-developed groove either side anteriorly, though grooves extend only till about midway in length of carapace. Posterior half of keel with portion forming slightly into inconspicuous double ridge. Front half of keel arched, highest

above eye-socket, with nine teeth, of which six on rostrum, and last back about opposite ends of grooves which extend parallel along base of carapace keel anteriorly. Position of this last spine thus about midway in length of carapace. Ophthalmopod moderate, depression on which it rests small. Eye large, and peduncle not nearly so robust, though basally becoming more bulky. Antennulues with large peduncle, not quite extended so far anteriorly as rostrum tip, basal joint trifle more than half length of rostrum, second joint less than half length of first, and third joint half length of second. Edges of antennules and scales setaceous. Flagella of antennules biramous, outer branch a little longer than peduncle and inner branch about half length of outer. Antennæ with very short though robust peduncles of three rather uneven subequal joints, and flagella extremely long filaments, about one and four-fifths times length of entire animal. Rostrum rather compressed, unarmed, very slightly inclined upwards towards tip, and two denticles on lower edge. Antennal spine, hepatic spine, carina and groove all well-defined. Hepatic spine with nearly horizontal suture below. Cervical suture extends half way from hepatic spine to dorsal keel. Outer joint of mandibular palp much larger than inner, very wide. First maxilla with long endognath, and well segmented. First maxilliped with slender four-jointed endopod and lamellar unsegmented exopod. First and second gnathopods with well-developed epipods, and exopods large. Peræopods all with small exopods, and only first, second and third with epipods. Pleopods all robust, well developed. Telson with deep median groove, and ends in sharp point. Color mostly transparent, turning brownish in alcohol. Length of body from tip of rostrum 195 mm.

Remarks.—This southern species occurs occasionally as far north as the shores of our State at least, though it does not seem to have been recorded north of Norfolk, in Virginia, before. It occurs associated with the preceding species, and is doubtless confused by such observers as casually notice large prawns. Southward it ranges to Florida and the Gulf of Mexico. I know of two large New Jersey examples, one secured at Holly Beach in August of 1893 by Mr. N. H. Boon, and another taken at Atlantic City in 1901, and obtained from Mr. C. Buvinger.

Possibly other examples reported to me on reliable authority are likely this species. They were noted at Peck's Bay, along Delaware Bay at various points, at Fishing Creek and Green Creek, Sea Isle City, Stone Harbor and Anglesea. They appear to be noticed mostly in the bays and sometimes in brackish or nearly fresh water. As food they are of value, though their scarcity usually precludes any local supply. Mr. D. McCadden secured it at Ocean City on July 6th, 1913.

Super-Family CARIDEA.

Pleura of first abdominal somite overlapped by those of second. Mandible often, not always, deeply cleft into incisor and molar branches, and endopodite (palp) when present only exceptionally expanded and foliaceous. Coxopodite of second maxillæ usually small and receding, or occasionally obsolete, never cleft into two lobes. Endopodite of first maxillipeds short. Second maxillipeds with last joint rarely articulating end-on with distal end of propodite, though occasionally so, and usually lying along inner edge of propodite as if a complementary piece of latter joint. External maxillipeds four or five jointed, dactylus and propodite fused together to form terminal joint, and ischium and merus, or basis, ischium and merus, fused to form third or second joint. First two pairs of legs chelate or subchelate, but third pair always monodactylus. Internal appendix usually armed with hooklets mostly present on base of endopodite of abdominal appendages from second to fifth. Branchiæ as phyllobranchiæ. Ova, when laid, attached to abdominal appendages of female.

Alliance CRANGONOIDA.

Mandibles not deeply cleft into incisor and molar branches, without palp. Exopodites of first maxillipeds end in slender flagellum. Last segment of second maxillipeds "complementary" of propodite as in Pandaloida. Except in few species of Crangonoida in which an exopodite present on first pair of thoracic legs, exopodites absent from latter. First pair of thoracic legs stout, subchelate.

Family CRANGONIDÆ.

Carapace short, rostrum short, not laterally compressed. Basal joint of antennular peduncle slightly concave dorsally, and with scale or spine on its outer border. Two short antennular flagella. Antennal scale usually foliaceous. Mandibles slender, incurved, not deeply cleft into divaricating incisor and molar branches, without palp. Second maxillæ have coxa and basis, and first maxillipeds coxa, much reduced. All maxillipeds have exopodites terminating in slender flagella. Terminal segment of second maxillipeds a narrow plate attached along all its extent to inner border of propodite, as if complementary piece of latter. External maxillipeds stout, pediform. First pair of thoracic legs much stoutest, subchelate, dactylus closing on oblique distal border of hand, fixed finger on oblique spine. Second pair of legs with simple carpus, usually slender and chelate, sometimes not chelate and sometimes wanting. Third pair much slenderer than fourth and fifth. First pair of thoracic legs alone sometimes have an exopodite.

Genus CRAGO Lamarck.

The Sand Shrimps.

Crago Lamarck, An. San. Vert., 1818, p. 150. Type *Cancer crangon* Linnæus, monotypic.

Crangon (nec Weber 1795) Fabricius, Suppl. Entomol. Syst., 1798, p. 409.

Type *Crangon vulgaris* Fabricius, second species, designated by Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 411.

Steiracragon Kinahan, Proc. Roy. Irish Acad. Dublin, VIII, 1862, p. 68.

Type *Crangon (Steiracragon) allmanni* Kinahan, monotypic.

Rostrum very short. Eyes free. Antennulæ biflagellate. External maxillipeds pediform. First pair of peræopoda stout, stouter than second, though but little longer than latter. Second pair slender, elongate, chelate, and remaining pairs acuminate. Hand subchelate, dactylus closing on margin of palm and pollex being spiniform. Branchiæ five on each side.

Crago septemspinosus (Say).

PLATE 93.

Common Shrimp. Sand Shrimp.
Gray Shrimp.

- Crangon septemspinosus* Say, Journ. Acad. Nat. Sci. Phila., I, pt. 2, 1818, p. 246. Bay shore and inlets of the sea far south as East Florida.
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 25, Pl. 8, fig. 24. Florida to the Arctic Ocean.
- White, Cat. Crust. Brit. Mus., XXV, 1847, p. 73. (East Florida, on Say's material.)
- Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 150. Great Egg Harbor, New Jersey.
- Crango septemspinosus* M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 19. (New England.)
- Fowler, Rep. N. J. State Mus., 1908 (1909), p. 376. Corson's Inlet, New Jersey.
- Fowler, Proc. Acad. Nat. Sci. Phila., 1913, p. 64. Wallops I., Va.
- Crangon vulgaris* Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 339, Pl. 3, fig. 10, sandy flats, tide pools; p. 529, young.
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 550, Pl. 3, fig. 10. North Carolina to Labrador.
- Kingsley, Bull. Essex Inst., X, 1878, p. 53. Massachusetts Bay to Florida.
- Uhler, Ches. Z. Lab. J. Hopkins Univ., I, 1878, p. 26. Fort Wool, Virginia.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 327. Fort Macon, N. C. northward.
- S. I. Smith, Trans. Conn. Acad., V, 1879, p. 55. North Carolina, New Jersey, south shore Long Island, Labrador.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 411. Northampton county, Virginia.
- Kingsley, Standard Nat. Hist., II, 1884, p. 51, fig. 60. Coast of North America.
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 816. Labrador to North Carolina.
- Benedict, Rep. U. S. F. Com., XI, 1883 (1885), p. 176. Off Montauk Point, Long Island.
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 651. N. Lat. 40°, W. Long. 69°, in 30 to 32 fathoms.
- Stebbing, Hist. Recent Crust. (Int. Sci. Ser. LXXIV), 1893, p. 225. Northern hemisphere.
- Kingsley, Amer. Nat., XXXIII, 1899, p. 715. Cape Cod to North Carolina region.

- Mayer, Sea Shore Life, 1906, p. 89, fig. 56. North Carolina to Labrador.
- Paulmier, 58th Rep. N. Y. State Mus., VI, 1904 (1906), p. 131, fig. 3. New York City.
- Crangon crangon* (nec Linnæus) Sharp, Proc. Acad. Nat. Sci. Phila., 1893, p. 125. Beesley's Point, New Jersey.
- Ortmann, Proc. Acad. Nat. Sci. Phila., 1895, p. 179. Northeastern America south to Virginia and North Carolina.

Description.—Cephalothorax moderately short. Ophthalmopod short, depression in which it rests small, eye moderate, and peduncle nearly as robust as latter, though at base smaller. First antennæ biramous, outer branch shorter. Second antennæ long as rest of body, multiarticulate, with broad long flagellum nearly equal to first antennæ in length. Rostrum short simple point, extends forward about midway between exposed ophthalmopods. Mandibles slender, curving in rather spacious mouth, ends tridentate. Labia well developed, upper of three elements of about equal proportions of which median rather evenly convex in shape, and lower broad, thin, deeply cleft medianly with each lobe well extended laterally. First maxillæ short, like mandibles. Second maxillæ with rather long slender basis, thus much longer than first maxillæ. Pereion rather cylindrical, short. First maxilliped long, compressed moderately at basal region, non-chelate, and with exopodite little longer than that of second maxillæ. All exopodites, on first and second maxillæ and on first maxillipeds, more or less subequally long, flagellate, and their distal filaments quite acuminate. First peræopods enlarged, stout, partly chelate, merus shorter and broader than basis, and dactylus depressible against oblique trenchant edge with short sharp erect spine at pollux. Second peræopods, also third, fourth and fifth, slender, subequally long, with articulations of more or less even proportions, and dactyli all slenderly acuminate, not chelate. Pleon capable of being evenly curved, with third shield largest, though sixth much longer and also narrowly compressed. Five pairs of pleopods ending acuminately, and shorter similar interior podite to each. Telson sharp slender acuminate firm process, with external elements of rhipidura each

side as two similar broad or expanded, also elongate, flagella, retractile to fold in vertical axis of body.

Remarks.—A species of mostly northern distribution on both coasts of North America. It ranges from Alaska to California on the Pacific Coast and southward on the Atlantic Coast to the Middle States region. It lives on sandy bottoms and ranges to a depth of sixty or seventy fathoms.

Verrill says it occurs in great numbers on the sandy flats and in tide-pools and rivulets, as well as on sandy bottoms in deeper water off shore. It is more or less specked irregularly with gray, and imitates the color of the sand very closely. When resting quietly on the bottom, or when buried partially and sometimes almost entirely, except the eyes and long slender antennæ it cannot easily be distinguished by its enemies, and therefore gains great protection by its colors. When left by the tide it buries itself to a considerable depth in moist sand. It needs all its powers for concealment, however, for it is eagerly hunted and captured by nearly all the larger fishes which frequent the same waters, and it constitutes the principal food of many of them, such as the weak fish, king fish, blue fish, flounders, striped bass, etc. Fortunately it is a very prolific species, and is abundant along the entire coast. The young swim free for a considerable time after hatching.

Many examples collected from various localities, as Corson's Inlet (March, 1909), Ocean City (June, 1911), Goshen Creek (October, 1911). Besides these are many examples which were examined in the field, such as at Point Pleasant, Stone Harbor, Sea Isle City, Anglesea, Fishing Creek, Green Creek, Dias Creek, Cape May and Atlantic City.

Several examples were taken from the alimentary canal of a smelt (*Osmerus eperlanus*) received from the Philadelphia markets and said to have been taken in the Raritan River in 1910.

This species was very abundant at Watchapreague in the inlet, Virginia, in May of 1911.

It was abundant at Manasquan July 19th, 1910, associated with *Palæmonetes vulgaris*, *Ucca pugilator*, *Callinectes sapidus*, *Anguilla chrysa*, *Fundulus heteroclitus macrolepidotus*,

Cyprinodon variegatus, *Lucania parva*, and *Menidia menidia notata*.

Mr. W. B. Davis and the writer found it abundant at Great Bay, in ditches, and along the shores, often in vegetation. It was less common than *Palæmonetes vulgaris*, with which associated, besides *Anguilla chrisypa*, *Fundulus heteroclitus macrolepidotus*, *Fundulus lucia*, *Tylosurus marinus*, *Apeltes quadracus*, *Syngnathus fuscus*, *Menidia menidia notata*, *Pomatomus saltatrix*, *Centropristis striatus*, *Tautoga onitis*, *Opsanus tau* and *Pseudopleuronectes americanus*.

It has been found in Staten Island, N. Y., by my friend Mr. W. T. Davis. .

Alliance PALÆMONOIDA.

Mandibles deeply cleft into well calcified incisor and molar branches, and usually have stout incurved palp. Exopodites of first maxillipeds end in flagellum. Dactylus of second maxillipeds "complemental" of propodite, as in Pandaloida, Crangonoida, etc. None of thoracic legs have exopodites, and of first two pairs one remarkably massive, both being chelate.

Key to the Families.

a. Carpus simple.

PALÆMONIDÆ.

aa. Carpus of many articles.

HIPPOLYTIDÆ.

Family PALÆMONIDÆ.

Rostrum well developed. Antennular scale present. Two long antennular flagella, outer split into two unequal filaments. Antennal scale of good breadth. Mandible deeply cleft into incisor and molar processes and with stout two or three-jointed palp. Coxa and basis of first maxillæ and first maxillipeds well developed, but not coxa of second maxillæ. Terminal joint of second maxillipeds lies obliquely along distal part of inner border of propodite, as if complemental piece of propodite. External maxillipeds pediform, third joint (ischium-merus) curved outwards a little. Exopodites of all three pairs of maxillipeds flagelliform and lax. First and second pairs of legs chelate, first

pair slender, and second pair of præminent size with undivided carpus. Last three pairs of legs slender and of moderate length. No exopodites to any of thoracic legs. Eggs small and numerous.

Species rather few.

Genus *PALÆMONETES* Heller.

Palæmonetes Heller, Zeitsch. Wissen. Zoöl., XIX, 1869, p. 157. Type *Palæmon varians* Leach, monotypic.

Palæmonopsis Stimpson, Ann. Lyc. N. Hist. N. Y., IX, November, 1871, p. 128. Type *Palæmon varians* Leach, virtually, though not included or so designated.

Antennulæ triflagellate, and antennæ and peræopoda as in *Palæmon*. Carapace with antennal and branchiostegal spines, though hepatic spine wanting. Rostrum long, lamellate. Mandibles without palp.

Species few, living in salt or fresh water.

Palæmonetes vulgaris (Say).

PLATE 94.

Præsen. Common Shrimp.

Palæmon vulgaris Say, Journ. Acad. Nat. Sci. Phila., I, pt. 2, 1818, p. 248.

Bays and estuaries as far south as East Florida.

—— White, Cat. Crust. Brit. Mus., XXV, 1847, p. 77. North American coast (Say's material).

Palemon vulgaris De Kay, N. Y. Fauna, Crust., VI, 1844, p. 29, Pl. fig. 30. Grassy bays of the Hudson River.

Palæmonetes vulgaris Stimpson, Ann. Lyc. N. Hist. N. Y., X, Nov., 1871, p. 129. Massachusetts to S. C.

—— Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 516 (in *Opsanus tau*), p. 520 (in *Lophopsetta maculata*), Great Egg Harbor, New Jersey.

—— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 550, Pl. 2, fig. 9. Massachusetts to South Carolina.

¹ Stimpson says, "the genus *Palæmonetes* was described by me in manuscript about twelve years ago under the name *Palæmonopsis*, but this name has never been published, and I believe it to be identical with *Palæmonetes* of Heller, recently described from a species found in the fresh-water lakes of Southern Europe."

- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 330. Massachusetts to Florida.
- S. I. Smith, Trans. Conn. Acad., V, 1879, p. 88. New Jersey.
- Leidy, Proc. Acad. Nat. Sci. Phila., 1879, p. 198. Atlantic City, New Jersey (with parasites).
- R. Rathbun, Rep. Fisher, Ind. U. S., I, 1884, p. 818. Massachusetts to Northern Florida.
- Leidy, l. c., 1888, p. 333. Beach Haven, New Jersey.
- Stebbing, Hist. Recent Crust. (Int. Sci. Ser. LXXIV). 1893, 249. E. coast U. S.
- Sharp, Proc. Acad. Nat. Sci. Phila., 1893, p. 124. Beesley's Point, New Jersey.
- Kingsley, Amer. Nat., XXXIII, 1899, p. 718. Cape Cod to North Carolina region.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 25. (New Hampshire and Massachusetts.)
- Paulmier, 58th Rep. N. Y. State Mus., VI, 1904 (1906), p. 132, fig. 4. New York City.
- Mayer, Sea Shore Life, 1906, p. 90. Massachusetts Bay to Florida.
- Fowler, Science, XXVI, November 8, 1907, p. 639. New England Creek, New Jersey.
- Fowler, Rep. N. J. State Mus., 1907 (1908), p. 161. New England Creek.
- Fowler, Proc. Acad. Nat. Sci. Phila., 1913, p. 61. Chincoteague and Assateague, Va.; p. 64. Wallops I., Va.
- Palamonopsis vulgaris*, Stimpson, l. c. (name only).
- Palamanetes vulgaris* Benedict, Rep. U. S. F. Com., XI, 1883 (1885), p. 176. Off Montauk Point, Long Island.

Description.—Cepalothorax moderate. Ophthalmopod rather short, and depression in which it rests moderate or shallow. Eye moderate, though little more bulky than peduncle, latter becoming considerably small or constricted at base. First antennæ biramous, ends in two long multiarticulate filaments, subequal and long as rostrum. Flagellum of first antennæ more robust than filaments, multiarticulate, but only projecting slightly beyond rostral tip. First antennæ with basal portion as broad scale, though less in width and length than that of second antennæ. Second antennæ longer than rest of body, multiarticulate, filamentous, with broad lobate scale above extending forward beyond rostral tip. Rostrum compressed, completely separating ophthalmopods, prominent, ends in long sharp-pointed spine in front, upper edge entirely antorsely serrate and lower anterior edge

similar. Lower posterior rostral edge entire. Mandible moderate, strong. Mouth moderate. First maxillæ small, short, broad, without exopodite. Second maxillæ similar, a little larger than first, with well developed exopodite. Pereion nearly cylindrical, short. First maxillipeds short, compressed, with terminal joint as rather broad compressed lamina folding over to completely obscure maxillæ. Two exopodites to each of first maxillipeds. Second maxillipeds pediform, long, slender, each with long slender exopodite. All exopodites on maxillæ and maxillipeds similarly tapering into flexuous filamentous ends. First peræopods not enlarged, slender, pediform, chelate, though little less developed than second pair. Latter a little longer, though not conspicuously enlarged, also chelate and pediform. Third, fourth and fifth peræopods subequal, similar to one another, slender, with simple dactyli. Pleon capable of curving evenly, with second and third shields largest, though sixth about equally long and narrowly constricted. Five pairs of pleopods, compressed, and each ending as two subequal flagella. Telson slender, acuminate, ending in several short bristles. External elements of rhipidura each side as two similarly broad expanded flagella, outer little longer, retractile to fold in vertical axis of body. Color in life pale brownish, mostly glassy or transparent in appearance. In alcohol or other preservatives they turn pink or reddish. Length 45 mm.

Remarks.—The prawn ranges all along the coast of North America, southward to Florida at least. It frequents muddy shores and brackish water. It is also abundant in the eel-grass, and is preëminently an inhabitant of weedy estuaries. Though living along the coast on sandy shores it also ranges well up the coastal rivers into fresh water. It seems to be most abundant in the eel-grass, occurring sometimes in myriads. In small ditches and ponds it is often very abundant. Its value lies chiefly in its affording an abundant food supply to most larger fishes.

On April 30th, 1904, it was found abundant in the ditches of Cold Spring Inlet, in Cape May County, associated with *Fundulus majalis*, *F. heteroclitus macrolepidotus*, *F. diaphanus* and *Menidia menidia notata*.

On June 18th, 1904, it was common at Grassy Sound, in Cape May County, and was found associated with *Fundulus heteroclitus macrolepidotus*, *Lucania parva*, *Cyprinodon variegatus* and *Menidia menidia notata*. It was taken in great numbers by the fishermen, who were all fishing about the wharf with it as bait. I saw numbers of *Centropristis striatus* and *Tautoglabrus adspersus* angled with it.

On December 31st, 1905, a number were found in Cedar Swamp Creek at Petersburg Bridge, in Cape May County, associated with *Anguilla chrisypa*, *Abramis crysoleucas*, *Esox reticulatus*, *Fundulus heteroclitus macrolepidotus*, *F. diaphanus*, *Apeltes quadracus* and *Eupomotis gibbosus*. Though the next day, January 1st, 1906, we found it rare above this point or at the forks, only an occasional example being taken with the numbers of small fish, such as *Umbra pygmaea*, *Aphredoderus sayanus*, *Acantharchus pomotis*, *Mesogonistius chætodon* and *Enneacanthus obesus*.

On October 6th, 1907, it was very common in New England Creek, in Cape May County, associated with *Anguilla chrisypa*, *Fundulus heteroclitus macrolepidotus*, *F. diaphanus*, *Lucania parva*, *Cyprinodon variegatus*, *Gambusia gracilis*, *Menidia beryllina cerea*, *Menidia menidia notata* and *Eupomotis gibbosus*.

On July 28th, 1909, a number were found associated with *Fundulus majalis*, *F. luciae* and *Cyprinodon variegatus*, in a small inlet tributary to Barnegat Bay below Seaside Park, in Ocean County.

On October 24th, 1909, it was very numerous in Coxe's Hall Creek, in Cape May County, associated with *Fundulus heteroclitus macrolepidotus* and *Gambusia gracilis*.

On November 2d, 1909, it was very abundant in the fresh waters of Muddy Creek, one of the headwaters of the Maurice River at Elmer, in Cumberland County. The associated animal life consisted of *Anodonta cataractæ*, *Sphærium (Musculium) partumenium*, *Physa heterostropha*, *Campeloma decisum*, *Abramis crysoleucas*, *Notropis chalybæus*, *Schilbeodes gyrimus*, *Esox reticulatus*, *Mesogonistius chætodon* and *Eupomotis gibbosus*.

On April 3d, 1910, many were found in the salt ponds at Corson's Inlet, in Cape May County, associated with *Fundulus heteroclitus macrolepidotus*, *F. luciae*, *Cyprinodon variegatus* and *Gasterosteus aculeatus*.

On October 13th, 1911, in Bidwell's Channel, an artificial outlet from Delaware Bay cut into Goshen Creek, we examined multitudes of this prawn, gathered by Mr. Edward Howell. The animals captured and mixed with them were *Callinectes sapidus*, *Anguilla chrisypa*, *Fundulus majalis*, *F. heteroclitus macrolepidotus*, *Cyprinodon variegatus*, *Menidia beryllina cerca*, *M. menidia notata*, *Bairdiella chrysura*, *Leiostomus xanthurus*, *Micropogon undulatus* and *Pogonias cromis*.

On April 5th, 1912, this species was found very abundant in small ditches tributary to Dennis Creek, at South Dennis, in Cape May County, associated with *Fundulus heteroclitus macrolepidotus*, *Fundulus luciae* and *Anguilla chrisypa*.

On July 4th, 1912, Mr. B. Long secured it, with *Apeltes quadracus*, at Spray Beach, in Ocean County.

Mr. W. B. Davis found it common in a mud-pool near the mouth of Cedar Creek, tributary of Barnegat Bay, on October 7th, 1912, with *Fundulus heteroclitus macrolepidotus*, *Lucania parva* and *Cyprinodon variegatus*.

Examples before me from Corson's Inlet, Elmer, Point Pleasant, Manasquan Inlet, Coxe's Hall Creek and Peck's Bay.

The prawn is also very abundant in our neighboring States. In Delaware I secured it in multitudes at Rehoboth, Millsboro, Milford, Laurel, Marydel and Delaware City. In Maryland it was found in small numbers at Fishing Creek near Elk Neck in Cecil County. In Virginia it was very abundant at Parmores Island, and in Locustville Branch, in May of 1911. Mr. W. T. Davis has also found it on Staten Island, N. Y.

Palæmonetes carolinus Stimpson.

Palæmonetes carolinus Stimpson, Ann. Lyc. N. Hist. N. Y., X, November 1871, p. 129. Charleston Harbor, S. C.; Great Egg Harbor, New Jersey; Beaufort Harbor, N. C.

— Kingsley, Amer. Nat., XXX, 1899, p. 718. Middle and Southern States region.

Palæmonopsis carolinus Stimpson, l. c., p. 129 (name only).

Description.—Rostrum of moderate breadth, rather long, reaches little beyond end of antennal scale and curved upward considerably. Rostrum ciliated and serrated above throughout to tip, with nine teeth, and posterior tooth little further removed from second than second from third, and placed at front third of carapace. Third rostral tooth directly above base of eye-peduncles. End of rostrum acute or sometimes minutely bifid. Beneath, rostrum armed with four teeth, and densely ciliated. Both pairs of antennæ as in *Palæmonetes vulgaris*. Feet of second pair long, reach well beyond end of rostrum. End of carpus falls just short of end of antennal scale. Hand much stouter than in *Palæmonetes vulgaris*, and fingers a little shorter than palm. First pair of feet reach scarcely beyond end of carpus of second pair. (Stimpson.)

Remarks.—Known in our limits from Stimpson's record for Great Egg Harbor, where it was secured by Prof. S. F. Baird. Stimpson says it is of the same size and nearly allied with *Palæmonetes vulgaris*, but easily distinguished by its recurved rostrum, and larger second pair of feet. Stimpson had it with a range from this State southward to South Carolina, and in depths from two to seven fathoms.

Family HIPPOLYTIDÆ.

Rostrum of important size. Eyes not covered by carapace. Mandible with or without a cutting-edge and palp. First pair of trunk-legs with moderate sized chelæ. Second pair chelate, with wrist or fifth joint sometimes much and sometimes little subdivided.

Genera about a dozen or more.

Genus VIRBIUS Stimpson.

- Virbius* Stimpson, Proc. Acad. Nat. Sci. Phila., 1860, p. 34. Type *Hippolyte acuminata* Dana, fourth and last species, designated by Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 421.
Caradina Bate, Proc. Zoöl. Soc. London, 1863, p. 499. Type *Caradina truncifrons* Bate, first species.

Dorsum of carapace and rostrum ecarinate. Antennulæ biflagellate. Antennal scale present. Mandibles without palp. External maxillipeds short, with exopodite. Peræopoda without epipodites. Carpus of first pair of peræopoda excavate in front. Carpus of second pair triarticulate. Species rather few.

Virbius pleuracanthus Stimpson.

PLATE 95.

Virbius pleuracanthus Stimpson, Amer. Journ. Sci. Art., (2) XXIX, 1860, p. 444. *Beaufort, North Carolina* (name only).

—— Stimpson, Ann. Lyc. Nat. Hist. N. Y., X, 1871, p. 127. *Somer's Point, New Jersey, (Norfolk, Va.)*.

—— S. I. Smith, Rep. U. S. F. Com., 1871-72 (1873), p. 550 (on Stimpson).

—— Kingsley, Bull. Essex Inst., X, 1878, p. 63. *New Jersey and Virginia*.

—— Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 329. *New Jersey to North Carolina*.

—— Kingsley, Amer. Nat., XXXIII, 1899, p. 718. *Cape Cod to North Carolina region*.

Virbius zostericola S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 550. Pl. 3, fig. 11. *Vineyard Sound*.

—— Paulmier, 58th Rep. N. Y. State Mus., VI, 1904, p. 132, fig. 5. *Jamaica Bay, Long Island, N. Y.*

Description.—Back depressed. Rostrum horizontally broad, smooth at base, acute, about half long as carapace, scarcely more than half length of acicle of antennæ, but reaches penultimate joint of peduncle of antennulæ, and armed with one or two teeth above and one below near end. A small spine on each side at base of rostrum, above and a little behind base of ocular peduncles. On front edge of carapace spine below each eye, but no pterygostomial spine. Sharp hepatic spine on surface of carapace behind base of antennæ. Scales of antennæ very large, long as carapace, and rather widening than narrowing toward their extremities. Dactyli of posterior three pairs of feet broad, compressed, knife-like, with inner edges nearly straight, and armed with minute spines. Dorsal angle of abdomen at third segment very prominent, but not acute. Length about one inch. (Stimpson.)

Remarks.—The distribution is southward along our Atlantic coast from New Jersey as the most northern locality. It was found abundantly at Somers Point in the summer of 1864, and according to its describer it lives among *Zostera* just below low-water mark. It was also obtained by Stimpson in the harbor of Norfolk, Virginia, in June, 1853.

Tribe ASTACIDES.

Body not compressed, sometimes depressed. Rostrum, when present, not compressed, usually depressed. Integument usually strongly calcified. Abdomen long, not flexed or humped, symmetrical. Pleura of first abdominal somite much reduced. Telson generally quadrangular, occasionally acute. Basal joint of antennular peduncle without "scale" on its outer margin. Olfactory setæ in distal part of outer antennular flagellum. Antennal scale, when present, of small or medium size, and never wholly conceals antennal peduncle. External maxillipeds almost always pediform and always much shorter than first pair of thoracic legs. All five pairs of thoracic legs almost always strongly developed. Variably, as sometimes all, first only, first two, first three, sometimes last alone or again none at all, chelate, and first pair usually much longer and stouter than any of others. Appendages of first abdominal somite, when present, uniramous and often modified in male for copulation. Genital openings of male pierced in coxopodites of fifth pair of thoracic legs.

Key to the super-families.

- a.* All segments of thoracic sternum usually, but not always, firmly united, and abdominal terga overlap one another. ASTACIDEA
- aa.* Last segment of thoracic sternum independent, and abdominal terga not at all, or only very slightly, overlapping one another. THALASSINIDEA

Super-Family ASTACIDEA.

The Crawfishes.

Thoracic sternum with all segments usually, though not invariably, firmly united and abdominal terga overlap one another. Longitudinal sutures of carapace absent, though cervical frequently present. Carapace united in front to epistome. Antennal scale small or obsolete.

Families rather few, and only one represented in our region.

Family ASTACIDÆ.

The Crawfishes.

Carapace subcylindrical, with distinct rostrum developed anteriorly. Carapace posteriorly produced over anterior half of first somite, though not kept down by pleocleis. Segments of pleon dorsally imbricated or overlapping each other. Second antennæ with long multiarticulate flagellum. Peræopods seven-jointed, first three pairs chelate, and first pair longest. Rhipidura well developed, and outer ramus with a diæresis. Mastigobranchiæ, or epipodal plates, large, with well developed podobranchial plume attached to all trunk-legs except last pair. Outer branch of uropods with transverse suture.

Six genera are included in this family by Stebbing, though only one represented on our shores, and one fresh water.

Sub-Family ASTACINÆ.

Hands of chelipeds large, broad, edges round, surface convex.

Key to the genera.

- | | |
|---|----------|
| <i>a.</i> Last thoracic segment not mobile; species marine. | HOMARUS |
| <i>aa.</i> Last thoracic segment free from rest; species fresh water. | CAMBARUS |

Genus HOMARUS Weber.

The Lobsters.

Homarus Weber. Nomenclator Entomol., 1795, p. 94. Type *Astacus marinus* Fabricius, first species. (Virtually designated [as *Cancer gammarus* Linnæus] by M. J. Rathbun, Proc. Biol. Soc. Wash., XVII, 1904, p. 170.)

Carapace nearly cylindrical, and rostrum armed on each side with three or four teeth. Thorax with last joint immovably connected with preceding one. Abdomen nearly cylindrical, segments ending laterally in large flattened triangular process. Terminal abdominal segment with tooth on each side near end. Telson with outer lamina divided transversely, about a third from end, with distinct movable joint. External antennæ situated above and to outer side of internal pair, scale dentiform, dilated on inner side and scarcely covers penultimate joint of peduncle. Internal antennæ with peduncle nearly long as that of external. Eyes subglobose, not broader than foot-stalks. External foot-jaws pediform, reach forwards beyond peduncles of antennæ. Anterior legs very robust, unequal, larger with fingers strongly tuberculated on grasping edge and smaller merely toothed. Second and third pairs of legs didactyle, and fourth and fifth pairs monodactyle.

Species three, and the single form known from our shores very large, prolific, and greatly valued as food.

The generic name of this animal has been the subject of much controversy. *Homarus* is accepted here in accord with prevailing opinion, and the name *Astacus* is allowed for the crawfishes. *Astacus* dates from Gronow in 1764, if polynomialists are accepted, or from Fabricius in 1792, if binomialists only are used. In any case *Cancer astacus* Linnæus is the type according to the law of tautonomy. According to Faxon, in 1898, its first designation with a type species was by Latreille, in 1810. Ortmann claims a prior designation, with different results, though his suggestions would be invalid if considered from the point of view of tautonomy. *Homarus* is used as a nomen nudum by Fabricius in 1796, in the index to his supplement.

Homarus americanus Milne-Edwards.

PLATES 96 TO 99.

Lobster.

- Homarus americanus* Milne-Edwards, Hist. Nat. Crust., II, 1837, p. 334. *No locality* (except as indicated in specific name).
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 23, Pl. 12, figs. 52-53. Cape Cod, New York, New Jersey, Delaware Breakwater, and introduced in Charleston harbor.
- S. I. Smith, Trans. Conn. Acad., II, 1870, p. 251, Pls. 1-5 (development).
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 395. Vineyard Sound, Menemsha (young), Pl. 9, figs. 38-39; p. 492, Long Island Sound.
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 522 (metamorphoses); p. 549 New Jersey to Labrador.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 327. New Jersey to Labrador.
- S. I. Smith, Trans. Conn. Acad., V, 1879, p. 55. New Jersey to Labrador.
- R. Rathbun, Rep. Fisher, Ind. U. S., I, 1884, p. 781 (786). Near and south of Navesink, Long Branch and Atlantic City, New Jersey.
- Kingsley, Standard Nat. Hist., II, 1884, p. 53. Labrador to New Jersey.
- Benedict, Rep. U. S. F. Com., XI, 1883 (1885), p. 176. Off Montauk Point, Long Island.
- Herrick, Bull. U. S. F. Com., XV, 1895 (1896), pp. 5-252, Pls. 1-54 (habits and development).
- Kingsley, Amer. Nat., XXXIII, 1899, p. 822. North Atlantic Coast and from Cape Cod to North Carolina.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 18. Bay of Fundy to Connecticut.
- Mayer, Sea Shore Life, 1906, p. 83, fig. 52. North Carolina to southern Labrador.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1906, p. 133. Extinct in limits of N. Y. City.
- Astacus marinus* (nec Fabricius) Say, Journ. Acad. Nat. Sci. Phila., I, pt. 1, 1817, p. 165. Long Branch, New Jersey.

Description.—Body thick, with carapace not quite twice as long as broad. Carapace rather compressed at sides, and surface more or less punctate. Gastric regions separated from posterior regions by groove or furrow. Rostrum narrowly pointed, reaches forward trifle beyond peduncle of external antennæ, and upper edge with several denticulations on each side. Antennules

with short peduncle, not extending forward far as that of external antennæ, and with two subequal flagellæ not quite equal to one and one-half rostral lengths, if latter measured from hind edge of orbital socket. External antennæ with peduncle almost cylindrical, and very long flagellum depressible back very slightly beyond end of telson. Eyes rounded, their diameter less than that of stalk. Abdomen partly cylindrical, segments smooth, and terminate on each side in strong triangular flat plate. Tail quite broad, outer plates well divided about outer fourth, and two strong denticles at common base of two outer lamina. Anterior legs greatly enlarged, unequal in size and dissimilar in shape, much larger than other legs. Very strong tubercles on chelipeds of first legs along inner edge, also several on carpus. Other legs weak, second and third pairs weakly chelate and fourth and fifth pairs with simple dactyls.

Color very variable. R. Rathbun says it is generally yellow or yellowish-red, with spots or mottlings of green, rarely blue. Mottlings most numerous and dense dorsally, while sides and lower surfaces of claws with yellow predominating. Along lower edge of carapace each side broad band of blue or bluish also extends short distance up hind edge of carapace. Just above this band yellow begins, where uniform or immediately variegated with dark blotches. Green color often replaced by blue shades. Sometimes entire carapace reddish. Rostrum olive-green, its spines deep rich red. Abdomen with markings corresponding to carapace. Distinct line down back of carapace usually dark green. Tail-flaps edged posteriorly by dark olive-brown band. Upper surface of anterior large claws reddish or orange shade, deeper towards ends where very bright red, fading whitish at tips. Over this general color outer edge of claw with broad dark olive-brown or black banding, and numerous large spots of same color cover more or less of remaining surface. Under surface of these claws mostly always of variable orange tints, terminal joints more intense than inner ones, which more or less marked with green or blue. Other legs much lighter below than large claws, with green or blue markings, especially above and at ends of joints. Tips end in deep orange-red, while

ornate bunches of hairs like on other parts of body almost ruby-red. Soft skin covering under surface of abdomen and swimmerets faint pink. Length four feet, with an average length of about 375 mm.

Remarks.—The lobster is distributed along the Atlantic shores of North America from Labrador to Delaware, and ranges in depths of from less than one to more than one hundred fathoms. It is most abundant and reaches its maximum size within the northern part of its range, or from Maine northward. De Kay says that lobsters were taken in comparative small numbers along the New Jersey coast, though two years after the Delaware breakwater was built in Delaware Bay, lobsters made their appearance there in great quantities. R. Rathbun says this point may be considered the southern boundary of the species, though several records are known from the region to the south. Of these, lobsters are said to have been seen along the beach in the surf near Indian River Inlet in Delaware, and two or three have been recorded at Johnstown in the northeastern corner of Virginia. Several have also been captured in North Carolina. The depth of water which these animals inhabit is variable, according to the season and the temperature of the water. They sometimes occur in shallow water close in shore, and again are stranded on the beach, sometimes in large numbers, after heavy storms at sea.

Herrick's summary of his extensive observations gives the following information:

The great diversity of the character of environment explains in some measure the numerous variations in the habits of the lobster, as time and frequency in moulting, egg-laying, hatching the young and rate of growth. It displays a considerable degree of intelligence and has organs to which the various senses of the higher animals have been ascribed. The tactile sense is diffused over the whole body. It has the sense of smell and of taste, though the so-called auditory are doubtfully really ears. The sea bottom is its natural habitat when adult, and it never leaves this location or the water unless obliged. No coastwise migrations are known, but numbers of lobsters move to and from deep

water during the fall and spring, these movements varying with the coast and nature of the bottom and influenced by oceanic temperatures, abundance of food, and to some extent by moulting and breeding habits. Lobsters often stay in relatively shallow and cold waters of harbors through the winter, but then they are only found on rocky bottoms, where food is most abundant. They seem to prefer a temperature of about 50°. In severe winters they are either driven into deep water, or if living in harbors seek protection by burrowing in the mud. In such cases a prolonged cold spell may prove fatal.

When adult the lobster is essentially nocturnal, though in the larval state the reverse is true. The lobster is a great burrower, making holes with the large claws and tail-fan, sometimes two or three feet in length. These burrows are never used when moulting, and are solely for protection. The burrows are almost always entered by the lobster tail first. The adult lobster feeds chiefly on fish, dead or alive, and also invertebrates. It also takes a small quantity of vegetable food, such as algæ and eel-grass. Fragments of dead shells, coarse sand and small gravelstones are also swallowed. The former yield lime, which is absorbed and finally laid down in the skeleton. Many small fish living on the bottom fall a pray to the sharp cutting claw of the lobster, which it uses with great skill and dispatch. The larger lobsters prey invariably upon the smaller and weaker ones they may find. The food is seized, torn and crushed by the large claws, and is then taken up by the appendages about the mouth (maxillipeds, maxillæ and mandibles), by which it is successively torn and chopped fine, when this is possible. While the animal is eating a stream of fine particles is passed into the mouth, thence to the gastric mill or masticatory stomach. Here the food is ground and the fluid or digestible parts are strained into the small delicate intestine from which they are absorbed. The indigestible refuse is regurgitated from the stomach bag.

In copulation the female receives the sperm of the male in packets or spermatophores, which are deposited in an external chamber (the seminal receptacle). This is a blue heart-shaped structure, placed on the lower side of body between bases of

the fourth pair of legs. Males do not discriminate the sexual condition of the female, which may be impregnated any time. Probably copulation takes place usually in the spring. Most females lay eggs in July and August, though eggs are also laid in lesser degree at other times. The females carry the eggs from ten to eleven months. Summer spawning lasts about six weeks. A lobster about eight inches long will produce 5,000 eggs, while one seventeen inches produces about 63,000. The egg-bearing female moves about with the tail folded. The period of hatching of a single brood lasts sometimes over a week, owing to the unequal development of the eggs. Females are sexually mature when from eight to ten inches long. Spawning does not take place more than once in two years. The relative number of males and females varies considerably in certain localities. Moulting takes place mostly during June till September, but soft ones are found at all times of the year. Males probably moult more frequently than the females, thus accounting for the large proportion of soft ones and the greater size attained. Moulting lobsters are more often taken on sandy or weedy than on rocky bottoms. From six to eight weeks are necessary to produce a shell as hard as the one cast off. Growth varies considerably with individuals and surroundings. When hatched a young lobster is 7.84 mm. long, and it then moults from fourteen to seventeen times during the first year. A ten and one-half inch lobster has moulted twenty-five or six times and is about five years old. All the appendages are capable of regeneration, and defensive mutilation is perfectly developed only in the large chelipeds. The greatest size attained by lobsters is about twenty-five pounds. Every predaceous fish which feeds on the bottom may be an enemy and the cod is one of the most destructive to small lobsters after the larval stages are passed.

Color variations, like the red, blue and cream colored types, are nonadaptive, and this is true of the remarkable color variations in the larvæ and older stages. The normal color has, however, a protective significance. The large crushing claw may be either on the right or left side, and it is probable that

all young of a brood have the larger claw developed on the same side. The young are hatched as pelagic free-swimming larvæ, living at the surface of the ocean from six to eight weeks, when, after having moulted five or six times, it goes to the bottom and appears in habit and general structure like a very small adult animal. After reaching the bottom it travels towards the shore and establishes itself in rock piles in harbors and at the mouths of rivers, where it remains until driven out by the ice. The problem of artificial propagation will be solved when means are devised by which the larvæ after hatching can be reared in large enclosures until the fifth or sixth stage, when they are able to care for themselves.

Frequently taken along our coast, though not common, and apparently mostly used locally. But few, or only occasionally large ones, are sent to restaurants or exposed for sale. I have examined several alleged New Jersey examples from Cape May, Atlantic City, Anglesea, also the Delaware breakwater and Ocean City. The latter was in the possession of Mr. W. B. Davis and was picked up on the beach. Mr. Davis assures me that occasionally he finds similar small ones during cold weather, or in late fall and early winter, where they seem to be cast up and be numb with the cold. An example is in the Academy from Delaware Bay received from Dr. Fittler.

Mr. W. T. Davis says he found lobsters occasionally washed on the south shore of Staten Island, N. Y., though had not met with any recently.

Genus **CAMBARUS** Erichson.

The Crawfishes.

- Cambarus* Erichson, Arch. Naturgesch., XII, 1846, p. 88. Type *Astacus bartonii* Fabricius, fourth species, designated by Faxon, Proc. U. S. Nat. Mus., XX, 1898, p. 644.
- Orconectes* Cope, Amer. Nat., VI, 1872, pp. 409, 419. Type *Orconectes inermis* Cope, first species.
- Cambarellus* Ortmann, Proc. Amer. Philos. Soc. Phila., XLIV, 1905, pp. 97, 106. Type *Cambarus montezuma* Saussure, third species, designated.
- Faxonius* Ortmann, l. c., pp. 97, 107. Type *Astacus limosus* Rafinesque, fifth species, designated.

- Bartoniuss* Ortmann, l. c., pp. 97, 117. Type *Astacus bartonii* Fabricius, sixth species, designated. (An exact synonym of *Cambarus* Erichson.)
- Procambarus* Ortmann, Ann. Carnegie Mus., III, 1905, p. 437. Type *Cambarus digueti* Bouvier, first species, designated.
- Paracambarus* Ortmann, Proc. Wash. Acad. Sci., VIII, 1906, p. 1. Type *Cambarus* (*Paracambarus*) *paradoxus* Ortmann, monotypic.
- Ortmannicus* subgen. nov. Type *Astacus blandingii* Harlan.

Cephalothorax subcylindrical. Last thoracic segment without gills and free from rest. No traces of rudimentary pleurobranchiæ on anterior segments. Hindmost podobranchia without any lamina. Branchiæ total thirty-four, counting those on both sides of thorax. Third or third and fourth (in our species) pairs of legs in male with prominent tubercle or hooks on front border of third segment. First pair of abdominal appendages in males ends in styles, hooks or teeth. More or less mobile annulus placed on sternum in female, just behind penultimate thoracic somite. Females with first pair of abdominal appendages, though much smaller than following pairs, simple, and somewhat larger than in *Astacus*. Telson clearly divided by transverse suture.

The crawfishes, or crayfishes, are widely distributed over North America, ranging from Lake Winnipeg to Guatemala, and from New Brunswick to Wyoming.

Commercially the crawfishes are little valued, except as bait to the angler. Though never reaching the size of the European species in demand as food, they are not inferior in quality. Their use as bait is chiefly in the angling of the black bass (*Micropterus*). Economically they are of value as scavengers, feeding on almost any decayed animal or vegetable substances they may find. In turn many animals prey upon them. According to Ortmann, their chief enemies are raccoons, kingfishers and other aquatic birds, water snakes (*Natrix sipedon* and *Regina leberis*), mud puppies (*Necturus maculosus*) and hell-benders (*Cryptobranchus alleganiensis*). Besides these are numerous of our larger and predatory fresh-water fishes, which often find them no doubt desired food.

The females are usually difficult to determine specifically, and where several species occur are only to be recognized provisionally, unless found actually copulating.

Ortmannicus is here proposed as a new subgeneric name, the intended *Bartoni*us Ortmann being an exact synonym of *Cambarus*. *Ortmannicus* will thus embrace the limits as defined by *Bartoni*us. This is offered as a slight tribute to Dr. Ortmann's recent studies of the crawfishes, which are among the most important and comprehensive yet attempted.

Key to the species.

- a. Male sexual organs with both parts, outer and inner, each ending in only one tooth, which rather slender, not sharply distinguishable from end, and never truncated.
- b. (CAMBARUS) Male sexual organs very uniform, short, thick, inner and outer part each end in only one short thick spine, tapering to point; both terminal spines strongly recurved, forming with basal part about right angle; third peræopods, in male only, with hooks; rostrum always without marginal spines; carapace generally without lateral spines.
- c. Areola wide; carapace depressed; species of small streams. *bartonii*
- cc. Areola narrow, generally obliterated in middle, or extremely narrow; carapace rather depressed. *diogenes*
- bb. (FAXONIUS) Male sexual organs shorter or longer, not very stout, generally slender or with slightly curved tips; tips never truncated, end always in two more or less elongated spines, one formed by outer part and other formed by inner part softer; never more than one tip to outer part and no terminal tooth distinguishable, but tip tapers gradually and whole outer part setiform; third peræopods, in male only, with hooks, very rarely on third and fourth pairs; rostrum always with marginal spine on each side; carapace with one or more lateral spines. *limosus*
- aa. (ORTMANNICUS) Male sexual organs stout, more or less straight, comparatively short, truncated or blunt at tip, outer part ending in one to three horny teeth, which sometimes recurved or compressed, or plate-like, and always sharply distinguishable from blunt end; inner part ends by shorter or longer acute spine, which sometimes distinct from tip of this part, so that it appears two-pointed; third, or third and fourth, peræopods in male with hooks. *blandingii*.

Cambarus bartonii (Fabricius).

PLATES 100 AND 101.

Barton's Crawfish. Mountain Crawfish.

Brook Crawfish.

Astacus bartonii Fabricius, Entomol. Syst. Suppl., 1793, p. 407. *North America.* (Likely Philadelphia.)

- Latreille, Hist. Nat. Crust., VI, 1803, p. 240 (on Fabricius).
- Say, Journ. Acad. Nat. Sci. Phila., I, 1817, p. 167. In rivulets and small streams of fresh water, under stones.
- Desmarest, Consider. Gen. Crust., 1825, p. 212 (on Fabricius).
- Harlan, Med. Phys. Res., 1835, p. 230, fig. 2. Near Philadelphia.
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 22, Pl. 8, fig. 25. (Most mountain streams of New York and adjoining States, Carolina, Massachusetts.)
- White, Cat. Crust. Brit. Mus., XXV, 1847, p. 72. United States (Say's material).
- Gibbes, Proc. Amer. Assoc. Adv. Sci., I, 1850, p. 195. New Jersey. (New York and Philadelphia collections.)
- Homarus bartonii* Weber, Nomenclator Entomol., 1795, p. 94 (name only, on Fabricius).
- Asiacus (Cambarus) bartonii* Erichson, Arch. Naturgesch., 1846, p. 97. North America.
- Cambarus bartonii* Girard, Proc. Acad. Nat. Sci. Phila., 1852, p. 88. Foxburg, Carlisle and Berwick, Pa.
- Hagen, Mem. Mus. Comp. Zoöl., III, 1870, p. 75, Pl. I, figs. 47-50, Pl. 2, figs. 135-139, Pl. 3, fig. 166. Schooley's Mt., New Jersey. (Berkshire and Elizabethtown, N. Y.; Lake Champlain; Schuylkill River and Philadelphia, Pa.)
- Abbott, Amer. Nat., VII, 1873, p. 80. Delaware River at Trenton, New Jersey.
- S. I. Smith, Rep. U. S. F. Com., II, 1872-73 (1874), p. 639. New Jersey. (Northern New York and McKean Co., Pa.)
- Faxon, Proc. Amer. Acad. Sci., XX, 1884, p. 22. New Jersey.
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 814 (from Abbott).
- Faxon, Mem. Mus. Comp. Zoöl., X, 1885, p. 59. Schooley's Mt. and Trenton, N. J. (New York, Lake Champlain, Ellenburg, Westport, Elizabethtown, Fulton Lakes, Canton, Port Jervis, Newberg, Fishkill, Fallsburg, Sherburne, Cazenovia, Ithaca, Berkshire, Rochester, Niagara, Forrestville, N. Y.; Bedford, Pattonville, Windham, Hummelstown, Carlisle, Berwick, Schuylkill River, Chester Co., Bainbridge, McKean Co., Foxburg, Pa.; Harford, Howard, Montgomery, Frederick, Washington, Garrett and Allegheny Cos., Md.; D. C. above Washington, Rock Creek; Canada to North Carolina, Kentucky, Tennessee, Missouri and Lake Superior.)
- Faxon, Proc. U. S. Nat. Mus., 1885, p. 358. (Fulton Lakes, N. Y.; Carlisle and Bainbridge, Pa.; Rock Creek and Washington, D. C.; Clarke Co., Va.)
- Underwood, Bull. Ill. State Lab. N. Hist., II, 1886, p. 367. New Jersey. (New York, Maryland, Virginia.)
- Faxon, Proc. U. S. Nat. Mus., XII, 1890, p. 622. (Shenandoah River and Peak Creek, Va.)
- Faxon, l. c., XX, 1898, p. 694. (Westmoreland Co., Pa.)
- W. P. Hay, Amer. Nat., XXXIII, 1899, pp. 959, 966. New Brunswick to Missouri, North Carolina and Tennessee.

- Williamson. Ann. Carnegie Mus., I, 1901, p. 47. (Allegheny Co., Pa.)
- Ortmann, Ann. Carnegie Mus., III, 1905, p. 390. (Green, Fayette, Somerset, Washington, Beaver, Allegheny, Westmoreland, Butler, Clarion, Mercer, Crawford, Erie, McKean, Potter, Warren counties, Pa.)
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 18. (New England.)
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1906, p. 134, fig. 6. (New York City.)
- Mayer, Sea Shore Life, 1906, p. 88, fig. 55. (Neighborhood of New York.)
- Osburn, Zool. Soc. Bull., N. Y., XVI, 1912, p. 924. Central Park Lake, N. Y., and Prospect Park Lake, Brooklyn.
- Cambarus (Bartoniuss) bartoni* Ortmann, Proc. Amer. Philos. Soc. Phila., XLIV, 1905, pp. (120) 134. Princeton, New Jersey. (East Canada Creek, N. Y.; Selbyport, Md.; Cherry Run, W. Va.; Greenville, Del.; Driftwood, Sinnamahoning, Keating Summit, Mance, Cush-Cushion Creek, Cresson, Ashville, Hollidaysburg, Wissahickon, Shoemakersville, Valley Forge, Grenoble, New Hope, West Manayunk, Wallingford, Loyalsock Creek headwaters, Ganoga Lake, Pinegrove, Pa.)
- Ortmann, Mem. Carnegie Mus., II, No. 10, 1906, p. 377, Pl. B, fig. 1, Pl. 39, figs. 1a-1f, fig. 8, Pl. 40, fig. 2. Princeton, New Jersey. (Altamont, Wilmurt, Dolgeville, Spencerport, N. Y.; Wallingford, Manayunk, Roxboro, Wissahickon, Germantown, Philadelphia, Holmesburg, Grenoble, New Hope, Buckingham, Shoemakersville, Easton, Portland, Emaus, Slatington, West Manayunk, Abrams, Lafayette, Avondale, Leopard, Valley Forge, Pequea, York Furnace, Halifax, Highspire, Harrisburg, Rockville, Dauphin, Georgetown, Montalto, Dickey, Williamson, Chambersburg, Morian, Mercersburg, Dogtown, Emmaville, McConnellsburg, Frankstown Branch Juniata R., near Hollidaysburg, Bedford Springs, Driftwood, Sinnamahoning, Ashville, Cresson, Summit, Lovett, Cherry Tree, Mance, Sandpatch, Rockwood, Windber, Laurel Hill, Cush-Cushion Creek, Homer, Creekside, Goodville, Punxsutawncy, Brockwayville, Brookville, Falls Creek, Cherry Tree, Ridgeway, Keating Summit, Ulysses, Larabee, Port Allegany, Garland, Corydon, Tionesta, Oil City, Red Bank, Long Run, Weskit, Mosgrove, Templeton, Ross Furnace, Crisp, Mechanicsburg, Ligonier, Jones Mills, Derry, Dundale, Livermore, opposite Leichburg, Braeburn, Blairsville Intersection, Milbank, Donegal, Jeanette, Ohio Pyle, Laurelville, Dunbar, Cheat Haven, Butler Junction, Tarentum, Harmarville, Russelton, Montrose, Aspinwall, Verona, Bakers-town Station, Pine Creek, Thornhill, Millvale, Westview, Avalon, Edgeworth, Schenley Park, Fern Hollow, Swissvale, N. Versailles Township, Jacks Run, Boston, Kennywood, Carnegie, Moon Township, Hulton, Sandy Creek, W. Winfield, Renfrew, Branchton, Girard, Swanville, Spartansburg, Lineville, Stoneboro, Mercer, Wampum, Newcastle, Summit, Comeautville, Ambridge, Baden, Beaver, Fallston, Monaca, Monongahela City, W. Brownsville, Burgettstown, Taylorstown, Dinsmore, Rice's Landing, Deer Lick, Waynesburg, Deep Valley, Huntingdon, Laurel Run, Shaver's Run, Greenpark, Marshrun, Erly, Williamsport,

Jersey Shore, New Albany, Wellsboro, tributary Beach Lake, Reading, Kingston, near Stillwater, State College, Boalsburg, Center Hall, Milesburg, Beach Creek, Lamar, Pa.; Horne's Valley, Sideling Creek, Town Creek, S. Cumberland, Corriganville, Rawlings, Deer Park, Selbysford, Stoyer, Md.)

Astacus ciliaris Rafinesque, Amer. Month. Mag. Crit. Rev., II, 1817, p. 42.

Brooks near Fishkill, Newburg, etc., N. Y.

Astacus pusillus Rafinesque, l. c. *Near Saratoga, Lake George, Lake Champlain, Utica, Oswego, etc.*

Cambarus pusillus Girard, Proc. Acad. Nat. Sci. Phila., 1852, p. 88. (Lake Ontario, three miles off Oswego, New York, in *Lota maculosa*.)

Astacus affinis (nec Say) Milne-Edwards, Hist. Nat. Crust., II, 1837, p. 332. North America.

Cambarus montanus Girard, l. c., p. 88. *Allegheny ranges in Virginia and Maryland. Tributary of James River, Rockbridge Co., Va. Shenandoah River, Clark Co., Va. Cumberland, Md. Potomac basin.*

Cambarus longulus Girard, l. c., p. 90. Middle States of the Union.

Cambarus acutus (nec Girard) var. b. Hagen, Mem. Mus. Comp. Zoöl., III, 1870, p. 36, Pl. 3, fig. 44. Essex, New Jersey. (New York.)

Cambarus acutus Abbott, Amer. Nat., VII, 1873, p. 80. Mercer County, New Jersey. (Habits.)

— S. I. Smith, Rep. U. S. F. Com., II, 1872-73 (1874), p. 637. (From Hagen and Abbott.)

— R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 814. Great Lakes to the Gulf and Missouri to the Atlantic Coast.

Description.—Body robust, sparsely pubescent (in fresh) to naked (in old examples). Carapace well depressed, partly ovate. Branchial regions with width well forward shortly behind cervical groove. Cervical groove deep, uninterrupted on sides. Areola distinctly longer than half anterior section of carapace, rather broad, with about three to five rows of punctures irregularly. Rostrum short, broad, usually reaches distal end of second joint of antennular peduncle, hardly extends beyond middle of fourth joint of antennal peduncle. Rostrum with upper surface nearly flat or slightly concave. Edges elevated without marginal spines, converge more or less from base, sometimes almost parallel and near apex suddenly contract into short triangular acumen with sharp point. Angles at base of acumen rounded, usually well defined, elevated edges continue to apex though slightly decreasing distally from lateral angles. Postorbital ridges short, almost parallel, angulated anteriorly, but without spine, except in young. Carapace surface punctate.

distinctly granulated on hepatic surface in larger examples. Few more or less distinct granulations just behind cervical groove, spine absent. Outer orbital angle well marked by angulation or small tubercle, more rarely in young, spiniform. Branchiostegal spine formed by small tubercle, sometimes obsolete. Abdomen long as carapace, or slightly shorter or longer. Abdomen slightly wider in female than in male, hardly wider than carapace in former. Front section of telson on hind lateral corners usually with two, more rarely with three, spines. Hind section of telson semi-elliptical, distinctly wider than long, slightly shorter than front section.

Epistome with hind part broad, short, about two and one-half times wide as long, with distinct transverse groove either side slightly posterior to middle, and anterior median depression. Front section of epistome constricted at base, semi-circular, with median front point. Latter strongly developed or almost absent. Transverse diameter of epistome distinctly greater than lengthwise. Antennule with small tubercle on lower edge of basal joint, often spiniform. Antennal peduncle with tubercle on outer side of first joint, often spiniform, especially in young. Second antennal joint with or without very indistinct tubercle. Antennal scale short, narrow, slightly longer than rostrum, reaches almost or to end of fourth joint of antennal peduncle. Antennal scale with spine on outer edge strong, and laminar part not much wider than marginal spine. Flagellum reaches front edge or middle of telson in male, slightly or considerably shorter in female, or sometimes only to middle of second abdominal segment.

First peræopods very strong and robust in old examples, especially males. Hands long, ovate, broad, strongly depressed, surface punctate. Inner palm edge short, curved, with single marginal row of more or less distinct low tubercles. Outer palm edge smooth, proximally rounded, distally carinate. Fingers longer than palm, not gaping in young, but wide gap at base and meeting only at tips most noticeably in old males. Outer edge of movable finger punctate, with few indistinct tubercles in older examples. Cutting-edges with tubercles.

larger in proximal part. Low lengthwise rib on upper surface of each finger, this rib edged with rows of punctures, though becoming indistinct on movable finger in old males. Carpus slightly longer than wide, shorter than palm, deep longitudinal sulcus above, inner edge with strong pointed or blunt spine usually hooked distinctly or formed at right angle, though distal part curves forward. Small spine or tubercle sometimes double, may also be proximal. Carpus below with blunt conic tubercle in middle of front edge, sometimes spine-like, and tubercle at articulation with hand usually obscure. Sometimes other tubercles present, one often as small spine between large one on inner edge and that on front edge of lower side. Merus smooth, with one to three tubercles near distal end of upper edge, one often spine-like in young, indistinct or absent in old examples. Lower side of merus with two rows of spine-like tubercles. Outer rows of one to six tubercles, very rarely only one and usually two or three. Inner row of six to eleven spiniform tubercles, distal largest. Small tubercle on outer articulation with carpus present or wanting. Ischium of third peræopod hooked in male, and hook of first formed strong and partly conic. Coxa of fourth peræopod in male with prominent rounded compressed tubercle.

First pleopods in male of first form stout, short, reach hind edge of coxa of third peræopods, not articulated basally, the two parts separated at tips for short space, both curved sharply back to form almost right angle with basal part, and distally partly twisted so that outer part directly anterior to inner. Outer part horny, compressed, falciform, tip pointed and with small posterior accessory point, its tip often abraded. Inner part soft, swollen basally and tapers suddenly to blunt point. Annulus ventralis of female transversely rhombiform, with deep central depression and longitudinal sigmoid fissure. Anterior and especially hind edges elevated, so that form often appears depressed, and where lengthwise fissure passes over hind edge latter slightly depressed. In young females central depression less marked.

Color usually little varied, greener in young and browner in old examples. Carapace and abdomen olive-green to tawny-olive, chestnut and burnt-umber. Edges of rostrum in browner examples ferruginous. Distal third of fingers rufous or tawny. Tubercles of cutting-edges of fingers ochraceous-buff, and in brown examples usually some green on chelæ. Length 90 mm.

Remarks.—This species ranges from Canada in New Brunswick and Quebec southward to North Carolina, Tennessee, Kentucky and southern Indiana. Westward it is represented by the allied *Cambarus bartonii robustus* (Girard). The present species does not appear to be a feature of the Atlantic Coastal Plain. According to Ortmann, also from whom the above description is somewhat elaborated, it is a mountain-loving species, where it lives in the rough, rocky highland streams or brooks, and is usually absent from the large river-basins. It is sometimes found in the uppermost waters of the brook, the very headwaters, or even in springs, where it lives under stones or often in burrows. These latter are holes frequently a foot or over in depth, and are made along the banks, the aperture often above water. Accordingly as the weather may be wet or dry the burrows are of less or greater depth, and in the latter case the so-called "chimneys" are found, at times equalling those of the typical chimney-building crawfishes. It is also frequently found associated with other species of crawfishes. In large rivers it occurs usually at the mouths of small streams or at places where springs may occur along the banks.

Mr. W. T. Davis writes that it is "still to be found in some of the Staten Island brooks. I kept one in an aquarium for some time, and he made a burrow for himself in the sand, etc., about the roots of a small pond-lily. I noticed him coming out of the burrow every now and then, always laden with an armful of small pebbles, which he deposited at a short distance. He would hold his two claws against his body and thus managed to carry a good deal of material. As he came out of the burrow, he always stopped and looked about before going to a distance. When I ran water into the aquarium the crawfish would place himself at the mouth of the hose so as to receive the stream of fresh wa-

ter. As he originally came from a brook he no doubt enjoyed this constant flow of water as something like his old home. A crawfish taken from Willow Brook, Staten Island, on September 13th, 1896, shed his shell a few days later."

Though abundant in Pennsylvania, I have seen but few New Jersey examples, and it seems to have been recorded in the latter from but three localities, as Schooley's Mountain, Trenton and Princeton. I have examined examples from Trenton and Schwartzwood Lake. In Pennsylvania I have found it common in many places, as Hulmeville, Schuylkill River at Philadelphia, Holmesburg, Gladwynne, Germantown, Abrams, tributaries of Darby Creek, North Branch of Langford's Run, Bustleton, Schuylkill River opposite Lafayette and Mill Creek in Montgomery County, Wycombe, Emporium, Wawa, Trout Run in Delaware County, Chester County, Sandy Run in Philadelphia, brooks in Fairmount Park, Sugar Valley Run at Newton Hamilton, Wopsonomick Creek in Blair County, Lakemont Run and Altoona. In Maryland I have found it in a small tributary of the Elk River near Bacon Hill, in Cecil County. In Delaware I have it from Greenville, Newcastle County and a dried female, likely from near Newark?

Cambarus diogenes Girard.

PLATES 102 AND 103.

Chimney Crawfish.

Cambarus diogenes Girard, Proc. Acad. Nat. Sci. Phila., 1852, p. 88.
Near Washington, D. C.

—— Faxon, Proc. Amer. Acad. Sci., XX, 1884, p. 144. New Jersey.

—— Abbott, Amer. Nat., XVIII, 1884, p. 1157. New Jersey.

—— Faxon, Mem Mus. Comp. Zoöl., X, 1885, p. 71. Mercer county, New Jersey. (Derry, Pa.; Baltimore Co., St. Mary Co., Caroline Co., Dorchester Co., Worcester Co., "Deer Park in Garrett Co.," Md.; Washington, D. C.; south to North Carolina, west to Wisconsin, Wyoming, Louisiana.)

—— Faxon, Proc. Acad. Nat. Sci. Phila., 1885, p. 359. (Washington, D. C.)

—— Underwood, Bull. Ill. State Lab. N. Hist., II, 1886, p. 368. New Jersey (Maryland, District of Columbia, Virginia).

—— Faxon, l. c., 1890, p. 624. (Prince William county, Va.)

- Ortmann, Zoöl. Jahrb. Syst., VI, 1891, p. 12. New Jersey to Colorado, Wyoming (North Carolina, Mississippi, Louisiana).
- W. P. Hay, Amer. Nat., XXXIII, 1899, pp. 959, 961. New Jersey to Wyoming and Mississippi.
- Williamson, Ann. Carnegie Mus., I, 1902, p. 235. (Allegheny, Co., Pa.).
- Ortmann, Ann. Carnegie Mus., III, 1905, p. 398. (Allegheny, Westmoreland, Washington, Greene, Fayette and Delaware counties, Pa.)
- Cambarus diogenes* Abbott, Amer. Nat., VII, 1873, p. 83. Trenton, New Jersey. (Impr. err.)
- Cambarus (Bartonius) diogenes* Ortmann, Proc. Amer. Philos. Soc. Phila., XLIV, 1905, pp. (120) 135. (Seaford, Delaware.)
- Ortmann, Mem. Carnegie Mus., II, 1906, p. 402, Pl. A, fig. 3. Pl. 39, fig. 11. Pl. 40, figs. 6-7. (Penn's Manor, Essington, Ridley Park, Marcus Hook, Waynesburg, Rice's Landing, Smithfield, Dunbar, Pennsville, Burgettstown, Badon, Raccoon Township, Troup's Retreat, Stowe and Neville Townships, Edgeworth, Westview, Millvale, Fern Hollow, Nine Mile Run, Schenley Farm, Silver Lake, Bruce's Ice Pond, Carnegie, Jack's Run, Rankin, near Aspinwall, Montrose, Harmarville, Russelton, between Gibsonia and Bakerstown Station, Thornhill, Donohoe, New Alexandria, Dundale, Derry, Blairsville Intersection, Livermore, Kiskiminetas Junction, Homer, Creekside, Punxsutawney, Avonmore Station, Kittaning, Renfrew, Branchton, Wampum, Mercer, Pa.; Seaford, Del.; Chestertown, Md.; W. Virginia, Ohio, Indiana, Iowa, Kansas.)
- ? *Astacus fossor* Rafinesque, Amer. Month. Mag. Crust. Rev., II, November, 1817, p. 42. *Virginia, Pennsylvania, New York.*
- Cambarus obesus* Hagen, Mem. Mus. Comp. Zoöl., II, 1870, p. 81, Pl. 1, figs. 39-42, Pl. 3, fig. 163, Pl. 9. *Illinois, Petersburg, Va., Arkansas, New Orleans, Lake Michigan.*
- S. I. Smith, Rep. U. S. F. Com., II, 1872-73 (1874), p. 639. (Virginia, Illinois, Lake Michigan, Arkansas, New Orleans.)

Description.—Body smooth, robust, short hairs on chelæ in fresh examples and these also on hand and fingers in older ones. Carapace partly ovate, rather compressed, transverse diameter slightly more than vertical at hepatic region, sometimes even less. Branchial regions widest well forward, not far from cervical groove, and latter not interrupted on sides. Areola distinctly longer than half of front section of carapace, very narrow, generally obsolete in middle, or two lines bordering branchial regions in contact in middle of carapace, rarely small space left between them without an area for punctures. Rostrum more or less lanceolate, rather narrow, reaches hardly beyond distal end of second joint of antennular peduncle, often less. Rostrum

surface slightly concave above, edges elevated and not much swollen, swelling gradually disappears toward tip, converging, straight or slightly convex, contracted to form short triangular acumen. Basal angles of acumen indistinct, rounded, without any trace of marginal spines, and point of acumen short. Post-orbital ridges short, end bluntly in front, slightly diverge behind end in low indistinct swelling. Carapace surface punctate, slightly granulate on hepatic region, with few granules on branchial region immediately behind cervical groove. No lateral spine. External orbital angle present, distinct, angular or rounded, without spine or tubercle. Branchiostegal spine small, often obsolete tubercle. Abdomen about long as carapace, narrower in male, equal or wider in female. Front section of telson with one to three, usually two, spines on hind lateral corners. Hind section semi-elliptical, slightly broader than long, about long as front section.

Epistome rather long, narrow, flat, front section partly circular or elliptical, or truncate and subquadrate, median joint present or absent, and about long as broad. Antennules with small tubercle on lower edge of basal joint. Antennal peduncle without spines or tubercles on proximal joints. Antennal scale small, short, slightly longer than rostrum, reaches base of fifth joint of antennal peduncle. Antennal scale with spine of outer edge strong, laminar part not much broader than spine and inner edge parallel to outer edge of spine for considerable space. Flagellum short, often long as or less, than carapace length, not reaching beyond second segment of abdomen.

First peraeopods stout and very robust in old examples, similar in sexes, except very large in old males. Hand ovate, depressed, wide, surface punctate. Inner palm edge convex, with two irregular rows of tubercles and a few scattered tubercles on upper surface near marginal rows. Outer palm edge smooth, rounded proximally, slightly angular distally. Fingers at least one and one-half long as palm, gape at base, straight cutting-edges with number of irregular strong tubercles, one about middle of edge of each finger usually largest. Outer edge of movable finger with more or less distinct tubercles at proximal end. Upper

surface of each finger with low longitudinal rib, bordered by rows of punctures. Carpus about long as wide, shorter than palm, with deep longitudinal groove above, and few more or less distinct tubercles between groove and inner edge. Strong pointed spine in middle of inner edge, straight, directed forward obliquely. Tubercle on front edge of lower side, and another lower at articulation with hand. Few more tubercles may occur on inner edge and lower side, but rarely spiniform. Merus smooth, with one to three tubercles near distal end of upper edge, lower side with external series one to four and inner series seven to eleven, spiniform. Ischium of third peraeopods hooked in male, hooks in first form strong, subconic. Coxa of fourth peraeopods with strong and slightly compressed tubercle.

First pleopods in male as in *Cambarus bartonii*, tip of inner part tapers gradually to point.

Color brownish or greenish, somewhat variable. Carapace and abdomen olive-green to rawumber, mummy-brown and ferruginous, shading on sides through drab or russet to fawn color and whitish. Rostrum edges rufous or ferruginous. Hand tawny-olive to burnt sienna and rufous, shading to olive-yellow toward outside. Bases of fingers often with distinct olive-green shade, tips rufous, and hand tubercles cream-buff or whitish. Legs ochraceous-buff with olive-buff, or russet with olive-green at joints. Lower body side rufous or pale orange-buff, or whitish. Antennal flagellum annulated, dark olive-green and whitish. Length 124 mm.

Remarks.—The distribution is somewhat complex, and is best expressed by Ortmann as follows: While in Pennsylvania its boundaries are tolerably well known, it is quite different with the rest of the range. This appears divided into two unequal discontinued parts, as eastern and western. The former comprises, aside from a small section in southeastern Pennsylvania along the Delaware River, the whole or portions of New Jersey, Delaware, Maryland, District of Columbia, Virginia and North Carolina. Here it seems to be found exclusively in the Coastal Plain, not even entering the Piedmont Plateau. The western range begins in southwestern Pennsylvania and northern West

Virginia, westward to Ohio, southern Michigan, Indiana, Illinois, Wisconsin and southern Minnesota and Iowa. It also occupies localities south of the drift in Indiana, Kentucky, Illinois, Missouri, Kansas, Arkansas, Mississippi and Louisiana, extending west to Colorado.

This crawfish is the typical burrowing species and the one most noted for its habit of constructing "chimneys" at the aperture of its burrow. It usually lives in swamps formed by spring heads, though not in the soft mud, but along the edges of such places. Such locations allow a better opportunity to dig more permanent burrows. It does not seem to ascend streams so far as related species which live in cold clear spring-water, and is not even averse to foul or stagnant water. The burrows, which are very variable in size, shape and depth, and extend down in the latter case at times to three feet, or even more. The object of the burrows is evidently to seek a habitat with moisture. Except when mating or the young are associated with the female, each burrow contains but a single animal. The burrow is usually simple with somewhat of an excavation at the end, and in diameter the burrow is the proper width to admit its occupant. The chimneys are usually constructed at night. According to Ortmann the crawfish, in building the chimney, moves to the top and deposits the mud pellet upon the rim, finally pushing it into the proper position with the upper (outer) surface of the claws. He adds that the mud is not brought up upon the back of the claw, but held between the folded claws and front part of the body. Many opinions have been given as to the purpose of the chimneys, though Ortmann thinks with Harris, that they are only "the result of the easiest method of disposing of the material removed in excavating the burrow."

I have examined but few New Jersey examples, and these from near Trenton, and two dried females from Schooley Mountain. Other material before me is from Piney Creek, in Cecil County, Fannel's Branch at Chestertown, and a tributary of the Choptank River near Denton, in Maryland. Also a male from Baden, in Beaver County, Pennsylvania.

Cambarus limosus (Rafinesque).

PLATES 104 AND 105.

River Crawfish.

Astacus limosus Rafinesque, Amer. Month. Mag. Crit. Rev., II, November, 1817, p. 42. *The Delaware near Philadelphia.*

—— Rafinesque, l. c., III, August, 1818, p. 272 (note).

Cambarus (Faxonius) limosus Ortmann, Proc. Amer. Philos. Soc. Phila., XLIV, 1905, pp. (107, 112), 131. Princeton, Delaware and Raritan Canal, North Cramer Hill, New Jersey. (Torresdale, Marcus Hook, Grenoble, New Hope, West Manayunk, Chadds Ford Junction, Holmesburg, Gettysburg, Pa.; Cherry Run, W. Va.)

—— Ortmann, Mem. Carnegie Mus., II, No. 10, 1906, p. 352. Pl. B, fig. 3, Pl. 39 figs. 5a-5b. Camden, North Cramer Hill, Princeton, New Jersey. (New Hope, Penn's Manor, Grenoble, Tullytown, Torresdale, Holmesburg, Manayunk, W. Manayunk, Abrams, Marcus Hook, Williamson, Chambersburg, Marion, Bedford, New Cumberland, W. Fairview, Landisburg, Green Park, Northumberland, Bloomsburg, Milesburg, Maiden Creek, Pa.; S. Cumberland, Md.; Cherry Run, W. Va.)

Cambarus limosus Osburn, Zoöl. Soc. Bull., N. Y., XVI, 1912, p. 924. Central Park Lake, N. Y., and Prospect Park Lake, Brooklyn.

Astacus affinis (part) Say, Journ. Acad. Nat. Sci. Phila., I, 1817, p. 168. Inhabits the River Delaware.

—— Harlan, Med. Phys. Res., 1835, p. 230, Pl., fig. 2. Delaware River and tributaries.

—— De Kay, N. Y. Fauna, Crust., VI, 1844, p. 23 (on Say).

—— White, Cat. Crust. Brit. Mus., XXV, 1847, p. 72. Delaware River (Say's material).

—— Gibbes, Proc. Amer. Assoc. Adv. Sci., I, 1850, p. 195. New York and Philadelphia.

—— R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 814. All Middle States.

Astacus (Cambarus) affinis Erichson, Arch. Naturg., XII, 1846, p. 96. Delaware River.

Cambarus affinis Girard, Proc. Acad. Nat. Sci. Phila., 1852, p. 87. (Reading, Pa. Delaware River.)

—— Hagen, Mem. Mus. Comp. Zoöl., III, 1870, p. 60, Pl. 1, figs. 19, 22, 84, 85, Pl. 3, fig. 152, Pl. 5. Mt. Abry, New Jersey. (Havre de Grace, Md.; Schuylkill River and Carlisle, Pa.: "Niagara" and "New York.")

—— Abbott, Amer. Nat., VII, 1873, p. 80. Trenton, New Jersey.

—— S. I. Smith, Rep. U. S. F. Com., II, 1872-73 (1874), p. 637. (On Hagen and Abbott.)

—— Faxon, Proc. Amer. Acad. Sci., XX, 1884, p. 146. New Jersey.

—— Faxon, Proc. U. S. Nat. Mus., 1885, p. 360. (Bainbridge and Susquehanna River, Pa.; Havre de Grace, Md.; Washington, D. C.; Gunnison, Va.)

- Faxon, Mem. Mus. Comp. Zoöl., X, 1885, p. 86. Schooley's Mountain, Red Bank, Trenton, Burlington, Camden Co., New Jersey. (Niagara, N. Y.; Brandywine Creek, Schuylkill River, Reading, Philadelphia, Susquehanna River, Bristol, Bainbridge, Carlisle, Pa.; Cecil Co., Havre de Grace, Gynn's Falls, Druid Hill, Anne Arundel Co., Montgomery Co., Charles Co., Potomac River, Williamsport, Washington Co., Cumberland, Allegheny Co., Md.; District of Columbia at Washington; Virginia; Lake Erie; Lake Superior.)
- Underwood, Bull. Ill. State Lab. N. Hist., II, 1886, p. 366. New Jersey. (New York, Pennsylvania, Maryland, District of Columbia, Virginia, Lakes Erie and Superior.)
- Hay, Amer. Nat., XXXIII, 1899, pp. 960, 964. Southern New York to Virginia and Lake Superior.
- Andrews, Amer. Nat., XXXVIII, 1904, p. 165, fig. 1. (Potomac River, Maryland.)
- Mayer, Sea Shore Life, 1906, p. 88. (New York markets.)
- Astacus bartonii* (nec Fabricius) Milne-Edwards, Hist. Nat. Crust., II, 1837, p. 331. Delaware River and other parts of North America.
- Cambarus pealei* Girard, Proc. Acad. Nat. Sci. Phila., 1852, p. 87. *Potomac River at Washington, D. C.*

Description.—Body robust, pubescent, especially on carapace and chelæ, old examples almost hairless. Hairs persist on fingers of large chelæ. Carapace partly ovate, depressed, due to bulging branchial regions. Carapace height about middle of gastric region to point on sternum just before first peræopods, also at point of areola directly above sternum between second peræopods, and greatest carapace width at hepatic regions about equal, though width at branchial regions greater. Cervical groove deep, continuous on sides. Areola about half length anterior carapace section, including rostrum. Latter long, broad, reaches middle of fifth joint in antennal peduncle and end of antennular peduncle, rarely slightly longer. Rostral surface deeply concave, edges elevated and thickened, nearly straight, very little converged toward marginal spines. Latter well developed, and long triangular acutely pointed acumen about one-third length of entire rostrum, sometimes more or less. Post-orbital ridges parallel, end in sharp spine in front. Carapace surface finely punctate, finely granulate on sides in old examples. Sides spinose, some larger or smaller spines on hepatic region, and few spines on branchial region just behind cervical groove, one usually much enlarged. All these spines better developed

in large examples. External orbital angle not distinct, rounded. Branchiostegal spine sharp, distinct. Abdomen longer than carapace, slightly narrower in male and slightly broader in female. Front section of telson on outer hind quarters with two spines, or one to three, also variable on the two sides. Hind telson section semicircular, slightly broader than long, also a little shorter than front section.

Epistome with hind part short, broad, almost thrice wide as long, not plane, transverse groove behind middle and a front median depression. Front section of epistome constricted basally, front edge almost semicircular, with small median point slightly variable in shape, and transverse diameter always slightly greater than longitudinal. Antennal peduncle with sharp spine on outer side of each of two basal joints. Antennal scale long as rostrum or more, reaches middle or end of last joint in antennal peduncle, outer edge with strong spine, laminar part rather broad with edge more or less regularly curved, greatest width medianly or slightly anterior. Flagellum reaches fourth or middle of fifth abdominal segment in male, and in female not reaching beyond hind edge of third segment.

First pereopods rather short, not stout. Hand short, not very wide, depressed, long, ovate, stronger and longer in male. Surface of hand punctate, inner edge nearly straight with double row of tubercles more or less spiniform, and outer edge smooth, bluntly angular, more distinctly so distally. Fingers distinctly longer than palm, straight, cutting-edges straight, in contact their whole length, with few very small tubercles in proximal part, for rest without teeth or tubercles, but with short dense pubescence becoming slightly barbate proximally on lower side. Upper surface of each finger with lengthwise rib, most distinct distally, and lower surface of hand almost smooth, sparsely punctate. Carpus slightly longer than wide, shorter than palm, punctate, upper surface with distinct lengthwise groove, inner edge with strong, procurved spine in middle and small spine anterior. Lower surface of carpus with two strong spines, one in middle of anterior edge and other at articulation with hand, sometimes other small spines proximal or above

large spine of inner edge. Merus smooth, upper edge with two, rarely more or many as four strong spines short space from distal end, lower edge with two rows of strong spines, inner row of four to ten, largest distally, and outer row of two to three spines. Also spine at outer articulation of merus with carpus. Ischium of third peræopods hooked in male, of first form strong and subconic. Coxa of hind peræopods without crests or tubercles in male.

First pleopods in male of first form rather strong, short, not extending beyond front edge of coxopodites of third peræopods, not articulated basally, straight, and two parts separated at tips only short distance. Tips crossed or twisted, divergent, that of gradually tapering inner part soft directed obliquely out, and horny gradually tapering outer part directed obliquely forward and slightly inward. Annulus ventralis in female transversely rhombiform, with short transverse groove slightly behind middle and sigmoid longitudinal fissure. Anterior to central groove on each side of fissure strong tuberculiform elevation so that fissure placed in rather deep depression. Posterior to central groove, slight elevation over which fissure passes.

Color greenish on upper surface, mottled with darker green, especially on chelæ. Finger tips orange, preceded by dark green ring, which extends along outer border of hand to wrists. Abdominal somites ornate with interrupted transverse chestnut-colored double bands and under surface of lighter hue. Length 120 mm.

Remarks.—This is our common river species, living in the ponds and canals of our lowlands. It is characteristic of the Atlantic Coastal Plain and Piedmont region, in the States of New Jersey, Pennsylvania, Maryland, District of Columbia and Virginia, doubtless also Delaware. In the Delaware it does not seem to go much above Trenton, according to Ortmann rarely to New Hope, and is more abundant in the tidal region. Like some other lowland aquatic animals it is likely an ancient type, and according to Ortmann is a "Tertiary relic at the northern extremity of the coastal plain, which has not been able to expand its area to any considerable degree in Postglacial times."

The river crawfish does not make much, if any, of a burrow, but usually hides under stones or in aquatic vegetation. It also does not live in rough rocky streams, but inhabits quiet or tidal fresh waters, where I have often taken it along with killifishes, sunfish and other small fishes.

A large series of examples before me from Mantua Creek at Mantua, Camden County, Pitman, Burlington, Burlington Island, Florence, Newbold's Island, Duck Island, Trenton and Hurd Cove of Lake Hopatcong. Besides these a large series also from Pennsylvania, as those from the Monocacy and Saucon Creeks at Bethlehem, Tullytown, Bristol, Torresdale, Holmesburg, the Schuylkill at Philadelphia, Abrams, Red Clay Creek near Kennett Square, Edderton, Walnut Hill, the Brandywine below Chadd's Ford, Ephrata and Gettysburg. In Delaware I secured it east of Iron Hill (Maryland), Shellpot Run and at Claymont. In Maryland I have only found it at Bohemia Mills in Cecil County. I also have examined dry examples from Red Bank, and Harlan's example from the Schuylkill River.

Cambarus blandingii (Harlan).

PLATES 106 AND 107.

Blanding's Crawfish.

- Astacus blandingii* Harlan, Trans. Amer. Philos. Soc. Phila., III, 1830, p. 464. Camden, South Carolina, and New Orleans, Louisiana.
- Harlan, Med. Phys. Res., 1835, p. 229, fig. 1. United States marshes and rivulets.
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 23 (on Harlan).
- Gibbes, Proc. Amer. Assoc. Adv. Sci., I, 1850, p. 195. (New York and Philadelphia collections.)
- Astacus (Cambarus) blandingii* Erichson, Arch. Naturgesch., XII, 1846, p. 23 (on Harlan).
- Cambarus blandingii* Hagen, Mem. Mus. Comp. Zoöl., III, 1870, p. 43, Pl. 1, figs. 63-64, Pl. 3, fig. 140 (type).
- Faxon, Proc. Amer. Acad. Sci., XX, 1884, p. 135. New Jersey.
- Faxon, Mem. Mus. Comp. Zoöl., X, 1883-85, p. 19, Pl. 7, figs. 2, 2', 2'' 2^a, 2^{a'}. New Jersey, Essex County, Delaware River and tributaries near Trenton. (New York; Baltimore, Carolina, Dorchester, St. Mary's, Somerset, Wicomico and Worcester Counties, Md., south to Georgia.)

- Underwood, Bull. Ill. State Lab. N. Hist., II, 1886, p. 367. New Jersey. (Virginia, Maryland, Georgia.)
- Faxon, Proc. U. S. Mat. Mus., XII, 1890, p. 619. (Lexington and Dismal Swamp, Va.)
- Hay, Amer. Nat., XXXIII, 1899, p. 963 (name in key).
- Mayer, Sea Shore Life, 1906, p. 88. (Neighborhood of New York.)
- Cambarus blandingi* Ortmann, Mem. Carnegie Mus., II, 1904-6, p. 431. Princeton, New Jersey.

Description.—Body compressed, though rather robust, with more or less wide-set minute pubescent patches, especially in males. Carapace little depressed, surfaces convex, partly ovate. Branchial region with width about median, well behind cervical groove. Carapace with upper surface convex, not flattened. Cervical groove deep, interrupted on sides. Areola shorter than half anterior section of carapace, quite narrow, and only few pubescent patches irregularly. Rostrum long, acute, falling but little short of outer end of antennular peduncle, though extends well beyond end of second antennular joint. Rostral surface concave, edges elevated with usually a subterminal spine on each and slight dent before each eye. Edges of rostrum converge in rather long isocles triangle, and sharply pointed. Postorbital ridges rather long, nearly parallel as viewed above, angulated anteriorly as sharp spine. Sharp anteriorly directed spine at posterior lower portion of cervical groove. Branchiostegal spine small and sharp. Abdomen about long as carapace, slightly wider in female than in male, less than carapace width in latter. Front section of telson on hind lateral corners with one spine each side. Hind edge of telson evenly convex, length about two-thirds width, and length about three-fourths that of front section.

Epistome broad, rounded anteriorly, oblique laterally. Antennules with small spine on lower edge of basal joint, though peduncle apparently without other tubercles. Antennal scale moderate, slightly longer than rostrum, reaches beyond antennular peduncle. Antennal scale with spine on outer edge strong, and laminar part nearly twice width of marginal spine. Flagellum reaches front edge of sixth abdominal segment at least in male.

First peræopods very elongate, rather slender, in males. Hand long, slightly compressed, surface punctate, slender. Inner palm edge a little less than fingers, nearly straight, with row of small wide-set and inconspicuous tubercles. Outer palm edge smooth, rounded, not carinated. Fingers about equal palm in length, their edges almost entirely approximated. Fingers punctate over surfaces, sometimes slightly hairy towards ends. Fingers with slight tooth usually at each tip and several similar teeth scattered along edges, which more or less finely setaceous. Ridges or grooves usually obsolete on fingers. Carpus nearly twice as long as wide, shorter than palm, sometimes rather deep longitudinal groove above, obsolete in males, and inner edge with strong hooked spine directed slightly forward. Sometimes another spine at upper front edge of carpus and one or several on lower front edge. Lower surface of carpus more or less tubercular. Merus mostly smooth, with two spines on upper edge anteriorly, and lower edge with two rather regular rows of small tubercle-like spines, these gradually smaller posteriorly. Ischium of third and fourth peræopods hooked in male.

First pleopods in male moderately long, reach hind edge of coxa of third peræopods, without basal articulations, formed of two subequal joints, curved sharply forward to form into right angle with basal portion, not twisted. Outer part compressed falciform, end pointed, with small posterior accessory tooth or point. Annulus ventralis of female transversely rhomboid.

Color usually olivaceous, paler below and on ends of feet. Length 90 mm.

Remarks.—This species ranges along the Atlantic Coastal Plain northwards to New Jersey at least, and New York. Southward its distribution is given as Georgia, according to Faxon, and it seems to have been of southern or Carolinian origin. Blanding's crawfish lives in still water, often in the masses of aquatic vegetation of our lowlands. It loves sluggish waters, often near the sea, or in muddy and grassy ditches, and is even said to be able to live in salt water.

In New Jersey I have obtained it in tributaries of Crosswicks Creek near Trenton, Repaupo Creek near Repaupo, and Mantua

Creek near Mantua. In Delaware it is frequently found, and I obtained it at Laurel, in Sussex county, and Brown's Branch near Harrington. Mr. S. N. Rhoads obtained it in the same state at Medford Mills. In Maryland I have found it in tributaries of the Choptank near Denton.

Super-Family THALASSINIDEA.

Last segment of narrow thoracic sternum movable and independent. Abdominal terga overlap one another hardly or not at all. Rostrum small and triangular, or rudimentary. Carapace not fused with epistome or in any way overlapped by first abdominal tergum. Antennal peduncle of five movable joints and supports lash-like flagellum. Telson usually subquadrangular, and first abdominal somite usually carries pair of uniramous appendages.

A single family in our limits.

Family UPOGEBIDÆ.

Carapace short, not overlapping first abdominal tergum. Rostrum short, triangular or rudimentary. Last thoracic somite movable and last thoracic sternum separate. Abdominal terga, which more or less unequal in size, hardly overlap one another, and pleura rudimentary or absent. Telson usually subquadrate and caudal swimmerets usually foliaceous. Two antennular flagella of no great length. Antennal peduncle five-jointed and flagellum lash-like. No antennal scale. External maxillipeds pediform. Thoracic legs seven-jointed, but no independent movement between basis and ischium. First or first and second pairs chelate, or first pair subchelate and second pair monodactylous. Third and fourth pairs monodactylous, but fifth pair subchelate or even imperfectly chelate. Branchiæ thoracic.

Genus UPOGEBIA Leach.

Eupogebia Leach, Edinburgh Encyclop.,¹ VII, 1813, p. 400. Type *Cancer (Astacus) stellatus* Montagu, monotypic. (Not consulted.)

¹(Leach, l. c., Am. Ed., VII, 1815, p. 239.)

Gebia Leach, Trans. Linn. Soc. London, XI, 1815, pp. 335, 342. Type *Cancer* (*Astacus*) *stellatus* Montagu, virtually, as this name give to replace *Eupogetia*.

Gebios Risso, Hist. Nat. Eur. Mer., Crust., V, 1826, p. 51. Type *Gebios littoralis* Risso, first species.

Gebius, auct.

Carapace narrowed anteriorly, ends in short triangular rostrum. Abdomen narrowed at each end, somewhat depressed. Antennæ of both pairs placed nearly on same level. Antennules very short, double flagella rather longer than peduncle, which latter dilated on outer side at base. Antennæ very slender, without vestige of movable scale at base, flagella very long and joints subelongate. External foot-jaws pediform, slender. First pair of feet somewhat robust, nearly equal, straight, arm becoming trigonus forward. Carpus short, rounded, elongate hand imperfectly cheliform, and large movable finger turns down to immovable one, which not half its length. Peræopods slightly compressed, with single dactyls.

Species rather few, and but one along our shores.

***Upogebia affinis* (Say).**

PLATE 108.

Mud Lobster.

Gebia affinis Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 241. *Georgia*.

—— De Kay, N. Y. Fauna, Crust., VI, 1844, p. 22 (on Say).

—— White, Cat. Crust. Brit. Mus., XXV, 1847, p. 71. *Georgia* (tail and part of abdomen of Say's material).

—— Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 150. Great Egg Harbor, New Jersey.

—— Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 368, Pl. 2, fig. 7. Great Egg Harbor, New Jersey, near Beesley's Point, New Haven, Wood's Holl, etc.; p. 519 (in *Paralichthys dentatus*); p. 520 (in *Lophopsetta maculata*, this and preceding at Great Egg Harbor); p. 530 (young).

—— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 549. Long Island Sound to South Carolina.

—— Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 327. Long Island Sound to Florida.

—— Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, New Jersey.

- Stebbing, Hist. Recent Crust. (Int. Sci. Series LXXIV), 1893, p. 185. (On Smith.)
- Kingsley, Am. Nat., XXXIII, 1899, p. 824. Middle and Southern Atlantic coast.
- Upogebia affinis* M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 17. (Massachusetts and Connecticut.)

Description.—Carapace compressed, deeper than broad, slightly narrowed in front, surfaces slightly convex. Length of carapace about equals first four abdominal segments. Gastric region of carapace elongated, rather triangular, hairy. Abdomen with first and sixth segments contracted or constricted slightly as compared with other four equal segments, all with convex surfaces. Telson broad, its entire posterior edge broadly ciliated, two outer plates each side broad, also each with two strong radiating ridges on upper surfaces. Median plate of telson much wider than deep, with transverse ridge above basally, and median vertical or longitudinal sulcus also dorsally. Rostrum small, narrowly triangular, depressed, smooth below and hairy above. Continued back above each eye process similar and shorter, though on same plane with rostrum. Eyes close together, with thick stalks not larger than their own diameter, and eyes themselves globular, and dark in color. Antennules small, peduncle longer than biramous flagella, first joint of peduncle longer than second, which smaller, and third joint but little less than flagella. Peduncle of antennules reach slightly beyond second joint of peduncle of antenna. Antennæ with first two joints of peduncle robust and short, third and fourth joints subequally longer, though less robust, and fifth joint smaller. Flagella of antennæ long and slender, reaches back to articulation between second and third abdominal segments. Peduncles of antennæ with large close-set cilia and peduncles of antennules with long setæ, though rather sparsely. Mouth-parts not conspicuous, hairy. Second maxillipeds quite pediform, hind edges strongly ciliated. Chelipeds quite large, of about equal development. Dactyl quite hairy, and cutting-edge with a series of six spines or teeth, of which one at each end enlarged and others uniform. Pollex a sharp strong spine, and six teeth of small size along basal portion of inner edge. Propodus twice as long as broad, upper surface with three rows of small spines, lower edge with fringe

of fine long setæ or hairs. Carpus with three subequally large inner spines on front edge superiorly and two similar ones on lower edge, from latter two more smaller ones form external series backward. Merus compressed, nearly broad as hand, with small thorn above and several below. First to fourth peræopods gradually smaller, all quite hairy or with setæ, especially dactyls, hands of all, and hind edge of merus of first pair. Merus of first pair with one thorn on lower edge, and merus of second pair with three thorns on lower edge. All dactyls of first to fourth peræopods simple, though strongly compressed and not sharply pointed. Color mostly light brownish or reddish-brown. Pleopods large, well fringed with hairs. Length 48 mm.

Remarks.—The range of this species is along our coasts, from Massachusetts to the shores of the Southern States. According to Verrill it lives on muddy shores and digs deep burrows near low-water mark, in the tenacious mud or clay, especially where there are decaying sea weeds buried beneath the surface. The burrows are roundish, half an inch to an inch in diameter, very smooth within, and go down obliquely for the distance of one or two feet, and then run off laterally or downward, in almost any direction, to the depth of two or three feet, and are usually quite crooked and winding. The animal is quite active, swimming rapidly and jumping back energetically. It is eagerly devoured by such fishes as are able to capture it. When living the colors are quite elegant. Along the back a broad band of mottled reddish-brown, which contracted on next to last segment, each side of band mottlings fewer, and surface somewhat hairy. Last segment and appendages of preceding one thickly specked with reddish-brown, and their edges fringed with gray hairs.

I have two examples, one from the Finger Channel in Great Egg Harbor Bay and the other from the inlet at Atlantic City. I examined the stomachs of two examples of *Sterna hirundo*, killed at Sea Isle City on August 21st, 1912. In one the remains of *Upogebia affinis* were found, while in both portions of *Menidia menidia notata* were discovered. Mr. Witmer Stone found it at Point Pleasant. Dr. R. J. Phillips secured a number at Corson's Inlet.

Sub-Order ANOMURA.

Abdomen in its entirety less well developed than cephalothorax, though exceptionally elongate and extended in straight line usually flexed on itself, or flexed against thoracic sternum, or coiled in a spiral, in which last case more or less soft and asymmetrical. Carapace traversed on either side in longitudinal or obliquely longitudinal direction by distinct suture (linea anomurica) which marks off more or less sidewall of carapace from dorsal and dorso-lateral region. Rostrum often ill-developed, and often fails to cover ophthalmic somite completely. Last thoracic somite independent and last thoracic sternum when not atrophied separate and freely movable. In correspondence with reduction of last thoracic somite, last pair of thoracic legs always reduced in length. Sometimes an orbital notch, but eyes never concealed in orbits. Antennular peduncle generally weak and flexed, longer than flagella. Antennal scale, when present, an "acicle" and never foliaceous. External maxillipeds commonly pediform. First pair of legs well developed and chelate, second and third pairs well developed and monodactylous, and either fourth and fifth pairs both much reduced in size or if fifth pair well developed as second and third, then fifth pair slender, weak and folded. Epipodites much more often absent than present on thoracic legs and second maxillipeds. Abdominal appendages weak, and with tendency to become rudimentary or to disappear on one or both sides. Genital ducts never open upon sternum. Branchiæ usually fourteen on each side, and also frequently developed as phyllobranchiæ.

This is a large group, embracing forms mostly in the deep seas. They are usually divided in five groups or super-families, as the *Hippidea*, *Paguridea*, *Porcellanidea*, *Lithodea*, and *Galatheidæ*, though only the first two are represented in our limits. The second to last of these groups are bathytic, while the *Hippidea* are littoral burrowing forms.

Key to the super-families.

- a. Carapace ovate or partly quadrate, smooth; abdomen usually firm, and not especially long, symmetrical. HIPPIDEA
- aa. Carapace elongate and partly cylindrical, more or less roughened; abdomen usually soft, long, coiled, rarely symmetrical. PAGURIDEA

Super-Family HIPPIDEA.

The Sand Bugs.

Carapace ovate or subquadrate, comparatively smooth, regions ill defined and front broad. Corneæ of eyes small. Generally first antennæ strongly developed, with one flagellum elongate and other of moderate size or absent. Second antennæ usually with short flagellum and massive peduncle of four or five joints, with or without movable acicle on second. Third maxillipeds moderately broad, sub-operculiform. Walking-legs with flattened terminal joint, fifth pair slender and filiform and folded under preceding pair. Sterna of trunk linear. Pleon partially extended, with telson large, longer than broad, and preceding segment carries pair of biramous lamellar appendages not so arranged as to form rhipidura. Males have no appendages to pleon but those of penultimate segment.

These animals live in the shallow waters of tropical and sub-tropical seas. Two families are usually admitted.

Family HIPPIDÆ.

The Sand Bugs.

Third maxillipeds sub-operculiform, with broad fourth joint, and exopod absent. First pair of legs subcylindrical, not chelate. Telson elongated and lanceolate.

Genera three or four. The non-chelate character of the anterior legs, and the ovate contour of the carapace render them especially adapted for moving quickly about in the shifting loose sands of surf-beaten shores.

Genus EMERITA Gronow.

The Sand Bugs.

Emerita Gronow, Zoöphylac., 1763, p. 234. Atypic. (Type *Cancer emerita* Linnæus. See J. E. Benedict, Bull. U. S. F. Com., XX, 1900 (1902), p. 138.)

Nectylus Rafinesque, Amer. Month. Mag. Crit. Rev., II, Nov. 1817, p. 41.

Type *Nectylus rugosa* Rafinesque, monotypic.

Nectodactylus Rafinesque l. c. (nom. orig. *Nectylus*).

Body greatly convex, and hemispherical in cross-section. Antennules moderate in length. Antennæ with very long robust many-jointed and strongly ciliated flagellum. Third maxillipeds with last joint narrow, laminate and compressed. First legs with last joint lamellate and oval.

Species few, and but one on our shores.

***Emerita talpoida* (Say).**

PLATES 109 AND 110.

Sand Bug. Bait Bug. Hippa.

Hippa talpoida Say, Journ. Acad. Nat. Sci. Phila., I, pt. 1, 1817, p. 160.
United States coast.

—— De Kay, N. Y. Fauna, Crust., VI, 1844, p. 18, Pl. 7, fig. 17. From near Cape Cod southward.

—— White, Cat. Crust. Brit. Mus., XXV, 1847, p. 58. United States (Say's material).

—— Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 149. Great Egg Harbor, New Jersey.

—— Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 338. Pl. 2, fig. 5. (Woods Holl and Fire Island); p. 530 (young) Vineyard Sound and Fire Island.

—— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 548. Cape Cod to Florida.

—— S. I. Smith, Trans. Conn. Acad. Sci., III, 1877, p. 311, fig., Pl. 45-48. (Fire Island Beach, Long Island. Early stages.)

—— Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 326. Cape Cod to Florida.

—— Uhler, Ches. Z. Lab. J. Hopkins Univ., I, 1878, p. 26. (Fort Wool, Virginia.)

—— Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 150 (remarks on S. I. Smith's observations).

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 16. Cape Cod southward.

—— Paulmier, 58th Rep. N. Y. State Mus., IV, 1904 (1906), p. 135, fig. 7. (Southern Long Island.)

—— Mayer, Sea Shore Life, 1906, p. 94, fig. 64. New Jersey and Long Island.

Hippa talpoidea Leidy, Proc. Acad. Nat. Sci. Phila., 1878, p. 336. Cape May and Ocean Grove, New Jersey.

——— Leidy, l. c., 1888, p. 333. Beach Haven, New Jersey.

Emerita talpoida Fowler, Proc. Acad. Nat. Sci. Phila., 1911, p. 3. (Beaches of Delaware.)

Nectylus rugosa Rafinesque, Amer. Month. Mag. Crit. Rev., II, Nov. 1817, p. 41. Long Island, N. Y.

Hippa emerita Miers, Journ. Linn. Soc. London, XIV, 1879, p. 323, Pl. 5, fig. 9. United States, New York.

——— Kingsley, Standard Nat. Hist., II, 1884, p. 59. America.

——— Ives, Proc. Acad. Nat. Sci. Phila., 1891, p. 181. New Jersey.

——— Young, Stalk E. Crust. W. Ind., 1900, p. 349. United States to Brazil.

Description.—Body with greatly convex surface, robust. Carapace as viewed above ovoid, with numerous irregular transverse wavy lines, which become obsolete or absent on sides and posteriorly. Distinct transverse postfrontal and postgastric line incised. Front with three subequal triangular lobes, as median and one each side, all well separated. Lateral lobes each slightly more anteriorly produced than median lobe, though otherwise similar. Eyes globular, a little more bulky than very slender long stalk, extend out till nearly to middle in length of third joint of antennal peduncle. Antennules densely ciliated or with setæ, peduncle nearly third their entire length, and subequal multiarticulate biramous flagella reach well beyond peduncle of antennæ. Antennæ with robust peduncle, outer basal joint quite large, ends anteriorly in three sharp spines, of which median much largest and slightly pointing upward and outward. Flagellum multiarticulate, robust, though tapering distally, densely hairy on lower edge, and when distended back reaches five-sixths to hind carapace edge. Buccal mass inconspicuous. Second maxillipeds completely covering buccal mass, and often concealing long plumose antennæ within, lobe at front edge triangular and somewhat acute, most all edges greatly hairy. First pair of legs with outer joint ovate. Second and third pairs of legs with outer joint broad falcate dactyls, and these directed outwards. Fourth pair of legs smallest, with small, short semi-falcate dactyls. Last pair of legs, and these articulating with outer front edges of telson, broad, larger than fourth pair, and outer joint consists of two subequal large ovate lobes. All legs very broad basally, narrow and partly acute in outer halves, also quite hairy. Telson elongate, triangular, narrow, acuminate, and

greatest width half its length. Abdominal segments greatly constricted to fourth, which narrowest. Color sandy-whitish, yellowish below, and lavender tints on carapace. Length about 30 mm.

Remarks.—The sand bug, as it is known in some localities, ranges from Cape Cod to Florida. It is an abundant and familiar crustacean along the entire coast of New Jersey, the sandy shores here afforded being its favorite haunts. It burrows in the sand head first, and makes rapid progress. Often along the beach at Ocean City and Cape May I have seen hundreds, all congregated in some favorite place, where they move about the shifting sands like a great army. It is a good swimmer, moving quickly through the water, and sometimes is left in little pools and drains along the beaches at low water. In such places their quaint and agile movements, as they burrow about in the water-soaked sand, frequently attract the attention and afford amusement to the summer visitors to the seashore. Frequently in hauling small seines along the beach great numbers of sand bugs may be obtained, along with *Ovalipes ocellatus*, various isopods, medusæ, small fishes, etc. Its chief value lies in affording food to various fishes, though in places it is used sometime as bait, and thus known as "bait bug."

I have examined multitudes of examples from Point Pleasant, Manasquan Inlet, Seaside Park, Barnegat, Spray Beach on Long Island, Absecon, Atlantic City, Longport, Ocean City, Corson's Inlet, Sea Isle City, Townsend's Inlet, Stone Harbor, Avalon, Anglesea, Wildwood, Cape May and Cape May Point. I also found it abundant at Rehoboth Beach on the coast of Delaware. Mr. W. T. Davis found it on South Beach, Staten Island, N. Y.

Super-Family PAGURIDEA.

The Hermit Crabs.

Carapace almost always elongate and subcylindrical, much less well calcified behind cervical groove than in front of it. Thoracic sternum narrow or linear. Abdomen elongate, usually soft,

asymmetrical, either coiled to fit spire of dead mollusk shell that animal usually inhabits, or bent, only occasionally well calcified, symmetrical and straight. Caudal swimmerets present, narrow and falcate usually. First three pairs of thoracic legs well developed, first pair massive and chelate, and second and third pairs long, stout, monodactylous. Fourth and fifth pairs of thoracic legs, one or both of which may be chelate or subchelate, exceedingly short. Paired appendages may be present on first and second abdominal somites of male and on first somite of female, but on third to fifth somites of male and second to fifth of female appendages usually developed on one side only.

While these crabs are familiar to all visitors, or others at the seashore, between the tides and along the sea beaches, they also occur in very deep water, and have been taken in depths of over two thousand fathoms. Several families are known, though only one in our region.

Family PAGURIDÆ.

The Hermit Crabs.

Carapace usually somewhat elongate, somewhat broadened posteriorly and feebly calcified laterally. Rostrum sometimes fairly prominent, sometimes obsolescent and leaving ophthalmic segment exposed. Thoracic sterna variable in breadth. Abdomen generally soft and spirally coiled in adaptation to form of cast-off gastropod shell which animal generally uses as a habitation. In few abnormal forms not using shell abdomen may reacquire secondary symmetry. Ophthalmic scales and antennal acicle present and often large. Antennular peduncle usually of moderate length and flagella usually short. Chelipeds usually massive, equal and similar, or very unequal and dissimilar. Legs of second and third pairs elongate, those of fourth and fifth pairs short, fourth pair simple, subcheliform or cheliform, and fifth pair subcheliform or cheliform. Abdominal appendages never all bearing paired appendages. Usually appendages on left side only, present on somites two to five or three to five. Occasionally

first, or first and second, abdominal segments of male, and first abdominal segment of female, carry pair of appendages modified for sexual purposes. Telson usually more developed on left side than on right, as also caudal appendages or uropods. Gills as phyllobranchiæ or trichobranchiæ, or intermediate between them.

Sub-Family PAGURINÆ.

External maxillipeds widely separated at base. Right cheliped usually vastly longer than left and latter never larger than right, though occasionally subequal.

Genus PAGURUS Fabricius.

The Hermit Crabs.

Pagurus Fabricius, Suppl. Entomol. Syst., 1798, p. 411. Type *Cancer bernhardus* Linnæus, third species, designated as example by Latreille, Hist. Nat. Crust., 1802, pp. 29, 30.

Eupagurus Brandt, Sibir. Reise Middendorff, Zoöl., Pt. I, 1851, p. 105. Type *Cancer bernhardus* Linnæus, designated by Stimpson, Proc. Acad. Nat. Sci. Phila., 1858, p. 236.

Bernhardus Dana, Proc. Acad. Nat. Sci. Phila., 1852, p. 6. Type *Pagurus bernhardus* Linnæus, virtually designated.

Carapace elongate, broadened posteriorly, well calcified in front of cervical groove. Rostrum either distinct or obsolescent. Abdomen well developed, soft, spirally coiled. Eyestalks either stout or slender, ophthalmic scales usually distant. Antennal acicle long and flagellum long, nude or more or less setose. External maxillipeds widely separated at base. Exopodites of all three pairs of maxillipeds flagellate. Endopodite (palp) of first maxillæ without flagellum, though sometimes a rudiment. Chelipeds usually dissimilar and unequal, right much larger, very rarely subequal, and fingers move in more or less horizontal plane, finger-tips calcareous, rarely corneous. Fourth pair of legs subcheliform, fifth pair minutely or imperfectly cheliform with short blunt fingers, and in both pairs (as also on uropods) usual subterminal pavement of imbricating granules. Abdominal appendages, in addition to those forming tail-fan, four (somites

two to five) in both sexes, unequally biramous, one ramus in case of fourth appendage being minute rudiment and placed as usual on left side. Sometimes in male somite of appendage two absent. Telson and uropods usually better developed on left side than on right. Gills phyllobranchiæ (occasionally having gill-plates at tip) and eleven on either side, arranged as in *Parapagurus* and *Sympagurus*.

This is the largest genus of the family, and embraces about one hundred and fifty species, of which about a third are sublittoral, though none are found in the sea below depths of eight hundred and fifty fathoms. The genus seems to reach its greatest diversity in cold or sub-arctic regions of the northern hemisphere.

Key to the Species.

- a.* Shore forms, ranging only down to fourteen fathoms depth; body more or less tuberculated, not very hairy; chelipeds more or less tuberculate.
b. Size larger; carpus, propodus, dactyl and pollex broad, coarsely tuberculate. *pollicaris*
bb. Size smaller; carpus, propodus, dactyl and pollex slender, granulated. *longicarpus*
- aa.* Deep-water species, rare at low-water mark, and ranging down to one-hundred and fifty fathoms depth; body more or less tuberculate to hairy; chelipeds more or less hairy to spinescent. *pubescens*

Pagurus pollicaris Say.

PLATE III.

Big Hermit Crab.

- Pagurus pollicaris* Say, Journ. Acad. Nat. Sci. Phila., I, pt. 1, 1817, p. 162. *Coast of the United States.*
 — De Kay, N. Y. Fauna, Crust., VI, 1844, p. 19, Pl. 8, fig. 21. New York.
 — White, Cat. Crust. Brit. Mus., XXV, 1847, p. 59. United States (Say's material).
 — Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 149. Great Egg Harbor, New Jersey.
 — M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 14. Cape Cod Bay to Long Island Sound.
Eupagurus pollicaris Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 313 (in *Lunatia* and *Fulgur*).
 — S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 548. Massachusetts to Florida.

- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 326. Massachusetts to Florida.
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 779. Massachusetts to Florida.
- Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, New Jersey.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1906), p. 136, fig. 8. New York City.
- Mayer, Sea Shore Life, 1906, p. 94. Cape Cod to Florida.

Description.—Body more or less soft. Carapace firmer, slightly wider behind, then more or less moderately constricted and hind edge moderately emarginated. Abdomen soft conic spiral. Front of carapace broad, undulated as three wide lobes, of which median little wider than each of slightly more advanced lateral ones. Eyes conspicuous, a little broader than pedicels, and reach slightly beyond articulation with outer joint of peduncle, also basally pedicels still more constricted than at noticeable median constriction. Antennules with broad basal joint in peduncle, others all narrower and slender, third joint longest and second joint shortest. Flagellum of antennule about long as second joint, tapers rapidly to point, finely articulated, with series of close-set long setæ below and also slender accessory flagella. Antennæ extremely long, slender, longer than carapace or chelipeds, and peduncle of three principal joints, of which basal robust, second shortest and third longest, though latter extends forward but slightly beyond peduncle of antennules. Flagellum long, tapering, multiarticulate, and end filamentous. Buccal mass fairly well developed, though not especially conspicuous. Mandibles firm, well developed. First and second maxillæ subequal, hairy, each with small palp. Maxillipeds well developed, second twice length of first, and both pairs with long exopodites. Chelipeds moderately large, left larger, though right moderately developed, and both quite roughened with tubercles. Lower surfaces of both chelipeds more or less hairy. Left cheliped with outer edge of propodus more keeled, comprising series of strong tubercles. Tubercles on inner edge of left propodus and inner edge of carpus largest. Carpus but little shorter than propodus. Dactyls of chelipeds subequal. First and second pairs of legs sub-

equally long, large, longer than chelipeds, slender, simple acuminate dactyls longest of joints. Both first and second pairs of legs quite hairy below distally. Third and fourth pairs of legs greatly shorter than others articulating with carapace, fourth little longer than third, and dactyl of third slightly better developed, that of fourth obsolete. Two undeveloped appendages on left side of abdomen anteriorly, anterior slightly larger and outer joint comprises at least two-thirds length of each. Very small rudimentary appendage still posterior. Last three terminal abdominal segments small, and pair of limbs extending from each side of median one, though that of left best developed. Large outer and small posterior joints of appendages with external posterior asperous surfaces, that of left better developed. Color when fresh mostly reddish or orange. Eyes dusky. Length 100 mm.

Remarks.—Found along the Atlantic Coast from Massachusetts to Florida. This is our largest species, and occurs frequently in large shells, under rocks at low water. It appears to be more abundant in the sounds and bays, affording food to many fishes, sharks and rays. My examples from Atlantic City, Ocean City and Cape May Point. Say says it is often cast ashore during the prevalence of heavy northeast winds, though otherwise not often found. He also mentions it lives in our largest species of shells, such as *Natica rugosa*, *Pyrula caniculata*, *Pyrula eliceans*, etc. Great variation in the claws is noticeable, and they are often unusually heavy, again subequal, and the animal may be either dextral or sinistral. I have also found it abundant in Virginia at Chincoteague and Wallops Island. Small examples, not over 30 mm. long, were obtained. Mr. W. T. Davis says it is occasionally found dead on the south shore of Staten Island, washed ashore in the shells of *Natica*.

Pagurus longicarpus Say.

PLATE 112.

Long-armed Hermit Crab.

Pagurus longicarpus Say, Journ. Acad. Nat. Sci. Phila., I, pt. 1, 1817, p. 163.
Inhabits bay shores.

- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 20, Pl. 8, fig. 22. New York.
- White, Cat. Crust. Brit. Mus., XXV, 1847, p. 59. United States (Say's material).
- Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 149. Great Egg Harbor, New Jersey.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 15. Cape Ann, Massachusetts to western end of Long Island Sound.
- Eupagurus longicarpus* Verrill, U. S. F. Com., I, 1871-72 (1873), p. 339 (in *Ilyanassa obsoleta*).
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 549. Massachusetts Bay to South Carolina.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 326. Massachusetts to South Carolina.
- S. I. Smith, Trans. Conn. Acad., V, 1879, p. 47. New Jersey coast, Southern Long Island, Long Island Sound, Block Island Sound, Gardiner's, Great Peconic and Little Peconic Bays in Long Island.
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 779. Massachusetts Bay to Mexico.
- Kingsley, Standard Nat. Hist., II, 1884, p. 56. Our eastern shores.
- Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, New Jersey.
- Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 163 (on Verrill).
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1906), p. 136. New York City.
- Mayer, Sea Shore Life, 1906, p. 94, fig. 63. Atlantic coast, New York.
- Fowler, Proc. Acad. Nat. Sci. Phila., I, 913, p. 64. Wallopp I., Va.
- Pagurus truncatulus* Rafinesque, Amer. Month. Mag. Crit. Rev., II, Nov. 1817, p. 42. *Shores of Long Island* (in the shells of small species of *Buccinum* and *Murex*).

Description.—Body more or less soft. Carapace better developed, broadening behind, then very narrowly constricted, and hind edge deeply emarginated. Abdomen soft, conic, spiral. Front of carapace broad, undulated as three wide lobes, all on about a plane, subequal, or each lateral one a trifle more constricted. Eyes conspicuous, much broader than pedicels, and reach nearly half way in length of terminal joint of antennal peduncle, though basally pedicels little if any more constricted than at slight median constriction. Antennules with stout basal joint, second joint a little smaller and narrower, and third joint longest. Flagellum a little longer than third joint of peduncle, thickened basally and ending in filament and accessory flagella about half as long, acuminate, simple. Antennæ about long as

right or longer cheliped, and peduncle of three principal joints, of which basal robust, second shortest and third longest, though latter extends forward well beyond peduncle of antennule. Flagellum long, tapers, multiarticulate, and end filamentous. Buccal mass well developed, though not very conspicuous. Mandibles firm, strong. First maxillæ laminar, rather firm, not very hairy, each with small palp. Maxillipeds well developed, quite hairy, second twice length of first, and both pairs with long exopodites. Chelipeds enlarged, right larger, though left a little over half length of right, both elongated or linear, and mostly finely granulated to minutely spinescent. On lower outer edge of propodus of right cheliped tubercles become a little large and directed forwards. Upper edge of propodus and carpus with two ridges, well separated, on propodus granulations not much enlarged beyond size of those adjacent, but outer series on carpus more enlarged, well spaced and somewhat spinescent. Carpus a little shorter than propodus, greatest width about one and three-fifths its own length. Width of propodus about two-fifths its own length. Dactyls of chelipeds subequal, cutting-edges not entirely in apposition, but leave narrow hiatus, and each with several large well-developed tubercles or molar-like teeth. Merus a little longer than carpus, but not equal to propodus length. Large cheliped with tufts of setæ within dactyl and pollex edges, and other setæ on lower surface of ischium. Left or smaller cheliped more or less hairy. First and second pairs of legs subequally large, about equal large cheliped, dactyls of second pair a little the longer, and these limbs but little hairy. Third and fourth pairs of legs subequal, with latter little longer, much shorter than others, and dactyls of third better developed. Two undeveloped appendages on left side of abdomen anteriorly, subequal, and outer joint comprising at least two-thirds length of each. Very small rudimentary appendage still posterior. Last three terminal abdominal segments small, and pair of limbs extending from each side of median one, though that of left best developed. Large outer and small posterior joints of these appendages with external posterior asperous surfaces, of which left better developed. Color various, usually from dark reddish-

brown to paler tints. Fingers gray or whitish. Eyes blackish. Length 26 mm.

Remarks.—Distributed along the Atlantic Coast from Massachusetts Bay to Mexico. It is an abundant species, and much smaller than the preceding, though with much the same habits. Verrill says they are generally abundant in the pools near low water, and concealed in wet places beneath rocks. In the pools they may be seen actively running about, carrying upon their backs the dead shell of small gastropods, most commonly *Anachis avara* or *Ilyanassa obsoleta*, though all the small spiral shells are used in this way. They are very pugnacious and nearly always ready for a fight when two happen to meet, but they are also great cowards, and very likely each, after the first onset, will instantly retreat into his shell, closing the aperture closely with the large claws. They use their long slender antennæ very efficiently as organs of feeling, and show great wariness in all their actions. The hinder part of the body is soft, with a thin skin, and one-sided in structure, so as to fit into the borrowed shells, while near the end there are appendages which are formed into hook-like organs by which they hold themselves securely in their houses, for these spiral shells serve them both for shields and dwellings. This species also occurs in vast numbers among the eel-grass, both in the estuaries and in the sounds and bays, and is also frequent on nearly all other kinds of bottoms in the sounds. It is a favorite article of food for many of the fishes, for they swallow it shell and all.

My numerous examples from Atlantic City, Ocean City, Townsend's Inlet, Cape May and Dias Creek. I have also seen it abundant at Point Pleasant, Manasquan, Corson's Inlet, Sea Isle City, Stone Harbor and Anglesea. Mr. W. T. Davis says it is common along the south shore of Staten Island, N. Y.

Pagurus pubescens Kröyer.

Hairy Hermit Crab.

Pagurus pubescens Kröyer, Dansk. Vid. Selsk. Nat., VII, 1838, p. 314. Greenland and Iceland.

— Benedict, Ann. Mag. N. Hist. London, (6) XVIII, 1806, p. 99, fig. a (left cheliped). New Haven, Connecticut.

- M. J. Rathbun, Occas. Pap. Boston S. Nat. Hist., VII, 1905, p. 15.
Bay of Fundy to Block Island.
- Eupagurus pubescens* S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873),
p. 549. In deep water off coast of New Jersey, northward to Greenland
and Northern Europe.
- S. I. Smith, Trans. Conn. Acad., V, 1879, p. 47. N. Lat. 40°, W. Long.
73° in 32 fathoms, and off Block Island.
- S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 26. N. Lat. 40°, W.
Long. 70° in 26-67 fathoms.
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 780. New Jersey to
Greenland.
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 641. N. Lat.
39°-40°, W. Long. 69°-70°, in 30-78 fathoms.
- Howe, Bull. U. S. F. Com., XIX, 1899 (1901), p. 240. N. Lat. 39°-40°,
W. Long. 70° trawled.

Description.—Eye-stalks reach middle of last joint of antennular and antennal peduncles, respectively. Chelipeds pubescent, armed with tubercles with a spiny tendency. Right cheliped with wrist equal to hand in length and spines along its inner edge. Left cheliped with central carina along upper surface of hand. Ambulatory limbs pubescent and spiny. Length about 50 mm. (Henderson.)

Remarks.—This is largely an off-shore or deep-sea species, living in water of five hundred fathoms depth. Though not definitely recorded from the State, it is mentioned by Prof. S. I. Smith as ranging from New Jersey northward to Greenland and Europe. I have not seen any examples.

Sub-Order BRACHYURA.

The Short-Tailed Crabs.

Carapace with well-defined lateral border to greater part of its dorsal surface, with an epimeral suture or its homologue (a linea anomurica) on either side. Front often in contact with epistome, often broad. Abdomen much smaller than cephalothorax, beneath which it folds. Abdominal plura, when distinguishable, in same plane and in same straight line with abdominal terga. Thoracic sternum usually broad, last segment never independently movable, usually channelled in median line for lodgment of male

abdomen. Eyes in repose commonly carried at right angles to longitudinal body axis, often lodged in orbits. Antennules always separated from one another by septum derived from front, their basal joint swollen and enlarged, flagella extremely short, and commonly retractile into fossæ beneath front. Antennal peduncle of four joints, first often reduced, cramped and concealed. Never movable antennal scale and antennal flagellum usually shorter than carapace. Mouth-parts lie in well-defined fold of carapace or buccal cavern. Mandibles consist of strongly calcified proto-podite, free end forming triangular trenchant incisor process, and a three-jointed incurved palp. Coxa and bases of first and second maxillæ well developed, those of second maxillæ being deeply cleft. Endopodite (palp) of first maxillæ usually curves obliquely outwards. Scaphognathite very broad plate. Flagella, when present, of exopodites and maxillipeds almost always bent inwards nearly at right angles, and epipodites of maxillipeds almost always very large. Ischium and merus of external maxillipeds broad plates, in most cases, which completely close buccal cavern like doors and conceal other mouth-parts. Thoracic legs six-jointed, basipodite and ischium fused to form single piece. None of these legs with exopodites, only in one primitive small group do any carry epipodites or podobranchiæ. First pair, often enlarged, chelate, second and third pairs monodactylous, and fourth and fifth pairs either monodactylous, or sometimes one or both may be subchelate and reduced in size. In male modified uniramous appendages present on first two abdominal somites. In female biramous setose appendages present on second to fifth abdominal somites. Only in Dromides a pair of small uniramous appendages on first abdominal somite, and in the Dromiidea alone pair of plates intercalated between sixth and seventh abdominal somites, modified homologues of appendages of sixth somite. Ducts of male reproductive organs open either on coxopodites of last pair of thoracic legs, or less commonly on corresponding segment of sternum itself. Oviducts almost always open on sternal segment corresponding with antepenultimate pair of thoracic legs, rarely upon coxæ of legs themselves. Gills mostly always phyllobranchiæ, only in Dromiidea sometimes trichobranchiæ or of an intermediate character.

This great group includes, as the above caption would signify, the short-tails or true crabs, typified by those forms known popularly as crabs, in distinction to the shrimps, crawfishes and lobsters, or the long-tails. In this division the crustacea attain their most specialized development, indicative of most every feature of adaptation. A vast assemblage of genera and species is thus embraced in this connection, which is rather poorly represented by the littoral shore forms of New Jersey waters.

Key to the tribes.

- a. Carapace usually triangular, with pointed or spinous protruding rostrum. OXYRHYNCHA.
- aa. Carapace not usually triangular, without pointed or protruding rostrum.
 - b. Buccal frame usually triangular, narrowed forward; efferent channels opening at middle of endostome. LEUCOSOIDEA.
 - bb. Buccal frame quadrate; efferent branchial channels opening at sides of endostome.
 - c. Carapace not quadrilateral, but short, broad, rounded anteriorly; verges of male inserted in basal joints of fifth pair of legs. CANCROIDEA.
 - cc. Carapace usually quadrilateral; frontal region curved downward; verges of male inserted either in sternal plastron or in basal joints of fifth pair of legs, thence passing through channels in sternum beneath abdomen. GRAPSOIDEA.

Tribe OXYRHYNCHA.

The Spider Crabs.

Carapace narrowed anteriorly, rostrate, with hepatic regions small and branchial large. Epistome generally large. Buccal frame quadrate, with anterior margin straight. Branchiæ in nine pairs, with efferent channels opening at sides of endostome and afferent channels opening behind pterygostomian regions in front of bases of chelipeds. First antennæ longitudinally folded. Third maxillipeds with fifth joint articulated at apex or at front inner angle of fourth. Genital organs, in male, inserted at bases of last pair of trunk legs.

This tribe sometimes known as the *Maiioidea*, including a great number of forms, has been divided into two families, as now understood.

Family MAIIDÆ.

The Spider Crabs.

Basal joint of antennæ slender or well developed. Chelipeds usually not much longer or more massive than other legs. Eyes retractile or not against sides of carapace or in orbits, which latter distinctly or not defined, though frequently more or less incomplete below, or marked with open fissures in their upper and lower edges.

Their bodies are usually narrow in front, sometimes orbicular. There is always a beak as that found in our common "spider crab." As their bodies are also furnished with many hairs, which may be either hooked or straight, and which vary in arrangement and form in the different genera and species, they collect quantities of dirt and mud. Their backs also often become covered with various sedentary animals like tunicates, sponges and bryozoans, also algæ, and as these are often secured by the hairs they grow in profusion, sometimes until their host is scarcely recognizable. The object of all this has been suggested to be to afford concealment from enemies.

Genera about ninety or more, though only two in our limits.

Key to the genera.

- a. Orbits with large blunt cupped postocular process into which eye is retractile, but not completely concealed. HYAS.
 aa. Orbits complete, often tubular, completely concealing retractile eye.

LIBINIA

Genus HYAS Leach.

Hyas Leach, Edinburgh Encyclop., VII, 1814, p. 394. Type *Cancer arenæus* Linnæus, monotypic.¹

¹Leach, l. c., 1815, Am. Ed., VII, p. 271.

Carapace depressed, broadly pyriform or lyrate, not spinose on dorsal surface. Rostral spines dilated, vertically compressed, acute, nearly in contact along their inner margins. No preocular spine. Orbits shallow, somewhat open above, with hiatus or fissure in upper and lower margins. Post-abdomen distinct, seven-jointed both in male and female. Eyes short and partially visible in dorsal view, when retracted. Basal antennal joint not greatly dilated, unarmed, next joint slightly dilated and third slender. These, with flagellum, visible from above at sides of rostrum. Merus of exterior maxillipeds distally truncated, antero-external angle rounded and not prominent, and antero-internal angle, where next joint articulates, scarcely emarginate. Chelipeds (in male) of moderate length, palm slightly compressed but not carinated, and fingers nearly straight, acute, scarcely toothed on inner margins and with scarcely any intermarginal hiatus when closed. Ambulatory legs subcylindrical, of moderate length, and dactyli nearly straight, acute.

Species not numerous, mostly of arctic or sub-arctic regions.

***Hyas coarctatus* Leach.**

PLATE 113.

Toad Crab.

- Hyas coarctatus* Leach, Trans. Linn. Soc. London, XI, 1815, p. 329. *Seas of Britain, Frith of Forth, Plymouth Sound and Salcombe.*
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 504 (on sandy and gravelly bottoms).
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 548. New Jersey to Cape Cod and northwards.
- S. I. Smith, Trans. Conn. Acad., V, 1879, p. 43. New Jersey, Long Island Sound, Block Island Sound.
- S. I. Smith, Proc. U. S. Nat. Mus., III, 1880, p. 414. N. Lat. 40° W. Long. 70°, in 86-115 fathoms.
- S. I. Smith, l. c., VI, 1883, p. 5. Off Middle States in 31 to 158 fathoms.
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 626. N. Lat. 40°, W. Long. 69°, in 18-33 fathoms.
- M. J. Rathbun, Proc. U. S. Nat. Mus., XVI, 1893, p. 69. Off Middle States.

- Stebbing, Hist. Recent Crust. (Int. Sci. Series LXXIV), 1893, p. 114. North Atlantic.
- M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 510. Cape Cod to Hatteras (Virginia province).
- Mayer, Sea Shore Life, 1906, p. 110. Arctic Ocean to New Jersey.
- Hyas coarctata* De Kay, New York Faun., Crust., VI, 1844, p. 3, Pl. 7, fig. 14. New York.
- Haldeman, Bridges and Zantzing, Proc. Acad. Nat. Sci. Phila., 1850, p. 28 (name only).
- Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 149. Great Egg Harbor, N. J.

Description.—Carapace width about one and two-thirds its length, rather well depressed, with rather lyriform contour as viewed above. Upper surface of carapace with some rather large tubercles, arranged somewhat triangularly, with apex median and directed forward. Rostrum dilated as two long subequal narrowly triangular spines, greatly depressed, and inner edges not in contact. Supraorbital ridge or flange moderate, entire, and with deep notch posteriorly separating rather broad hepatic flange. Latter directed anteriorly in sharp point, and posteriorly rounded. Eyes globular, greater than thickness of peduncle except basally. Antennules small, placed in depressions below bases of rostral spines. Antennæ moderate, and basal joint extends forward about half way in length of rostral spines, without large tubercle at outer front angle. Folded outer maxillipeds cover buccal mass in area much deeper than wide, with rather long ischium, its distal end rather long and pointed, and inner edge setous. Merus about wide as long, with few sharp thorns on outer surface. Similar thorns on surfaces of ischia, but usually as well-defined series near outer edges. Ridge extends back obliquely on side of body from upper edge of meri of outer maxillipeds. Male with moderately long chelipeds, dactyl half length of propodus and its end in apposition with that of pollex, though cutting-edges form slight hiatus with a series of weak tubercles along each. Palm somewhat constricted above, rounded and swollen a little below, sides convex. Carpus about long as pollex, with ridge surmounted by several tubercles on upper surface. Merus rather long, though less than length of propodus, and two ridges on lower surface and another

on upper surface, and these mostly with small tubercles. Ambulatory legs long, slender, and gradually smaller to last pair. Dactyls all rather small. Longer anterior legs formed by lengthened propodus and carpus, as meral joints mostly uniform. Legs with body generally, especially lower surface, more or less hairy. Outer or distal joints of legs usually quite velvety. Post-abdomen quite broad in female, covering region between all coxal articulations. Pleopods rather long, slender, setous. Color muddy-brown to olive generally. Length of carapace 30 mm., width 19 mm.

Remarks.—A northern species, attaining its most southern distribution off the shores of Carolina, where it is apparently not common or met with, except in deep water. Northward it ranges to the Arctic regions, mostly in deep water. It appears to be a favorite food of the codfish. In New Jersey it has been found only in Great Egg Harbor. It lives off shore on sandy or gravelly bottoms of the sea, and is recorded from five and one-half to nine hundred and six fathoms depth. I have not examined any New Jersey examples.

Genus LIBINIA Leach.

The Spider Crabs.

Libinia Leach, Zoöl. Miscell., II, 1815, p. 129. Type *Libinia emarginata* Leach, monotypic.

Carapace convex, tuberculous or spinous, triangular orbiculate and evenly rounded behind frontal region, or oblong, orbiculate and constricted behind laterally dilated hepatic regions. Preocular spine usually distinct. Rostrum emarginate or bifid at apex. Orbits small, nearly circular, sometimes with an open fissure in upper and lower margins. Basal antennal joint moderately enlarged. Merus of exterior maxillipeds truncated at distal end. Chelipeds well developed. Palm elongated and fingers evenly denticulated on inner margins. Ambulatory legs well developed, sometimes elongated and joints subcylindrical, usually unarmed.

Species several.

Key to the species.

- a. Median spines six.
 aa. Median spines nine.

dubia.
emarginata.

Libinia dubia Milne-Edwards.

PLATE 114.

Spider Crab.

- Libinia dubia* Milne-Edwards, Hist. Nat. Crust., I, 1834, p. 300, Pl. 14, bis fig. 2. *Coasts of United States.*
- Gibbes, Proc. Acad. Nat. Sci. Phila., 1850 (March), p. 22 (name only).
- Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850 (1851), p. 169. Massachusetts to South Carolina.
- Streets, Proc. Acad. Nat. Sci. Phila., 1870, p. 104. Delaware Bay and Long Island.
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 368 (on muddy shores).
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 548. Cape Cod to Florida.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 316. Long Island to Florida.
- Kingsley, l. c., 1879, p. 386. Northampton Co., Va.
- A. Milne-Edwards, Miss. Sci. Mex. Crust., V, 1875, p. 129, Pl. 18, fig. 5. Near New York.
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 778. Maine to Mexico.
- Miers, Rep. Voy. Challenger, Crust., XVII, 1886, p. 72. East Coast of U. S.
- M. J. Rathbun, Proc. U. S. Nat. Mus., XV, 1892, p. 237, Pl. 31, fig. 1. Fire Island and Patchogue, Long Island; Barnegat, Ocean City, Great Egg Harbor and Beesley's Point, New Jersey; Crisfield, Maryland; Willoughby's Point, Hungers Wharf, Hampton Roads, Norfolk and Cape Henry, Va.
- M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 513. Cape Cod to Gulf of Mexico.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 12. Cape Cod southward.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1905), p. 145. (New York City.)
- Mayer, Sea Shore Life, 1906, p. 109, fig. 77. Cape Cod to Gulf of Mexico.
- Libinia canaliculata* (nec Say) De Kay, N. Y. Fauna, Crust., VI, 1844, p. 2 (part).

Description.—Carapace as seen above broadly ovoid, thick, narrowed greatly anteriorly to long, triangular and pointed rostrum. Surface covered with more or less conspicuous large wide-set tubercles, between which are set some smaller ones, and on lateral or branchial region tubercles assume more or less longer and conic form. Posterior edge of carapace rather evenly rounded. Upper surface of carapace all more or less velvety, though along anterior edges becoming more or less conspicuously villose. Body in lateral profile nearly ovoid or ellipsoid, becomes somewhat attenuated anteriorly, and deepest part a little over half width of carapace. Eye-socket small, little developed, rounded, with well-developed supraorbital tubercle, also a postorbital and two infraorbital tubercles. On each side of carapace seven large well-defined conic tubercles. Eye small, rounded convexly at ends, and stalks short, mobile, and bases little constricted. Rostrum very conspicuous, large, strongly bifid at tip, where curved slightly inferiorly. First antennæ larger, inferior below rostrum, below which they fold and are more or less concealed, only separated by narrow low deeply-set partition. Basal joint of first antennæ well developed, peduncle terminated in slender flagellum and tuft of setæ, and well directed or bent upward to form distal joint. Second antennæ lateral, or spring from each side of rostral base, though not extending forward much beyond rostrum tip, basal joint well developed or nearly half its entire length, and end a slender flagellum narrow to pointed tip. Mandibles strong, well developed, with slender incurved palp joined to upper edge. First and second maxillæ broadly laminar, palps and exopodites of both also well developed. First maxillipeds with well-developed exopodites. Second maxillipeds broad, velvety over their external surfaces, and formed as doors to buccal mass. Other limbs mostly similar. Chelipeds not more enlarged than legs, though well developed, and with inner edges of forceps finely dentated with a single series of tubercles along each one. First pair of ambulatory legs longest, similar to others, last pair shortest, and second a little longer than third. All legs, except chelipeds, monodactylous, and dactyli curved, conic, and velvety

over basal portions like all other legs. Post-abdomen slender, or rather narrow in male, and folds on abdomen about two-thirds of space to mouth-parts. Color in life nearly uniform muddy-brown with slight olive tint. Length of carapace 130 mm., width 108 mm.

Remarks.—Similar in many ways to the next species, and with much the same habits. It ranges from Cape Cod to Florida. Characteristic or distinctive marks, as pointed out in the preceding key, are the row of but six median spines down the carapace. In New Jersey it has been recorded from Barnegat, Ocean City, Great Egg Harbor and Beesley's Point. It is essentially a species of muddy shores. Mr. Witmer Stone found it at Point Pleasant. I have found it at Cape May and Ocean City, and not so frequent as the next species.

Libinia emarginata Leach.

PLATE 115.

Spider Crab.

Libinia emarginata Leach, Zoöl. Miscell., II, 1815, p. 130, Pl. 108. *No locality.*

— S. I. Smith, Trans. Conn. Acad., V, 1879, p. 45. Maine to Key West.

— Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 386. Northampton Co., Va.

— R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 778. Maine to Mexico.

— M. J. Rathbun, Proc. U. S. Nat. Mus., XV, 1892, p. 235, Pl. 31, fig. 2. Fort Pond Bay and Fire Island Beach, Long Island; Chesapeake Bay and Hampton Roads, Va.

— Stebbing, Hist. Recent Crust. (Int. Sci. Series LXXIV), 1893, p. 120. Long Island Sound (on M. J. Rathbun).

— M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 513, fig. 10. Cape Cod to Florida.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 12. Maine and southward.

— Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1905), p. 145, fig. 14. (New York City.)

— Mayer, Sea Shore Life, 1906, p. 109. Maine to Mexico.

Libinia canaliculata Say, Journ. Acad. Nat. Sci. Phila., I, pt. 1, 1817, p. 77, Pl. 4, fig. 1. *Inhabits bays and inlets of the coast.*

— Milne-Edwards, Hist. Nat. Crust., I, 1834, p. 300. Coasts of U. S.

- Milne-Edwards, Règne An. Cuv. Crust., Ed. Luxe., 1839?, Pl. 23, fig. 1 (no locality).
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 2, Pl. 4, fig. 4. New York, Chesapeake Bay northward.
- White, Cat. Crust. Brit. Mus., XXV, 1847, p. 4. United States (Say's material).
- Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850 (1851), p. 169. Massachusetts to South Carolina.
- Gibbes, Proc. Acad. Nat. Sci. Phila., 1850, p. 23 (name only).
- Streets, Proc. Acad. Nat. Sci. Phila., 1870, p. 185. North Atlantic Coast to West Indies.
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 339 (on muddy bottoms); p. 368 (on muddy flats).
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 548. Maine to Florida.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 316. Maine to West Indies.
- Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, N. J.
- Heilprin, An. Life of Our Sea Shore, 1888, p. 88, Pl. 6, fig. 2. New Jersey and southern Long Island.

Description.—Carapace as viewed above broadly ovoid, tapering anteriorly to pointed rostrum, thick, surface covered with more or less conspicuous large wide-set tubercles between which a number of smaller inconspicuous ones, and on anterior lateral region tubercles assuming a more or less longer or conic appearance. Posterior edge of carapace rather evenly rounded. Upper surface of carapace all more or less velvety, though along anterior edges becoming more conspicuously villose. Body in lateral profile nearly evenly ovoid, becomes somewhat attenuated anteriorly, and deepest part about three-fifths width of carapace. Eye-socket little developed, rounded, with well-developed supra-orbital tubercle, also a postorbital and infra-preorbital. On each side of carapace seven well-developed conic tubercles. Eye small, rounded convexly at ends, and stalks short, mobile, and bases little constricted. Rostrum conspicuous, bifid at tip where curved slightly inferiorly. First antennæ larger, inferior below rostrum, below which they also fold and are largely concealed, only being separated by low deep-set partition. Basal joint of first antennæ well developed, organ ends in slender flagellum and tuft of bristles, and strongly bent upwards to form swollen distal articu-

lation. Second antennæ short, not longer than rostrum, basal joint well developed or nearly half its entire length, and end a slender attenuated flagellum. Mandibles strong, well-developed, with well-developed though slender incurved palp joined to its upper edge. First and second maxillæ well developed, broad, palps and exopodites of both also well developed. First maxillipeds with well-developed exopodites. Second maxillipeds broad, velvety over their outer surfaces, and act as doors to buccal mass. Other limbs all more or less similar. Chelipeds not more enlarged than legs, though well developed, and with inner edges of forceps rather obsoletely dentate or serrate. First pair of ambulatory legs longest, similar to all others, last pair shortest, and second a trifle longer than third. All but first pair of legs monodactylous, and dactyli curved, conic, and velvety over basal portions like all other legs. Postabdomen slender, or rather narrow in male, folds on abdomen two-thirds space to mouth-parts. Color in life muddy-brown with slight olive tinge, nearly uniform. Length of carapace 70 mm., width 55 mm.

Remarks.—This is the “sea spider” of the seashore excursionists, and is often taken on his line when it touches the bottom, the crab simply holding tight to the bait till hauled out. As it is quite slow in its movements, it will often still cling to the bait some time after being drawn from the water. The common spider-crab ranges all along our coast, from Maine southward to Florida, and is especially numerous in the bays and sounds. Though a bottom animal, or living in the mud or eel-grass, or in decaying vegetation, it also occurs below low-water mark on sandy beaches occasionally. As stated above, it is quite sluggish in its motions, and offers no resistance to its captor. Of no commercial value it is an object of disgust to the fisherman, and equally amusing to the excursionists. It does not seem to be much sought as food by predatory fishes, though its remains have been found in the smooth hound (*Mustelus canis*). As the whole body of the spider crab is hairy or velvety, it collects dirt and mud, which probably renders its concealment more effectual. Algæ, hydroids, barnacles and other marine animals have also been found growing on its body, and these may also

contribute still further in its concealment. The males have long stout claws, and are larger than the females, sometimes reaching a foot or over across their extended legs. The females have much shorter and smaller legs, and rather weak claws.

I have many examples from Cape May, Cape May Point, Great Egg Harbor, and Beesley's Point. Many have been examined at Barnegat Inlet, Point Pleasant, Great Bay, Atlantic City, Ocean City, Sea Isle City, Anglesea and Cape May, besides numerous other localities along the coast. Near Barnegat Pier, on August 20th, 1903, they were very abundant, and many were taken while angling. Besides them numbers of the following fishes were also angled: *Pomolobus mediocris*, *Pomatomus saltatrix*, *Roccus lineatus*, *Centropristis striatus*, *Cynoscion regalis* and *Lciostomus xanthurus*. Mr. W. T. Davis says it is occasionally found washed ashore on the south side of Staten Island, N. Y.

Tribe LEUCOSOIDEA.

Carapace with antero-lateral edges arcuate or orbiculate, sometimes subglobose or more or less oblong with subparallel edges. Epistome much reduced. Buccal frame more or less triangular, produced and narrowed forward, with edges anteriorly convergent. Branchiæ in pairs of six to nine. Efferent channels open at middle of endostome, latter produced forwards. Afferent channels open either behind pterygostomian regions and in front of chelipeds, or at antero-lateral angles of palate. First antennæ folded longitudinally or obliquely. Genital organs of male exerted, either from bases of fifth pair of legs or from surface of sternal plastron.

In this group are several families, and these are greatly diverse in general appearance.

Family CALAPPIDÆ.

The Box Crabs.

Afferent channels to branchiæ open behind pterygostomian regions and in front of chelipeds. Antennæ small. Outer max-

illipeds not completely closing buccal cavern, and with palpus not concealed by merus joint. Verges of male exerted from bases of fifth pair of legs.

These are among the best known of their tribe. They are largely characterized by the unusual formed and large chelipeds, these being furnished with cockscomb-like crests on the upper edges of the hands, and which in flexion are pressed tightly against the lower surface of the carapace like a shield. This arrangement is credited to protect from attack any morsels of food they may be eating. These crabs mostly live on sandy shores, into which they burrow. One genus represented on our shores.

Genus CALAPPA Fabricius.

The Box Crabs.

Calappa Fabricius, Entomol. Syst. Suppl., 1793, pp. 309, 415. Type *Cancer calappa* Linnæus, virtually first species and thus by tautonomy. (To avoid the latter Fabricius names it *Calappa fornicata*.)

Carapace strongly convex, rounded in front, much broadened behind by pair of clypeiform expansions or wings, beneath which ambulatory legs are concealed in flexion. Front small, somewhat triangular, projecting little or not at all beyond level of orbits, bilobed. Orbits small, circular. Eye-stalks short and thick. Antennulæ nearly vertical. Basal joint of antennæ very broad and filling wide hiatus at inner angle of orbit. Outer maxillipeds not meeting, but leaving exposed mandibles and, in front of them, lamellar processes from first pair of maxillipeds. These processes form bases of two channels separated by deep vertical septum extending to antennular fossæ. Chelipeds very large, and in flexion fitting closely front half of carapace, forming a sort of buckler. Merus externally and near distal end with transverse wing-like expansion. Hand strongly compressed, its upper border forming high dentate crest. Chelipeds equal except for fingers, which on one hand have, outside near base, a stout pro-

jecting lobule. Abdomen, in adult, with third, fourth and fifth segments fused.

Species rather numerous, usually living along sandy shores, in which they burrow.

Calappa flammea (Herbst).

PLATE 116.

Box Crab.

Cancer flammea Herbst, Natur. Krab. Krebs. II, 1794, p. 161, Pl. 40, fig. 2.
"Ostindien." (Doubtless West Indies.)

Calappa flammea M. J. Rathbun, Am. Nat., XXXIV, 1900, p. 516. Virginian province.

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 13.
(Ram's Island, Wood's Holl harbor, Massachusetts.)

Description.—Carapace strongly convex, sloping down more abruptly behind than anteriorly, front edge more rounded than posterior, length about two-thirds its width. Greatest width formed at posterior wing-like expansion, with about seven compressed serræ, of which median largest. Surface of carapace, outer surface of chelipeds, upper surface of carpus, granular, and also with rather numerous varied large or small tubercles scattered about. Tubercles somewhat more numerous on anterior part of carapace than elsewhere, and larger somewhat in three series, as median and one well spaced each side. Front lateral edge of carapace granulate and crenate. Posterior edge of carapace slightly undulated, with beaded margin. Edges of posterior lateral serræ also beaded. Front edge of carapace with distinct notch, scarcely projects beyond orbits. Pterygostomian regions covered thickly with hair. Septum of endostome produced forward in strong denticle, though not so far anterior as frontal edge. Orbits small, rounded, and short eye-stalks robust. Antennules small, peduncle not quite long as flagellum, which latter simple and tapering. Second maxillipeds strongly compressed and hairy. Chelipeds quite large, and equal, except that left closes over right and has smaller dactyl and pollex. Inner edges of both dactyl and pollex with large teeth. Large elevated crest

on upper edge of propodus with eight serræ, subequal, and uppermost somewhat crowded. Inner face of palm smooth, and lower edge with three series of fine bead-like tubercles, all small and close set. Transverse wing-like expansion on merus with three broad serræ. Walking legs with simple dactyls, and not hairy. Fourth and fifth abdominal segments entire. Color (in alcohol) largely dull brownish, apparently not variegated. Lower regions slightly paler than upper. Length of carapace 22mm., and width 28 mm.

Remarks.—The box crab is found chiefly along the southern shores of the United States, from North Carolina to the shores of northern South America. It has been found as far north as Massachusetts, where, however, it is doubtless a straggler from the south. Previously to the capture of the above-described example, which though only a young one, the species had never before been taken in New Jersey. This specimen was taken several years ago at Corson's Inlet, by my friend, Dr. Richard J. Phillips. I may also state that Mr. H. Walker Hand, who has examined the specimen in question, also tells me that he has seen another some years ago at Cape May Point. It is evidently rare within the limits of the State, having never been mentioned by any of the early writers. The species obtains a length of 90 mm. measured lengthwise over carapace.

Tribe CANCROIDEA.

The Edible Crabs.

Carapace usually broader than long, regularly arched in front, not rostrate. Epistome short and transverse, outer maxillipeds with fifth joint articulated at inner front angle of fourth. Branchiæ nine, efferent channels opening at sides of endostome or palate. Genital organs of male inserted at bases of last pair of trunk legs.

This group contains all the large edible crabs of the United State, many of which, like the blue crab (*Callinectes*) of the

eastern coast, the stone crab (*Menippe*) of the southern coast, and the common crab (*Cancer magister*) of the western coast, are well known.

Key to the families.

- a. Antennules folded transversely or obliquely transversely; outer maxillipeds usually not overlapping epistome.
- b. Last pair of legs not modified for swimming. PILUMNIDÆ
- bb. Last pair of legs usually modified for swimming, last two joints compressed, very broad and paddle-like. PORTUNIDÆ
- aa. Antennules folded longitudinally; outer maxillipeds long, overlapping epistome. CANCRIDÆ

Family PILUMNIDÆ.

The Mud Crabs.

Carapace commonly transverse and convex, antero-lateral edges arcuate, armed with several lobes, teeth or spines. Front of moderate width, generally not projecting over first antennæ and bases of second, latter seldom excluded from inner hiatus of orbits.

These crabs are transversely oval or hexagonal, and are without either projecting spines or natatory feet. They include many small species living among rocks or sponges, under stones, or in muddy places. Most of our forms occur on the oyster-beds of the bays and sounds, where they live among the dead oyster-shells, when the latter remain in clusters with the valves attached though rigidly open. The crabs are slow in their movements, and not agile. They apparently remain a long time in one place and wait for such food as happens their way. They often live in holes in the banks above the mark of high tide, like *Uca* and *Sesarma*. In deeper water they frequent almost any objects affording some measure of concealment, such as dead shells, clusters of oysters, corals, sponges, etc. Many are distinguished in such habitats only with difficulty.

Key to the genera.

- a. Ridges defining efferent branchial channels, if present, low and confined to hind part of endostome, never reaching to front boundary of buccal cavern.
- b. Carapace transversely oval. EURYPANOPEUS
- bb. Carapace more or less hexagonal or subquadrate.
- c. Terminal abdominal segment of male long; carapace subquadrate, narrow (length about three-fourths width); prominent transverse dorsal ridges. RHITHROPANOPEUS
- cc. Terminal abdominal segment of male subtriangular; carapace, when subquadrate, wider than in preceding.
- d. Front arcuate; carapace hexagonal. NEOPANOPE
- dd. Front with truncate or sinuous lobes.
- [e. Front very narrow and advanced; postero-lateral margins strongly converging; carapace hexagonal. HEXAPANOPEUS]
- ee. Front moderately wide; postero-lateral margins not strongly converging; carapace subquadrate. EUPANOPEUS
- aa. Ridges defining efferent branchial channels extending to front boundary of buccal cavern, often very strong. EURYTUM

Genus EURYPANOPEUS A. Milne-Edwards.

Eurypanopeus A. Milne-Edwards, Miss. Sci. Mex. Crust., V, 1878, p. 318.
Type *Panopeus crenatus* Milne-Edwards, first species.

Carapace transversely oval. Fronto-orbital border half or more than half greatest width of carapace. Chelipeds without a circular cavity on front edge. Four antero-lateral teeth besides orbital, first of which low and more or less fused with orbital. Carpal joints of ambulatory legs not armed with a horned crest. Ambulatory legs not spiny nor granular on upper border.

One species in our region.

Eurypanopeus depressus (S. I. Smith).

PLATES 117 AND 118.

Mud Crab.

Panopeus depressus S. I. Smith, Proc. Boston Soc. N. Hist., XII, 1869, p. 283. *New Haven, Connecticut. Egmont Key, Florida.*

— (S. I. Smith) Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 312, Pl. 1, fig. 3 (under stones in muddy places; extending to Florida or the Gulf coast of Southern States, rare north of Cape Cod).

- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 547, Pl. 1, fig. 3. Cape Cod to Florida.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 319. Massachusetts Bay to Florida.
- S. I. Smith, Trans. Conn. Acad., V, 1879, p. 37. Massachusetts to Gulf of Mexico.
- Kingsley, l. c., 1879, p. 394. Northampton Co., Va.
- Uhler, Sci. Res. Chesapeake Z. Lab., 1878 (1879), p. 25. Ft. Wool, Virginia.
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 772, Pl. 269, fig. 3. Cape Cod to Florida.
- J. E. Benedict and M. J. Rathbun, Proc. U. S. Nat. Mus., 1891, p. 366, Pl. 20, fig. 5, Pl. 23, figs. 4-5. Beesley's Point, N. J.; Virginia.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1905), p. 140, fig. 10 b. New York City.
- Mayer, Sea Shore Life, 1906, p. 102. Atlantic coast near New York.
- Eurypanopeus depressus* A. Milne-Edwards, Miss. Sci. Mex. Crust., V, 1878, p. 320, Pl. 59, fig. 2. New Haven to Egmont Key.
- M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 137. Virginia province to Gulf of Mexico.
- Eupanopeus depressus* M. J. Rathbun, Occas. Papers Boston Soc. Nat. Hist., VII, 1905, p. 6. Massachusetts Bay southward.

Description.—Carapace depressed or flattened, with transverse series of minute granulations, more or less broken, and thus series of various lengths. Gastric regions hardly or not elevated. Front horizontal, nearly straight or but very slightly notched medianly, also but slightly or little produced. Orbit with inner anterior notch of upper edge forming slight spine. Posterior upper orbital edge medianly with slight notch. Front portion of first anterior lateral coalesced spine short, and hind portion rounded and longer. Front edge of second anterior lateral spine rounded, apex rather blunt and directed forward. Front edge of third anterior lateral spine curved moderately to sharp point and directed nearly forward. Last lateral tooth small, sharp, apex extending forward at oblique angle. All anterior lateral teeth but moderately incised or rather short. Subhepatic and subbranchial regions with many close-set depressed granules, and no tubercle on former region. Abdominal segments five in male, form narrow post-abdomen, third and fourth segments longest and latter longest of all, though edges of none notice-

ably concave. Terminal abdominal segment rounded. Post-abdomen broader in female, terminal segment rather triangular.

Antennules robust. Antennæ slender, when depressed reach to or a little beyond outer edge of orbit. Latter rather ovoid and moderately large. Eye large, with slightly more robust short peduncle. Outer maxillipeds completely cover buccal cavern, which latter a little broader above. Ischium with width half its length, and merus with length three-fifths its own width. Chelipeds very unequal, pollex with low edge nearly straight and much stronger than dactyl, which latter strongly curved down, and edges with a few more or less irregular obsolete tubercles, edges also not approximated except at tips of fingers. Propodus swollen to greatest and elevated depth at articulation of dactylus, so that depth about three-fifths its length. Hand minutely granulated, slightly rougher above and surfaces otherwise evenly convex. Carpus with short inner tooth on anterior inner superior edge, and upper convex surface of joint granulated. Merus a little longer than carpus. Ambulatory feet similar, all more or less hairy, especially on outer joints, as dactyls, and propodi and meri. Dactyls of last pair of feet shortest.

Color muddy-brown, more or less uniform above. Examples with the carapace 14 mm. long and 19.5 mm. wide have been recorded.

Remarks.—Found along the Atlantic Coast from Cape Cod to Florida and the Gulf of Mexico. It is abundant on muddy bottoms, and in general color greatly resembles the same surroundings in which it dwells. My specimens from the oyster grounds of Great Bay in Ocean County. It is a slow-moving crab and not very active as seen crawling about among the oysters and clams brought up by the tongs of the oystermen. Females taken July 3d were gravid with ova. These crabs, like others of the family, doubtless form food for numerous fishes and other predatory marine animals. I have also seen this species in abundance on the oyster-grounds off Dias and Green Creeks, in Delaware Bay. Mr. W. T. Davis has secured two examples in Staten Island, N. Y.

Genus RHITHROPANOPEUS M. J. Rathbun.

Rithropanopeus M. J. Rathbun, Bull. Labor. Nat. Hist. State Univ. Iowa, IV, 1898, p. 273. Type *Pilumnus harrisii* Gould, designated, monotypic.

Ridges defining efferent branchial channels, if present, low and confined to hind part of endostome, not extending to front boundary of buccal cavern. Fronto-orbital border half, or more than half, greatest width of carapace. Carapace more or less subquadrate, narrow, length about three-fourths its width, approaching that of *Catometopa*. Prominent transverse dorsal ridges present. Chelipeds without circular cavity on front edge. Carpal joints of ambulatory legs not armed with horned crest. Terminal segment of abdomen, in male, long.

Species rather few, one in our limits.

***Rhithropanopeus harrisii* (Gould).**

PLATES 119 AND 120.

Harris's Crab.

Pilumnus harrisii Gould, Rep. Invert. Mass., 1481, p. 326. Cambridge marshes, Charles River, Massachusetts.

Pilumnus harrisii De Kay, N. Y. Fauna, Crust., VI, 1844, p. 7, Pl. 7, fig. 15. Connecticut.

Panopeus harrisii S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 547. Massachusetts Bay to Florida.

— Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 319. Massachusetts Bay to Florida.

— A. Milne-Edwards, Miss. Sci. Mex. Crust., V, 1878, p. 312, Pl. 58, fig. 3. Mexico to mouth of Charles River, Mass.

— S. I. Smith, Trans. Conn. Conn., V, 1879, p. 37. Massachusetts Bay; Long Island Sound; St. John's River, Fla.

— R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 772. Massachusetts Bay to Florida.

— Gissler, Amer. Nat., XVIII, 1884, p. 225. Florida to New England.

— J. E. Benedict and M. J. Rathbun, Proc. U. S. Nat. Mus., 1891, p. 378, Pl. 21, fig. 2, Pl. 24, fig. 16. Beesley's Point, New Jersey; Potomac River.

— Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1905), p. 140, fig. 10a. New York City, and Fresh Kills, N. Y.

Rhithropanopeus harrisii M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 138.
Virginia province.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 7.
Long Island Sound.

?*Panopeus wurdemanii* (nec Gibbes) Leidy, Journ. Acad. Nat. Sci. Phila.,
(2) III, 1855, p. 149. Delaware Bay.

Description.—Carapace a little broader than long, surface convex longitudinally. Gastric region with two transverse series of minute granules. Also a transverse series of minute granules extends from posterior lateral tooth to gastric region, interrupted at mesogastric region, where a similar median series, and then another counterpart to first series on other side. Front broad, scarcely produced, edge very slightly convex with obsolete median notch, its forward edge producing bisected appearance, upper and lower edges well defined, and median notch obsoletely triangular. Each external corner of front with very slight notch or emargination. Orbit large, rather ellipsoid, with slight obsolete notch on its hind edge medianly. Anterior lateral teeth obsolete or not well marked. First anterior lateral tooth obscure, slightly concave-convex. Second anterior lateral tooth a little better formed, though obtuse and directed forward. Third anterior lateral tooth similar to second. Fourth anterior lateral tooth obsolete. No subhepatic tubercle. Surface of carapace all more or less smooth, with but few hairs. Female with rather broad post-abdomen, and in male much constricted at articulation of fused and penultimate segments. Terminal segment about equally broad as long, depressed distally and of partly rectangular form. In female penultimate and terminal segments subequally longest in series, though second and third broadest.

Antennules large, of two subequal joints with outer swollen distally. Antennæ long, slender, length but little less than width of front. Outer maxillipeds completely cover buccal cavern, a little broader above, ischium with width about three-fifths its own length, merus nearly long as wide, and other distal joints subequal. Chelipeds unequal, rather compressed, and moderately enlarged. Propodus elevated at articulation of dactylus, latter not much curved and nearly closing with pollex, compressed, and

a longitudinal groove on outer and inner edges. Upper edge of dactylus punctate. Outer surface of pollex with two longitudinal ridges, converge toward apex, distinct on outer surface and obsolete on inner surface. Inner palm smoothly convex, outer surface with two longitudinal median ridges. Both edges of carpus and hand with series of minute granules, and several patches on upper surface of former. No large tooth at base of dactyl or on hand. Merus and carpus subequal. Ambulatory feet more or less similar, hairy on outer portions, and posterior pair a little shorter, its dactyls also shorter.

Color more or less dull brownish, paler below. Chelipeds brownish above, paler below, and fingers pale brownish, not contrasted with rest of propodus. Ambulatory legs all brownish, paler below. Length of carapace 8.5 mm., width 10.3 mm.

Remarks.—Found along the Atlantic Coast from Massachusetts to Florida, though, unlike our other related species, it ascends to fresh water in the tidal regions of the Coastal Plain. It lives in muddy waters, often among submerged vegetation or under stones, roots, etc. It ranges also into the salt marshes of our bays and sounds, and along the coast. My specimens, from Cedar Swamp Creek in fresh water above Petersburg Bridge, where I found it in cold weather, though not abundant. Though my largest example measures as stated above, the species attains a length of 11 mm. and a width of 14.5 mm. for the dimensions of its carapace. Characteristic of this species are the ridged or keeled chelipeds and the pale fingers.

It occurs in Dennis Creek, as I have seen examples obtained from there many years ago, though have not met with it myself while collecting in that locality.

I found a number in the purely fresh water of the Elk River at Elk Neck, in Cecil County, Maryland, on June 3d, 1911. Numerous fishes, as young *Alosa sapidissima*, *Anguilla chrisypha*, *Abramis crysoleucas*, *Fundulus heteroclitis macrolepidotus*, *F. diaphanus*, *Tylosurus marinus*, *Menidia beryllina*, *Morone americana*, *Pomolobus pseudoharengus* and *Brevoortia tyrannus* were found associated. I also have an example from the Sassafras River, in the same State, taken at Betterton.

Mr. W. T. Davis secured it at South Beach on Staten Island, N. Y., January 22d, 1905.

Genus **NEOPANOPE** A. Milne-Edwards.

Neopanope A. Milne-Edwards, Miss. Sci. Mex. Crust., V, 1878, p. 329. Type *Neopanope pourtalesii* A. Milne-Edwards, first species.

Carapace narrow, its length three-fourths or more of width, hexagonal, regions well delimited. Antero-lateral edge arcuate, about long as postero-lateral, five-toothed, teeth prominent, orbital or first tooth partly fused with second, fourth tooth very prominent, fifth sometimes much smaller and almost postlateral in position. Postero-lateral edges strongly converging. Fronto-orbital border from half to three-fourths greatest width of carapace. Front from fourth to about third greatest carapace width. Front advanced, with median notch and oblique, sinuous or straight lobes, separated from inner orbital angle by notch. Orbital angle with well-marked lobe between sinuses above, otherwise orbits similar to those of *Eupanopeus*. Basal joint narrower than in *Eupanopeus*. Terminal abdominal segment in male subtriangular.

Species several, mostly of shores southern to ours.

Neopanope texana sayi (S. I. Smith).

PLATE 121.

Say's Crab.

Panopeus sayi S. I. Smith, Proc. Boston Soc. Nat. Hist., XII, 1869, p. 284.

New Haven, Connecticut; Eastham, Cape Cod, Massachusetts.

—— Verrill, Rep. U. S. F. Cem., I, 1871-72 (1873), p. 312 (under stones in muddy places).

—— J. S. Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 319. Massachusetts to Florida.

—— S. I. Smith, Trans. Conn. Acad., V, 1879, p. 37. Massachusetts to Gulf of Mexico.

—— R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 772. Cape Cod to Florida.

—— Gissler, Amer. Nat., XVIII, 1884, p. 225. New England to Florida.

- Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, New Jersey.
- J. E. Benedict and M. J. Rathbun, Proc. U. S. Nat. Mus., 1891, p. 363, Pl. 22, fig. 4, Pl. 23, figs. 7-8. Long Island Sound; Beesley's Point, N. J.; Virginia.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1905), p. 140, fig. 10, c, e. New York City.
- Panopus sayi* S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 547. Cape Cod to Florida. (Impr. err.)
- Neopanope texana sayi* M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 138. Virginia province.
- M. J. Rathbun, Occas. Papers Boston Soc. Nat. Hist., VII, 1905, p. 7. Massachusetts southward.
- Cancer panope* (nec Herbst) Say, Journ. Acad. Nat. Sci. Phila., I, 1817, pp. 58, 447. Oyster beds, etc.
- Panopeus texanus* (part) Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 394. Northampton Co., Va.

Description.—Carapace convex, greatest width opposite posterior lateral teeth, length about one and one-third its width, surface smooth, more or less minutely pubescent in females, and grooves marking branchial boundaries more or less distinct. Front depressed moderately, profile convex with slight median notch, as viewed from above, and deeper notch marks off inner orbital spine each side on upper edge of orbit. Upper edge of orbit deeply emarginated, with median notch and another about midway in remaining part of outer edge. First coalesced anterior lateral spine separated from second spine by shallow notch, and edge shallowly concave-convex. Second anterior lateral tooth with outer edge slightly convex and somewhat blunt apex directed forward. Third anterior lateral tooth sharp, apex directed forward and slightly outward, otherwise like second. Fourth anterior lateral tooth sharp, smaller than others, directed outward and slightly upward, and with sharp apex. Post-abdomen only extends about half way to maxillipeds, in male quite narrow, second segment slightly narrower than terminal, and first and basal segments made up of first to third segments. Length of terminal segment two-thirds its width, and rather broadly triangular.

Antennules robust. Antennæ long, slender, length about three-fourths width of front. Outer maxillipeds close over

buccal cavern, and wider above than below. Width of ischium about three-fifths its length, and length of merus about two-thirds its own width, a little larger than propodus and conic dactylus equals or a trifle longer than merus. Chelipeds a little unequal, robust and swollen. Propodus with slight or obsolete outer groove above longitudinally, surfaces otherwise convex. Dactyl and pollex robust, compressed, former a little more curved, edges of lesser cheliped usually approximated, and those of greater nearly so. Cutting-teeth sharp-edged, irregular, larger and better developed in left organ. Propodi usually with irregular color-markings, fingers with smooth surfaces contrasting to rest of very minutely granulated surfaces of chelipeds. Dactyl less than half length of propodus, and without a large tubercle at base or on front outer edge of hand. Carpus with well-developed spine on upper inner angle, and one also on merus in same location. Carpus and merus of about equal length. Ambulatory feet similar, outer joints more or less hairy on edges, and fourth pair shortest with long slender dactyls but trifle shorter than those of first pair.

Color mostly pale grayish-brown, and this general tint more or less uniform, with slight lilac tints on lower surface of body. Feet all slightly brownish. Chelipeds largely brownish like rest of body, though fingers lilac to slaty, darker basally and whitish at tip. Dactyl same shade as pollex, only extent of color of latter extends back on propodus, at least along its lower edge, for about three-fifths its entire length. Eyes dark. Length of carapace 16 mm., width 20 mm.

Remarks.—This form, as now understood, ranges from Massachusetts to Virginia, being replaced southward by *Neopanope texana* (Stimpson), of South Carolina, Florida and the Gulf of Mexico. This latter is said to differ in having pale-colored fingers in the male, and also in having the anterior lateral teeth blunter and less produced. Though my examples, obtained at Spray Beach on Long Beach Island in Ocean County, during the past June, certainly have pale-colored fingers at present I am unable to say what color they were in life. This species is found in salt water like *Eurypanopeus depressus*, with which it

also occurs associated sometimes. The above dimensions are a millimeter or so shorter than the maximum size recorded. I have also examined examples from Delaware Bay. Mr. Witmer Stone found it at Point Pleasant. Mr. W. T. Davis found it at Staten Island, N. Y.

Genus **EUPANOPEUS** M. J. Rathbun.

The Mud Crabs.

Eupanopeus M. J. Rathbun, Bull. Labor. Nat. Hist. State Univ. Iowa, IV, 1898, p. 273. Type *Panopeus herbstii* Milne-Edwards, designated, first species.

Panopeus (nec *Panopea* Ménard 1807) Milne-Edwards, Hist. Nat. Crust., I, 1834, p. 403. Type *Panopeus herbstii* Milne-Edwards, first species.

Carapace of moderate width, length two-thirds to three-fourths its width, moderately convex, regions fairly well delimited, crossed by broken transverse lines on front half. Antero-lateral borders horizontal or slightly upturned, shorter than postero-lateral, arcuate, tending to subquadrate, cut into five teeth, including orbital angle which more or less fused with next tooth. Third, fourth and fifth teeth well marked usually and distinctly dentiform. Outer edge of all teeth sublaminar. Postero-lateral edges of carapace moderately convergent, straight. Fronto-orbital border more than half greatest carapace width. Front between third and fourth greatest carapace width. Front horizontal or slightly deflexed, laminar, with median notch, and two sinuous lobes separated from more elevated inner angle of orbit by notch. Orbital edge with two small but distinct V-shaped notches above, continued backward by closed fissures, and broad notch below outer angle. Prominent tooth at lower inner angle. Orbits transversely oblong, not tightly filled by eyes. Inner portion of front edge of basal joint touches front, outer angle of joint prolonged into broad orbital hiatus but not excluding flagellum from orbit. Merus of outer maxillipeds transverse, anterior edge mostly sinuous. Chelipeds unequal in both sexes, merus with superior subterminal tooth, carpus with tooth at inner angle, fingers acute and movable finger of large cheliped with

large basal tooth. Legs rather thick, compressed. Abdomen of male of five segments.

Species few.

Eupanopeus herbstii (Milne-Edwards).

PLATES 122 AND 123.

Herbst's Crab. Mud Crab.

Panopeus herbstii Milne-Edwards, Hist. Nat. Crust., I, 1834, p. 403. *Coasts of North America.*

—— White, Cat. Crust. Brit. Mus., XXV, 1847, p. 18. United States (Say's material).

—— Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 149. Great Egg Harbor, N. J.

—— Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 472 (oyster beds).

—— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 547. Long Island Sound to Brazil.

—— Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 318. Long Island Sound to Brazil.

—— Kingsley, l. c., 1879, p. 393. Northampton Co., Va.

—— R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 772. Long Island Sound to Brazil.

—— Gissler, Amer. Nat., XVIII, 1884, p. 225. Florida to Brazil, Long Island, New Jersey and Connecticut.

—— J. E. Benedict and M. J. Rathbun, Proc. U. S. Nat. Mus., XIV, 1891, p. 358. Pl. 19, figs. 1-2, Pl. 23, figs. 10-12. Rhode Island to Brazil.

—— Mayer, Sea Shore Life, 1906, p. 102, fig. 77. Brazil to Rhode Island

Panopeus herbstii De Kay, N. Y. Fauna, Crust., VI, 1844, p. 5, Pl. 9, fig. 26. New York, New Jersey and Virginia.

—— Heilprin, An. Life of Our Sea Shore, 1888, p. 88. New Jersey and southern Long Island.

Panopeus herbstii Ortmann, Plankton Ex. K. Leipzig, 1893, p. 57. New York to Brazil.

Eupanopeus herbstii M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 138. Virginia province southward.

—— M. J. Rathbun, Occas. Papers Boston Soc. Nat. Hist., VII, 1905, p. 6. Long Island Sound

Cancer panope (nec Herbst) Say, Journ. Acad. Nat. Sci. Phila., I, pt. 1, 1818, pp. 58, 447. Pl. 4, fig. 3. Oyster beds, etc.

Panopeus depressus (nec S. I. Smith) Uhler, Ches. Z. Lab. J. Hopkins Univ., I, 1878, p. 25. Fort Wool, Va.

Description.—Carapace length about two-thirds its width, surface rather finely granulated, variously convex, and regions well-

marked. Front moderate, advanced a little, width about two-sevenths greatest width of carapace. Edge of front slightly convex to nearly straight, with slight median notch, and separated from supraorbital edge by slight notch at external edges. Orbit rather ovoid, as viewed above rather deeply incised in carapace, inner edge convexly elevated and outer with slight median notch, also another slight notch in remaining or outer half. Infra-orbital edge with spine at inner corner and broad flange on outer, both visible as viewed above. First anterior lateral tooth of carapace coalesced with smaller external triangular orbital tooth, and edge of former triangularly blunt or lobiform. Second anterior lateral tooth larger, separated from first by deep notch, rather triangular and apex directed nearly vertically. Third anterior lateral tooth similar, usually directed a little more outward. Fourth lateral tooth shorter, sharply pointed, tip acute, straight on outer edge, and transverse ridge extends from its front edge obliquely back a short distance on carapace.

Eye rounded, with constricted pedicel, base a little swollen. Antennules robust. Antennæ slender, reaches to outer supra-orbital spine. Small tubercle just below coalesced anterior lateral spine. Subbranchial and sternum with granulated surfaces. Outer maxillipeds broad, cover buccal cavern completely, ischium width about two-thirds its length, length of merus two-thirds its width, and three remaining joints subequally short. Chelipeds large, minutely granulated, slightly unequal. Propodus with large swollen appearance, especially externally, smooth, and without ridges or grooves. Dactyl curved down from elevated base, with large or conspicuous convex tubercle at base externally on larger cheliped, and rest of cutting-edge with several more small irregular tubercles or teeth. Also large tubercle at outer basal articulation of dactyl, though on front upper edge of hand. Slight longitudinal median basal groove on upper surface of dactyl. Pollex robust, elongate, triangular, with denticles along nearly straight cutting-edge, and median ones enlarged. Outer and inner surfaces of pollex with longitudinal groove, though usually better developed on former. Smaller examples with two similar grooves sometimes on both faces of pollex and also dactylus, in

case of lesser cheliped. Carpus broad, with groove to its distal edge, though spine at inner anterior corner. Merus about equals carpus. Ambulatory feet similar, two median pairs little longer, fourth shortest and border widely on third abdominal segment. Fused segment of narrow abdomen in male with distal two-thirds nearly straight, rest curves outward each side. Penultimate abdominal segment with straight sides, and terminal segment rounded at end.

Color brownish above, paler below. Chelipeds more brownish, paler below, and fingers blackish, turning pale bluish in preserved examples. Length of carapace 30 mm., width 42 mm.

Remarks.—This species occurs from Long Island Sound to Brazil along our Atlantic coast, but is not common north of New Jersey. It is easily distinguished from any of our other related mud crabs, not only by its large size, but by the tubercle on the subhepatic region just below the front lobe of the anterior lateral edge of the carapace, by the postorbital tooth being separated from the second tooth of the antero-lateral edge by a rounded sinus, and by the dactylus of the larger cheliped having a stout tooth near the base within.

These crabs live on the oyster-beds and in our bays and sounds, where they are often dredged up by the oystermen. My examples from Beesley's Point, collected many years ago by Samuel Ashmead. The species attains a larger size than noted above, examples with the carapace 40.6 mm. long and 62 mm. wide, being known. Mr. Witmer Stone found it at Point Pleasant.

Genus EURYTIUM Stimpson.

Eurytium Stimpson, Ann. Lyc. N. Hist. N. Y., VII, 1859, p. 56. Type *Cancer limosa* Say, virtually monotypic and designated.

Carapace broad, length about two-thirds its width, convex, region slightly marked, without transverse raised lines. Antero-lateral borders regularly arcuate, shorter than postero-lateral, cut into five shallow teeth, second tooth rounded and intimately fused with first. Fronto-orbital border over half carapace width. Front from a fourth to almost third carapace width. Front

deflexed, two rounded lobes separated by shallow notch. Upper edge of orbit with two short and inconspicuous fissures, lower edge with deep rounded sinus outside and two lobes, of which inner and smaller slightly more advanced than outer. Basal antennal joint broad and in contact with front, flagellum standing in orbital hiatus. Ridge on endostome which defines efferent branchial channel well marked, continued to edge of epistome. Chelipeds massive and rounded, unequal in both sexes. Abdomen in male five-jointed.

Similar to *Eupanopeus* and related genera, but differs in the oval and nearly smooth carapace, without ridges, and by its palatal ridge. One species on our shores.

***Eurytium limosum* (Say).**

PLATE 124.

Cancer limosa Say, Journ. Acad. Nat. Sci. Phila., I, pt. 1, 1818, p. 446. *Muddy places of our southern coast.*

?*Grapsus limosus* Rafinesque, Amer. Month. Mag. Crit. Rev., II, Nov. 1817, p. 42. *Sea-shores of Long Island.*

Panopeus limosus Milne-Edwards, Hist. Nat. Crust., I, 1834, p. 404. *Coasts of North America.*

—— White, Cat. Crust. Brit. Mus., XXV, 1847, p. 18. *North America (Say's material).*

Panopeus limosum De Kay, N. Y. Fauna. Crust., VI, 1844, p. 5. *New York, New Jersey and Virginia.*

Eurytium limosum Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 319. *New York to Florida.*

—— A. Milne-Edwards, Miss. Sci. Mex. Crust., V, 1878, p. 332, Pl. 60, fig. 2. *New York to Rio Janiero.*

—— M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 138. *Virginia province.*

Description.—Carapace very convex in transverse section, contour very broadly hexagonal, length about two-thirds its width. Surface apparently smooth though under a lens granulated, with granules becoming coarser near frontal and antero-lateral edges. Front much deflexed, very slightly advanced, formed of two similar lobes divided by median notch and each lobe with broadly convex edge as seen from above. Front about two-ninths width of carapace, and divided on each external edge by very slight

notch from each inner supraorbital flange, latter a little convex. Emargination of orbit as viewed above deepest or most posterior in median portion of its extent, and outer corner with very slight notch. Outer orbital tooth coalesced with first anterior lateral tooth, only separated by slight emargination, also a little more triangular, narrower and slightly more advanced than latter. Second anterior lateral tooth broad, lobate, but little posterior to first, though separated by deep notch. Third anterior lateral tooth arcuate, narrower than second, separated from fourth by very deep excavated notch, and apex deflected but little from vertical. Fourth antero-lateral teeth triangular, directed obliquely forward, pointed or more dentiform. Anterior-lateral edges, along edges of teeth, with beading of fine granules.

Orbits rather oblong, with inner tubercle and broader outer flange comprising inferior edge, and these seen as viewed from above. Eye rounded, with constricted pedicel, and base a little more swollen than bulk of eye. Antennules robust. Antennæ slender. Maxillipeds large, cover branchial cavern, ischium width about three-fourths its length, length of merus about three-fourths its own width, and small terminal joints subequal. Subbranchial regions all granular. Chelipeds large, massive, subequal. Propodus swollen and smooth over surfaces, rather long, not greatly elevated at dactylus articulation, but conic and slender pollex bent down somewhat and curved a little inward at tip. Latter also with external longitudinal groove and well-toothed along a nearly straight cutting-edge, median denticles a little enlarged. Dactylus similar to pollex, usually elongate, slender, conic, slight tubercle basally and externally below, mostly with smaller and less developed teeth than on pollex, and cutting-edge nearly approximated with latter. Carpus smooth above, convex, and with large inner anterior tooth. Merus and carpus about equal in length. Ambulatory feet similar, dactyls similar, pointed. Male with slender post-abdomen, outermost of three fused segments with straight edges and similar to penultimate. Terminal segment rounded.

Color of carapace bright purple-blue. Carpus and hand bluish, and color of fingers not continued on palm. Proximal upper half

of dactylus pink, rest porcelain-white, and chelipeds below, also carpal tooth, yellow. Feet all paler below, like lower surface of body. Length of carapace 30 mm., width 46 mm.

Remarks.—A tropical and subtropical species, ranging from New York to Brazil and Bermuda. I have not seen any recent specimens. Two dried examples in the Academy of Natural Sciences of Philadelphia, described above, and labeled "New Jersey," were recived from Thomas Say. It is upon this data that I venture to include the species within our limits. De Kay also mentions it from New Jersey, possibly on Say's material.

Young examples, from Absecon, are also likely this species.

Family PORTUNIDÆ.

The Swimming Crabs.

Carapace depressed, moderately transverse, usually widest at least antero-lateral marginal spine. Usually from five to nine antero-lateral spines or teeth. Front horizontal. Orbits and eye-stalks of moderate length. Last trunk legs usually adapted for swimming, with terminal joint ovate, flatly expanded.

These crabs, with a single exception, have the last pair of legs formed as swimming-paddles. They include several very common and valued species in a commercial way. Some are also palagic, or with wide distribution.

About seven genera represented in Eastern North America.

Key to the genera.

- | | |
|--|--------------|
| <i>a.</i> Last pair of legs narrow, with lanceolate dactyls. | CARCINIDES. |
| <i>aa.</i> Last pair of legs broad, formed as swimming-paddles. | |
| <i>b.</i> Carapace decidedly transverse; antero-lateral margins cut into nine teeth. | |
| <i>c.</i> No longitudinal ridge on palate. | ARENÆUS. |
| <i>cc.</i> A longitudinal ridge on palate. | CALLINECTES. |
| <i>bb.</i> Carapace not very broad; antero-lateral edges cut into fine teeth. | OVALIPES. |

Genus **CARCINIDES** M. J. Rathbun.*The Green Crabs.*

- Carcinides* M. J. Rathbun, Proc. Biol. Soc. Wash., XI, 1897, p. 164. Type *Cancer mænas* Linnæus, virtually, as this name proposed to replace *Carcinus* Leach.
- Carcinus* (nec Latreille 1796) Leach, Edinb. Encyclop., VII, 1814, p. 429. Type *Cancer mænas* Linnæus, monotypic.¹ (Not consulted.)

Last pair of legs narrow, with slender and lanceolate dactyls. This genus differs from all the others of the family in the above character. One species in our limits.

Carcinides mænas (Linnæus).

PLATES 125 AND 126.

Green Crab.

- Cancer mænas* Linnæus, Syst. Nat., Ed. 10, 1758, p. 627. *European and Asiatic Oceans.*
- Carcinus mænas* De Kay, N. Y. Fauna, Crust., VI, 1844, p. 8. Pl. 5, figs. 5-6. Long Island Sound; Newport, R. I.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 398. Northampton, Co., Va.
- Kingsley, Standard Nat. Hist., II, 1884, p. 63, Pl. Cape Cod to Maryland.
- Heilprin, An. Life of Our Sea Shore, 1888, p. 88, Pl. 6, fig. 3. New Jersey and southern Long Island.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1905), p. 144, figs. 13. New York City.
- Mayer, Sea Shore Life, 1906, p. 100, fig. 68. Long Island Sound, north of New England, northern Europe.
- Carcinus mænas* S. I. Smith, Trans. Conn. Acad., V, 1878, p. 34. Long Island Sound: New Jersey.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 321. Cape Cod to New Jersey.
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 774. Cape Cod to New Jersey.
- Carcinides mænas* M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 142. Virginia province.

¹ Edinb. Encyclop., Am. Ed., VII, 1815, p. 228.

- M. J. Rathbun, *Occas. Papers Boston Soc. N. Hist.*, VII, 1905, p. 8. New England.
- Portunus manoides* Rafinesque, *Amer. Month. Mag. Crit. Rev.*, II, Nov., 1817, p. 42. *New York, Long Island, New Jersey, etc.*
- Cancer granulatus* Say, *Journ. Acad. Nat. Sci. Phila.*, I, pt. 1, 1817, p. 61. *Inhabits bays and inlets near the sea.*
- Verrill, *Rep. U. S. F. Com.*, I, 1871-72 (1873), p. 312 (rocky shores).
- S. I. Smith, *Rep. U. S. F. Com.*, I, 1871-72 (1873), p. 547. Cape Cod to New Jersey.

Description.—Carapace moderately convex and depressed, surface rather uneven and dorsal grooves distinct. Contour of carapace generally convex anteriorly, and sides narrowing considerably to moderately broad posterior edge. Front with five distinct nearly equal similar crests or flattened spines so arranged as to form convex contour between eyes. Last of median frontal spines elevated to form inner wall of orbit, and separated from outer by posterior slight notch. Anterior lateral edges of carapace with five large flattened serratures, pointed, outermost directed slightly outward and more slender than others, which become gradually smaller towards eye and to which they slightly turn. Posterior lateral edges of carapace undulated or double-convex towards median line. Hind edge of carapace with posteriorly directed slightly convex line. All edges of carapace with fine beading of small uniform close-set tubercles. Upper surface of carapace finely granular, and where ridges slope off from anterior lateral marginal serræ some of granulations a little enlarged.

Orbit moderate, rather ovoid, and lower inner edge projects forward similar to serræ along frontal edge medianly, so as to be visible as viewed from above. Eye-stalks moderate, greater than rounded eyes, and outer basal surfaces villose. Antennules robust, two joints of peduncle semi-cylindrical, and subequal. Two attenuated flagella surmount terminal joint, of which upper ends in filament, longer than lower, and with bunch of setæ on its lower edge. Upper flagella a little shorter than terminal joint of antennules. Antennæ attenuated, slender, when depressed extend to second serra of anterior lateral edge, peduncle short, of two robust joints, of which basal larger.

Lower surface of carapace laterally, above articulations of chelipeds and first pair of ambulatory legs, hairy. Outer maxillipeds with long ischium, merus a little longer than broad, and other three terminal joints subequally small. Inner and outer edges of outer maxillipeds densely hairy. Chelipeds subequally enlarged, though left a little larger, and both more or less smooth. Dactyl and pollex robust, approximated distally, with molar-like tubercles as teeth, these rather obsolete, though large. Propodus rounded convexly below, though with ridge on upper inner edge well developed, also another broader but less defined one parallel and external. Carpus with large inner triangular tubercle above. Merus unarmed. First and second pairs of ambulatory legs longest, and fourth shortest, though with dactylus, propodus and carpus more compressed than others. First and last pair of legs with ridges of close-set brush-like setæ on both edges of dactyls and lower edges of propodus. Fourth pair of legs also with similar ridges of setæ on upper and lower edges of carpus, besides upper anterior edge of merus. Dactyls of second and third feet with setæ similar to others, only little developed. Post-abdomen forms bell-shaped triangle in contour in male, and in female much broader or ovate.

Color greenish above, marked with yellowish spots, paler below. Length of carapace 53 mm., width 68 mm.

Remarks.—A northern species ranging from Virginia to New England and northward, and also in Europe. It lives usually near low-water mark. When disturbed it is a good runner. It also lives about our larger tidal pools. In New Jersey I have found it at Ocean City and Stone Harbor. My specimens at present from Atlantic City Inlet, Townsend's Inlet and Turtle Gut Inlet. Mr. Witmer Stone met with it at Point Pleasant. Mr. W. T. Davis says it is not uncommon along the shores of Staten Island, N. Y., particularly where rocks abound.

Genus ARENÆUS Dana.

Arenæus Dana, Amer. Journ. Sci. Art., (2) XII, 1851, p. 130. Type *Portunus cribrarius* Lamarck, monotypic.

Palate smooth, or without longitudinal ridge. Superior fissures of orbit open, V-shaped. Abdomen in male narrower than in typical *Portunus*, not -shaped as in *Callinectes*.

Related to *Portunus*, with which it is sometimes united. A single species in our limits.

***Arenæus cribrarius* (Lamarck).**

PLATE 127.

Portunus cribrarius Lamarck, Hist. Nat. An. Sans Vert., V, 1818, p. 259.
Brazil.

Arenæus cribrarius S. I. Smith, Trans. Conn. Acad., II, 1871, p. 35. New Jersey to Rio Janeiro.

— Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 320. New Jersey to Brazil.

— M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 139. Virginia province southward.

Neptunus (Neptunus) cribrarius Young, Stalk-Eyed Crust. W. Indies, 1900, p. 176. New York to Brazil.

Lupa maculata Say, Journ. Acad. Nat. Sci. Phila., I, pt. 1, 1818, p. 445. (Coasts of Georgia and Florida.)

— De Kay, N. Y. Fauna, Crust., VI, 1844, p. 11. (Georgia and Florida.)

— Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 149. Great Egg Harbor, N. J.

Description.—Carapace broad, with rather even apparent convex surface, under a lens minutely granulated, with little-marked grooves, and front edge more evenly convex than hind edge. Front rather narrow, not produced or not extending forward far as larger anterior lateral teeth. Front with series of four marginal denticles directed forward, and median incision separating them into two pairs, with innermost denticle of each pair largest. Notch separating inner supraorbital denticle equally large as median notch, and supraorbital denticle not quite extended so far anteriorly as innermost median denticles of front, though with much wider base. Orbit rather oblong, edge as seen from above with its most posterior emargination at base of eye-stalk, a decided notch externally about midway in its length, and still another notch on middle of outer half. Lower

or inferior orbital edge advanced greatly before inner supraorbital spine, as viewed from above, and as seen below with wide external notch. Anterior lateral teeth of carapace begin with first forming outer edge of orbit, similar, first five subequal and a little smaller than sixth or eighth, which latter larger though also subequal. Apices of anterior lateral teeth, except last one, would all radiate from a line drawn to articulation of last pair of legs. Last lateral spine enlarged, directed out at right angles to axis of carapace, narrowly triangular, sharp pointed, and its length twice that of spines immediately anterior. Anterior lateral teeth covered below with hairs so that notches between well screened. Epistome, antennal and pterygostomial regions hairy.

Antennules moderately large, outer joint little longer. Antennæ with short and moderately stout peduncle, and depressed flagellum, reach first anterior lateral spine of carapace. Eyes moderate, pedicel a little constricted, and base greater than diameter of eye itself. Maxillipeds cover rather square buccal frame, ischium width half its own length, merus about broad as long. Propodus and dactylus subequal and a little longer than merus. Chelipeds rather short. Propodus convex over surface generally, dactyl and pollex about equal, approximated at tips and former a little less than half length of propodus. Cutting-edges with sharp compressed teeth, each with four enlarged teeth with small cusps between, and larger fitting alternately when closed. Upper surface of propodus broad, with three ridges, median continued also on upper and superior lateral portions of dactyl for greater portion basally at least. At origin of median ridge large forward directed spine. On propodus upper innermost ridge ends anteriorly in sharp spine. Ridge along lower side of propodus from hind basal edge medianly on outer surface toward cutting-edge. Lower surface of propodus with outer keel beginning well beyond articulation with carpus and extending to end of pollex. Inner marginal ridge obsolete at first and then extending along side of pollex below. Carpus about half length of merus, with four spines on upper anterior edge, though innermost well separated from

others. Merus with five spines on upper edge, graduated down from outermost which longest, and last very small. A distinct rounded tubercle oposite each end of lateral ridge of dactylus on upper edge of palm. Ambulatory feet moderately long, all compressed, but propodi and dactyli more so. Last pair of feet quite broad distally, meri rounded. Sternum smooth. Abdomen in male narrowly triangular, terminal segment very pointed.

Carapace and chelipeds violet to yellowish-brown in life, and marked with numerous rounded light yellowish to whitish spots and latter retained in alcoholic material. Length of carapace 26.5 mm., entire width 54 mm.

Remarks.—Found from New Jersey to Rio Janeiro, in Brazil. This species was recorded from Great Egg Harbor, in New Jersey, by Leidy, in 1855. The example described above was secured at Holly Beach by Mr. J. E. Ives, in 1890. It is a male and dried, also faded nearly uniformly whitish. It is smaller than recorded dimensions, males being known 46.5 mm. long and 103.6 mm. wide.

I have also examined similar small examples to the one described above from Cape May and Absecon. In the summer of 1908 I obtained it at Ocean City in small numbers.

Genus *CALLINECTES* Stimpson.

The Blue Crabs.

Callinectes Stimpson, Ann. Lyc. N. Hist. N. Y., VII, 1860, p. 220. Type *Cancer dicantha* Latreille, monotypic.

Front with strong antero-lateral teeth, last considerably stronger than others. Merus of outer maxillipeds strongly produced outwardly at antero-external angle. Chelipeds stout, manus with five external costæ and not more than two teeth or springes. Abdomen of male very narrow, \perp -shaped.

Differs from *Portunus* in the above characters. Species several, though but one on our shores.

Callinectes sapidus M. J. Rathbun.

PLATES 128 TO 130.

Blue Crab.

- Callinectes sapidus* M. J. Rathbun, Proc. U. S. Nat. Mus., XVIII, 1895, p. 352, Pl. 12, Pl. 24, fig. 1, Pl. 25, fig. 1, Pl. 26, fig. 1, Pl. 27, fig. 1. *Cape Cod to Texas; Sing Sing, New York; Jamaica; Bermudas; Brazil.*
- M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 140, fig. 3. *Cape Cod to Gulf of Mexico.*
- M. J. Rathbun, Occas. Papers Boston Soc. Nat. Hist., VII, 1905, p. 9. *Cape Cod, southward.*
- Mayer, Sea Shore Life, 1906, p. 99, fig. 67. *Gulf of Mexico to Cape Cod.*
- Fowler, Proc. Acad. Nat. Sci. Phila., 1911, p. 3. *Beaches of Delaware.*
- Fowler, l.c., 1913, p. 64. *Wallops I., Va.*
- Lupa hastata* (nec Linnæus) Say, Journ. Acad. Nat. Sci. Phila., I, pt. 1, 1817, p. 65. *Our markets, from all the bays and inlets of the sea coast.*
- Callinectes hastatus* Ordway, Boston Journ. Nat. Hist., VII, 1863, p. 568. *Nantucket to Mobile; Brazil; Chesapeake Bay.*
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), pp. 367, 468, 516. *Great Egg Harbor, N. J. (in Opsanus tau).*
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 548. *Cape Cod to Florida.*
- Uhler, Field and Forest, II, 1876, pp. 73-76. *Maryland and Virginia.*
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 320. *Massachusetts to Florida.*
- A. Milne-Edwards, Miss. Sci. Mex. Crust., V, 1878, p. 224. *Nantucket to Mobile and Brazil.*
- Conn, Johns Hopkins Univ. Circul., Nov. 1883, p. 5 (note).
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 775. *Cape Cod to Florida.*
- Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. *Beach Haven, N. J.*
- Heilprin, An. Life of Our Sea Shore, 1888, p. 85, Pl. 6, fig. 4. *New Jersey and southern Long Island.*
- H. M. Smith, Bull. U. S. F. Com., IX, 1889 (1891), p. 104. *Crisfield, Md.*
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1905), p. 142, fig. 11. *Long Island.*
- Neptunus hastatus* Uhler, Ches. Z. Lab. J. Hopkins Univ., I, 1878, p. 25. *Ft. Wool, Va.; throughout Chesapeake Bay.*
- Kingsley, Standard Nat. Hist., II, 1884, p. 63. *Massachusetts to Florida.*
- Paulmier, 55th An. Rep. N. Y. State Mus., 1901, p. 129r. *Great South Bay, Long Island.*

- Lupa dicantha* (nec Latreille) De Kay, N. Y. Fauna, Crust., VI, 1844, p. 10, Pl. 3, fig. 3. Florida to Cape Cod.
—— Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 149. Absecon and Great Egg Harbor, N. J.
Callinectes dicanthus A. Milne-Edwards, Miss. Sci. Mex. Crust., V, 1878, p. 223, Pl. 41. Atlantic coast of America.

Description.—Carapace moderately convex and depressed, surface rather uneven and dorsal grooves more or less distinct. Contour of carapace generally ellipsoid, anterior half nearly evenly hemispherical, and posteriorly sides narrowing with very oblique edges to moderately broad posterior straightened edge. Front with four distinct flattened spines, outer, which forms inner orbital edge, slightly larger or with broader base. Contour of front as formed by these spines very slightly convex. Orbital edge above with two slight notches, one about midway and other external. Outer orbital spine a little larger than seven subequal spines along front lateral edge, though at widest part of carapace much larger angular and narrower spine points directly out. From this lateral spine fine beading of minute tubercles generally bends up till opposite outer orbital spine, though not above level of sixth front lateral spine. Posterior lateral edges of carapace slope obliquely, though somewhat bent down medianly, towards median line. Hind carapace edge slightly convex or concave. Upper surface of carapace finely tuberculate, rather sparsely so over front half, close-set behind middle, when soon gradually crowded and smaller. Orbit rather large, slightly ovoid, and lower edge with spine-like process projecting forward, similar and but little external to inner supraorbital, though visible as seen from above.

Eye-stalks moderate, about same thickness as rounded eyes, and outer basal surfaces hairy. Antennules slender, of two long slender subequal joints, with larger of two short flagella about two-thirds length of outer joint. Antennæ long, slender, filamentous flagellum reaches to fourth anterior lateral spine beyond eye, and peduncle of three joints, basal largest and third smallest. Lower surface of carapace laterally smooth in front, posteriorly somewhat villose. Outer maxilli-

ped with long ischium, length of merus about-thirds its width, and other three terminal joints subequally small. Inner and upper edges of outer maxillipeds hairy. Chelipeds about equally enlarged, both more or less smooth. Dactyl and pollex attenuated, slender, former with tip fitting inside latter, approximated distally, with a single series of large compressed teeth along each cutting-edge, and three or four enlarged alternately so that series continuous when fingers close. Usually one or two rather conspicuous tubercles close to base of dactylus on outer edge of palm, and another on inner edge of palm. Upper surface of hand with three longitudinal ridges, inner two of which a little closer. Ridge on outer surface of palm, though not extending forward quite to gape of fingers. Inner surface of palm with an inner ridge similar, though rather obscure. Tubercle at upper front end of carpus. Upper anterior meral edge with three large spines, outer largest. First three pairs of legs similar with edges of dactyls, lower edge of carpi, and both edges of propodi except upper edges of third pair with dense setæ. Fourth pair of feet with fine setæ along edges of dactyls, carpi, and upper edges of meri and ischia. Post-abdomen quite narrow, with penultimate segment width about two-fifths its length, in male. Female with much broader post-abdomen.

Color of carapace deep olive, above chelipeds brownish to olivaceous, with bluish at bases of joints and about edges of fingers. Feet brownish, paler below. Entire lower surface of body more or less whitish. Spines along front edge of carapace and on chelipeds reddish. Eyes blackish. Length of carapace 115 mm., width 210 mm.

Remarks.—The most familiar and valued of all our local crustacea. This is chiefly on account of its abundance, for its flesh is but little inferior to that of any other member of the class. I have examined hosts of specimens in the field, in most every place where collecting, as at Manasquan, Point Pleasant, Sea Side Park, Barnegat Pier, Great Bay, Bass River at New Gretna, Atlantic City, Ocean City, Corson's Inlet, Sea Isle City, Townsend's Inlet, Avalon, Peermont, Stone Harbor, Anglesea, Grassy Sound, Beesley's Point, Somer's Point,

Cape May, Town Bank, Green Creek, Dias Creek, Dennis Creek, Bayside, and Penns Grove. They occur in the lower Delaware River tidal occasionally, as far as Camden during periods of drought in summer. The range of the species is from Cape Cod to Brazil.

Verrill says it is a common inhabitant of muddy shores, especially in sheltered coves and bays. It is a very active species, swimming rapidly, and is therefore often seen swimming near the surface. The full-grown individuals generally keep away from the shores, in shallow water, frequenting muddy bottoms, especially among the eel-grass, and are also found in the somewhat brackish waters of estuaries and the mouths of rivers. The young of all sizes, up to two or three inches in width, are very frequent along the muddy shores, hiding in the grass and weeds or under the peaty banks at high water, and retreating as the tide goes down, though if disturbed they swim quickly away into deeper water. They also have the habit of pushing themselves backward into and under the mud for concealment. They are predaceous in their habit, feeding upon small fishes and various other animal food. They are very pugnacious and have remarkable strength in their claws, which they use with great dexterity. When they have recently shed their shells they are caught in great numbers for the markets, and these "soft-shelled crabs" are greatly esteemed. Those with hard shells are also sold in our markets, but are not valued so highly. As a distinguishing character this species may be known at once from all our other crabs by the presence of the large sharp spine on each side of the carapace. Crabs are usually brought to our markets early in May, though the more valued "soft crabs" are taken later. Their period of shedding is often quite irregular, or of long duration, for soft-shelled examples are taken nearly all summer.

This crab is equally abundant along the coasts of our neighboring States. I have found it at Lewes, Rehoboth, Dewey Beach, Rehoboth Beach, Indian River Inlet, Delaware City, Newcastle and Wilmington, though it seldom ascends the Delaware much further, except during drought in warm weather.

In Maryland it is very abundant about most all the Chesapeake Bay region. I have examined examples at Baltimore in the Patapsco River, the Bohemia River, Cape Charles, Old Point Comfort, and Norfolk, near many of which places are important industries. It is also abundant in the Chincoteague Bay region, as on Chincoteague Island, Assateague, Wallops, and further south as at Cedar Island, Parmores Island and Watchapreague Inlet. Mr. W. T. Davis says this crab is still to be found in numbers in the salt creeks of Staten Island, N. Y. In winter a great many dead are often washed ashore on the south Side.

Megalops and Zoea of crabs before me, taken in great abundance at Point Pleasant and in Great Egg Harbor, are very likely of this species.

Genus **OVALIPES** M. J. Rathbun.

The Lady Crabs.

Ovalipes M. J. Rathbun, Proc. U. S. Nat. Mus., XXXI, 1899, p. 597. Type *Cancer ocellatus* Herbst, designated.

Carapace depressed, transverse, dorsal surface without tubercles or transverse ridges, front rather narrow and armed with three or four lobes or teeth. Antero-lateral margins of carapace arcuated, armed with five teeth or spines, including lobe at exterior orbital angle and lateral epibranchial tooth, which longer than preceding tooth. Orbits rather widely open above, with one or two fissures in superior and one in inferior margin. Ridges of endostome obsolete. Post-abdomen usually distinctly seven-jointed, or sometimes five-jointed with third to fifth segments consolidated. Eyes of moderate length. Basal joint of antennæ short and not dilated, occupies but not wholly filling interior hiatus of orbit and not united at its distal extremity with front. Exterior maxillipeds rather large, ischium joint not produced at antero-internal angle, merus obliquely truncated at distal extremity with antero-external angle rounded and not at all produced. Chelipeds (in adult males) subequal, not greatly elongated, palms externally more or less distinctly longitudi-

nally costated, and elongated fingers armed on interior margins with large triangular lobes alternating with smaller teeth. Ambulatory legs of moderate length, dactyli styliform and compressed. Fifth natatory legs as usual with penultimate and terminal joints compressed and dilated, and terminal joint not lanceolate as in *Portumnus*, but broadly ovate and rounded at distal extremity.

Species rather few, in warm seas, living in shallow and rather deep water.

Ovalipes ocellatus (Herbst).

PLATES 131 AND 132.

Lady Crab.

Cancer ocellatus Herbst, Nat. Krab. Krebs., III, I, 1799, p. 61. Pl. 49, fig. 4. Long Island, New York.

Platyonichus ocellatus De Kay, N. Y. Fauna, Crust., VI, 1844, p. 9, Pl. 1, fig. 1, Pl. 5, fig. 7. Our sea beaches.

— Gibbes, Proc. Acad. Nat. Sci. Phila., 1850, p. 24 (name only).

— Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850 (1851), p. 177. New Jersey coast.

— Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 149. Great Egg Harbor, N. J.

— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 547. Cape Cod to Florida.

— Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 324. Massachusetts to Florida.

— S. I. Smith, Trans. Conn. Acad., V, 1878, p. 33. Massachusetts to Florida.

— Uhler, Ches. Z. Lab. J. Hopkins Univ., I, 1878, p. 25. Ft. Wool, Va.

— Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 399. Beach, opposite Ft. Monroe, Va.

— R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 774. Cape Cod to Florida.

— Kingsley, Standard Nat. Hist., II, 1884, p. 63, fig. 78 (no locality).

— Miers, Rep. Voy. Challenger, Brach., XVII, 1886, p. 202. East coast of United States.

— Heilprin, An. Life of Outr Sea Shore, 1888, p. 85, Pl. 6, fig. 5. New Jersey and southern Long Island.

— Mayer, Sea Shore Life, 1906, p. 101. Cape Cod to Florida; southern Long Island coast.

Platyonichus ocellatus White, Cat. Crust. Brit. Mus., XXV, 1847, p. 24. United States (Say's material).

- Young, Stalk-Eyed Crust. W. Ind., 1900, p. 199. Eastern coast of United States to West Indies.
- Platyonichus ocellatus* Leidy, Proc. Acad. Nat. Sci. Phila., 1878, p. 337. Ocean Grove, N. J.
- Ovalipes ocellatus* M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 142, fig. 4. Cape Cod to Gulf of Mexico.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 9. Provincetown and Barnstable southward.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1905), p. 143, fig. 12. New York City.
- Fowler, Proc. Acad. Nat. Sci. Phila., 1911, p. 3. Beaches of Delaware.
- Fowler, l. c., 1913, p. 64. Wallops I., Va.
- Portunus pictus* Say, Journ. Acad. Nat. Sci. Phila., I, pt. 1, 1817, p. 62, Pl. 4, fig. 4. *Inhabits sandy shores of the sea.*

Description.—Carapace as viewed from above broadly ovoid, greatest width a little before center in vertical diameter, and latter about three-fourths of horizontal diameter. Dorsal surface of carapace smooth and moderately convex. Rostrum as a single median spine directed forward, though much shorter than extended stalked eyes, and on each side of former a shorter and similar spine. Antero-lateral edge of carapace with five strong anteriorly directed equidistant similar spines. Postero-lateral edge of carapace slightly emarginate. Hind edge of carapace broadly convex. Body in profile laterally rather ellipsoid, and greatest depth nearly equals half of vertical diameter of carapace. Eye-socket moderate, ellipsoid, inclined downward from rostral spine slightly, and enclosed below by long epibranchial spine, latter longer and better developed than any of antero-lateral spines of carapace and inclined anteriorly towards rostral spine.

Eyes well developed, when erected conspicuous, when depressed fit in cavity between base of epibranchial spine and first antero-lateral spine. Eyes somewhat conic, surfaces rounded, and though stalks somewhat swollen sub-basally they become more constricted at base. First antennæ rather slender, close before base of eye-stalk, about long as extended eye-stalk, and ends in tapering slender flagellum. Second antennæ close together below rostral spine, with long basal joint, bent back so that distal articulation falls within hiatus between

rostral spine and antero-orbital spine, and if distended much longer than protruded eye. Mandibles strong, well developed, with well-developed compressed incurved palp joined to its upper edge. First and second maxillæ well developed, both with palp also well developed. First maxilla with short flagellum, and second maxilla with long flagellum curved medianly for distal portion, also with branchial plume well developed as large triangular distal expansion, its upper edge fringed with series of long hairs, and reposing within branchial cavity. First maxilliped well developed, with flagellum similar to that of second maxillæ. Second maxilliped large, with firm flagellum though this narrow, completely closing buccal cavity. Thoracic legs with anterior and posterior pairs modified, though all well developed. Anterior pair, or chelipeds, considerably enlarged, about equal, massive, and palms with strong outer superior keel and also similar inner superior keel. Dactyli of chelipeds with inner edges furnished with alternating stronger or larger and weaker or smaller molar-like teeth. Second, third and fourth pair of thoracic legs similar, monodactylous, all much more slender and smaller than chelipeds, and third pair a trifle longer than others, which are more or less subequal. Fifth pair of ambulatory legs smallest, and with two distal articulations modified into swimming-paddles, being broad and compressed, or greatly dilated, and each joint rounded in contour. Telson broad and rounded somewhat, extends trifle over half way to mouth.

Color in life pale sandy-brown. Carapace above, and upper basal articulations of thoracic legs mottled or spotted with a tinge of maroon-brown. Smaller examples are usually less mottled or with fewer spots than older ones. Lower surface of body and limbs pale or immaculate. Paddles of last legs with brownish edges. Length of carapace 60 mm., width 70 mm.

Remarks.—One of our most abundant species, occurring all along sandy beaches, even along our most open beaches below low-water mark, and also living off shore where sandy bottoms occur. I have found it abundant at Manasquan Inlet, Point Pleasant, in Barnegat Bay at Barnegat Pier and near Seaside Park, Atlantic City, in Great Egg

Harbor Bay at Ocean City, Corson's Inlet, Sea Isle City, Stone Harbor, Avalon, Peermont, Anglesea, Cape May, Green Creek, Fishing Creek and Dias Creek along Delaware Bay. It is a good swimmer and progresses rapidly by means of its modified or paddle-like hind legs. Often when hauling a small seine in the surf great numbers of lady crabs, or as they are usually called locally "sand crabs," are taken with small fishes such as *Fundulus majalis*, *Trachinotus carolinus*, *Menticirrhus saxatilis*, *Menidia menidia notata*, *Syngnathus fuscus*, etc. It generally buries in the sands, with only the eyes and antennæ exposed, ever on the watch for food and enemies. If disturbed it instantly moves down and backwards deeper into the sand, and in this way is also able to avoid the breakers or storms. Its food consists of small animals, though it is useful as a scavenger, devouring dead animals, often fishes. I have found them feeding on the latter, these often *Anchovia mitchilli*, *Tautoga onitis*, *Pomolobus mediocris*, *Prionotus evolans strigatus*, *Fundulus majalis*, etc., as they were left by the tides. The crabs were sometimes in great numbers, all gleaning bits of the carcasses, and often when disturbed they all moved off or into the loose sand, only to reappear shortly if not molested and continue their feast. Though of no importance as an article of food itself, the lady crab is often used as bait by the fisherman. It is also eaten by many of our valued food-fish, such as *Tautoga onitis*, *Cynoscion regalis*, *Scomber scombrus*, *Menticirrhus saxatilis*, *Paralichthys dentatus* and *Centropristis striatus*. Most all these, besides others, have been taken on it when used as bait by the angler. I have also found remains in the dog fish, *Mustelus canis*, and doubtless many other predatory animals devour quantities.

On July 12th, 1903, great numbers were seined in the surf at Stone Harbor, in Cape May County, associated with medusæ. *Fundulus majalis*, *Menidia menidia notata*, *Mugil curema*, *Syngnathus fuscus*, *Trachinotus carolinus*, *Mullus auratus* and *Menticirrhus saxatilis*.

On August 30th, 1905, they were equally common at Ocean City, in Cape May County, and were seined with *Anchovia*

brownii, *A. mitchilli*, *Fundulus majalis*, *Kirtlandia vagrans lacin-iata*, *Menidia menidia notata*, *Trachinotus carolinus* and *Menticirrhus saxatilis*, in the surf.

On July 25th, 1906, they were again found abundant in the surf at Stone Harbor with *Fundulus majalis*, *Trachinotus carolinus* and *Menticirrhus saxatilis*.

On June 21st, 1911, they were abundant in the surf at Ocean City with *Crago septemspinosus*, *Anchovia mitchilli*, *Fundulus majalis*, *Syngnathus fuscus*, *Menidia menidia notata*, *Trachinotus carolinus* and *Menticirrhus saxatilis*. In great Egg Harbor Bay at this place they were abundant about the bars with *Crago septemspinosus*, *Pomolobus pseudoharengus*, *Fundulus majalis*, *F. heteroclitus macrolepidotus*, *Menidia menidia notata*, *Lophopsetta maculata*, *Etropus microstomus*, *Paralichthys dentatus* and *Pseudopleuronectes americanus*.

Mr. W. T. Davis says this crab is often found dead on the south shore of Staten Island, N. Y.

Family CANCRIDÆ.

The Edible Crabs.

Carapace transverse, usually convex, with front lateral edges more or less arcuated, rarely subquadrate. Epistome short, transverse. Antennules folded longitudinally. Outer maxillipeds long, overlapping epistome. Ambulatory legs all gressorial, with styliform dactyls.

Genera few, marine and littoral. They are typified by the edible crab of the Old World, and this genus also represented in our limits.

Genus **CANCER** Linnæus.

The Edible Crabs.

Cancer Linnæus, Syst. Nat., Ed., 10, 1758, p. 625. Type *Cancer pagurus* Linnæus, eighteenth species, designated as "example" by Latreille, Hist. Nat. Crust., III, 1802, p. 22.

Platycarcinus Milne-Edwards, Hist. Nat. Crust., I, 1834, p. 412. Type *Cancer pagurus* Linnæus, first species.

Carapace depressed, or moderately convex, very broadly transverse or elliptical, dorsal surface uneven to smooth, with regions very obscurely defined. Front lateral edges of carapace regularly arcuated and divided into ten lobes or teeth, which sometimes broad, subtruncated and little prominent, or sometimes more prolonged and acute. Anterior lateral lobes or teeth sometimes armed with accessory denticles. Posterior lateral edges of carapace shorter than anterior lateral edges, and defined by raised line or crest (postbranchial crest). Front relatively narrow, divided into five lobes or teeth (if lobes comprising upper and inner orbital angle be included) and projects somewhat beyond orbits, which small and sometimes denticulated. Teeth defined by two fissures in upper and two in lower edges. Postabdomen five-jointed in male, with third to fifth joints coalescent. Eyes small, set on very short thick pedicels. Antennules longitudinally, or nearly longitudinally, plicated. Basal antennal joint somewhat enlarged, with distal lobe or tooth, which unites with front so as to exclude short flagellum from orbit. Exterior maxillipeds with merus joints usually truncate distally, anterior external angle not produced, usually more or less distinctly notched on inner edge, but notch sometimes obsolete. Buccal cavity completely closed by outer maxillipeds. Chelipeds usually subequal and not very largely developed, their palm nearly always longitudinally costated on external surface. Fingers acute and dentated on inner edges. Ambulatory legs somewhat elongated, dactyls slender and nearly straight.

Species numerous, though only two on our shores.

Key to the species.

- a. Front lateral teeth of carapace with dentate or spinulose edges. *borealis*.
 aa. Front lateral teeth of carapace with simple dentated edges. *irroratus*.

Cancer borealis Stimpson.

PLATE 133.

Jonah Crab.

Cancer borealis Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 1859, p. 50.
Cape Cod to Nova Scotia.

- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 546. Nova Scotia to Vineyard Sound and No Man's Land, likely both north and south.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 317. Nova Scotia to West Indies.
- S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 417. N. Lat. 39° - 40° , W. Long. 70° , in 65-225 fathoms.
- S. I. Smith, Bull. Mus. Comp. Zool., X, 1882, p. 5. Off Middle States.
- S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 15. Off Middle States.
- Kingsley, Standard Nat. Hist., II, 1884, p. 62. Our eastern coast.
- Miers, Rep. Voy. Challenger, Brach., XVII, 1886, p. 110. East coasts of North America.
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 629. Off Middle States.
- Stebbing, Hist. Recent Crust. (Intern. Sci. Series LXXIV), 1893, p. 59. North America.
- M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 134. Virginia province.
- Howe, Bull. U. S. F. Com., XIX, 1899 (1901), p. 240. N. Lat. 39° - 40° , W. Long. 70° .
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1905), p. 139, fig. (New York City possibly.)
- M. J. Rathbun, Occas. Papers Boston Soc. Nat. Hist., VII, 1905, p. 10. (New England.)
- Mayer, Sea Shore Life, 1906, p. 104, fig. 71. Long Island to Nova Scotia.
- Cancer irroratus* (part) Say, Journ. Acad. Nat. Sci. Phila., I, pt. 1, 1817, p. 59 (female). Inhabits the ocean.
- Platycarcinus irroratus* De Kay, N. Y. Fauna, Crust., VI, 1844, p. 6 (nec Pl. 2, fig. 2). Long Island.
- Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850 (1851), p. 176. New England and Middle States collections.

Description.—Carapace well convex, surface rather uneven and grooves obscure or ill-defined. Contour of carapace broadly convex anteriorly, with front moderately or little conspicuous, anterior lateral sides bulging very obliquely, and hind edge well constricted, with emargination each side. Front with five distinct nearly equal similar tubercles, arranged to form slightly triangular contour with median spine at apex, and spine each side of median one a little broader. Outermost of frontal spines little elevated to form orbital wall. Hind edge of orbit, as seen from above, with slight median notch and another median in

outer half. Front lateral edges of carapace each with ten obtuse flattened serræ, each more or less sharply pointed, outermost or ninth directed outward nearly at right angles. Fine uniform granulations along posterior edges of carapace very evident. Along anterior edges of serræ of anterior lateral region each serrature with two or three at least smaller accessory cusps, giving serræ appearance of cut into smaller teeth. Upper surface of carapace rather coarsely granular, granules often of quite unequal and irregular size, also quite hairy, especially along lateral edges. Orbit small, rounded, and lower or infraorbital edge projects more anteriorly with innermost of three graduated serræ, which largest, and each of serræ finely beaded with granules. All three infraorbital serræ visible as carapace viewed from above.

Eyes rounded, smaller than short rounded stalks. Antennules robust, of two elongated subequal joints. Antennæ slender, basal joint moderate. Subbranchial regions granular and villose. Outer maxillipeds with long ischium, merus trifle broader than long, and other three terminal joints subequally long. Maxillipeds all more or less hairy, especially along inner edges. Chelipeds subequally enlarged, moderately compressed. Dactyl and pollex robust, cutting-edges mostly approximated, each with about five teeth, with median enlarged. Propodus with seven longitudinal series of granules on outer face, three uppermost rows with wide-set small spinous tubercles. Three uppermost of series reflected out on dactylus at least basally, and two lowermost on outer side of pollex. Inner surfaces of hands and fingers mostly entire. Carpus and merus subequal, with several series of spinous tubercles above and on outer surfaces of former, which also more or less hairy. Tubercle on upper posterior marginal region of propodus externally at beginning of third outer series of spinous granules, or articulation with carpus. Carpus with large inner triangular tubercle or spine above in front, and one well external also on front edge. Ambulatory legs similar, last pair shortest and more compressed than others. Legs all more or less hairy, especially distal joints. Post-abdomen narrow, triangular, and terminal segment narrowly triangular in male.

Color brownish above, paler below. Length of carapace 40 mm., width 60 mm.

Remarks.—Ranges from Nova Scotia to the West Indies. Said to be rare or local, and likely confused with the far more abundant following species, which it greatly resembles. It is sometimes found dead on the shores of New England, and hardly likely occurs above low-water mark, as it ranges down in deep water off shore. I have no definite record for the State, except a number washed up on the beach at Corson's Inlet, several winters past, according to my friend, Dr. R. J. Phillips. The above-described example was obtained by Leidy, at Point Judith in Rhode Island, many years ago.

Cancer irroratus Say.

PLATES 134 AND 135.

Rock Crab.

- Cancer irroratus* Say, Journ. Acad. Nat. Sci. Phila., I, pt. 1, 1817, p. 59, Pl. 4, fig. 2 (male). *Inhabits the ocean.*
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 546. Labrador to South Carolina.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 317. Labrador to South Carolina.
- S. I. Smith, Trans. Conn. Acad., V, 1879, p. 38. Great Egg Harbor, N. J.; southern Long Island; Long Island Sound.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 39. Northampton Co., Va.
- S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 15. New England coast.
- Kingsley, Standard Nat. Hist., II, 1884, p. 62. Our eastern coasts.
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 766, Pl. 260, figs. 1-3 (Smith's record).
- Miers, Rep. Voy. Challenger, Brach., XVII, 1886, p. 110. Eastern North America.
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 630. Off Middle States.
- Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, N. J.
- Heilprin, An. Life of Our Sea Shore, 1888, p. 85, Pl. 6, fig. 1. New Jersey and southern Long Island.

- Stebbing, Hist. Recent. Crust. (Int. Sci. Ser. LXXIV), 1893, p. 58. North America.
- M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 134. Cape Cod and north, south to Gulf of Mexico.
- M. J. Rathbun, Occas. Papers Boston Soc. Nat. Hist., VII, 1905, p. 9. New England.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1905), p. 139, fig. New York City.
- Mayer, Sea Shore Life, 1906, p. 102, fig. 71. South Carolina to Labrador.
- Platycarcinus irroratus* Milne-Edwards, Hist. Nat. Crust., I, 1834, p. 414. North American coasts.
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 7. Long Island and Rhode Island.
- Gibbs, Proc. Acad. Nat. Sci. Phila., 1850, p. 24 (name only).
- Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 149. Great Egg Harbor, N. J.
- Verrill, Rep. U. S. F. Com., I., 1871-72 (1873), p. 312 (under large rocks near low-water mark); p. 530, Pl. 8, fig. 37 (Young).
- Cancer sayi* De Kay, l. c., p. 7. New York.
- Leidy, l. c. Great Egg Harbor, N. J.

Description.—Carapace well convex, surface uneven and dorsal groove not evident or very obscure. Contour of carapace broadly convex anteriorly, front well set off from anterior lateral region, sides sloping very obliquely as serrated, then emarginated posterior edges little inclined to comparatively narrow posterior edge. Front with five distinct nearly equal similar tubercles or depressed spines, so arranged to form an obtuse triangular contour, with median spine at apex. Outermost of frontal spines scarcely elevated to form wall of orbit. No very distinct notch to posterior median edge of orbit, as viewed above. Front lateral edges of carapace with eleven obtuse flattened serræ, more or less rounded, outermost or ninth directed outward almost at right angles. Beading of fine tubercles along edges of anterior serræ not very distinct, though continuous posterior edges of carapace with better development of minute uniform ones. Upper surface of carapace finely granular, and none of granules especially enlarged. Orbit small, rounded, and lower infra-orbital edge projects more forward, though similar to outermost of frontal serræ, immediately below, and so visible as viewed above.

Eyes rounded, smaller than rounded stalks, which nearly completely fill orbit, and outer basal surfaces villose. Antennules robust, two joints in peduncle semicylindrical and subequal. Antennules each with two attenuated flagella surmounting terminal joint, upper a little longer, ends in filament, with bunch of setæ on its lower edge, and in length a little shorter than terminal joint of peduncle. Antennæ attenuated, slender, basal joint of peduncle largest, second joint but little less in width though of about equal length, and flagella extends laterally to outer edge of orbit at least. Subbranchial regions more or less villose. Outer maxillipeds with long ischium, merus about broad as long, and other three terminal joints subequally long. Inner and outer edges of maxillipeds hairy, though above and about bases of three terminal joints quite hairy. Chelipeds subequally enlarged, left a little larger, and both more or less finely granular. Dactyl and pollex robust, their cutting-edges mostly in contact, with several enlarged keeled though obsolete denticles. Propodus with keel above, though rounded convexly below, and five more or less distinct longitudinal ridges on outer surface. Tubercle on upper posterior marginal region of propodus externally at its articulation with carpus. Inner surface of propodus without keels. Carpus with large inner triangular tubercle or spine above in front. Merus unarmed. First pair of ambulatory legs longest and fourth shortest, though with all joints but slightly more compressed than others. First and last legs with few close-set setæ along lower edges of dactyls and propodi. Postabdomen rather broadly ovate.

Color reddish-brownish, dotted or specked with darker above, paler below. Length of carapace 37 mm., width 54.

Remarks.—A widely distributed species ranging along our Atlantic coast from Labrador to the Gulf of Mexico. It lives in salt pools and inlets along the shore, and often occurs well up to the limit of high tide. The males are sometimes pugnacious, and will battle among themselves. In our region it lives often on the sandy shores, though also frequents rocky or stony bottoms equally well elsewhere. It is devoured by numerous fishes, such as cod and black bass, though many others doubtless

eat it as the opportunity affords. It is abundant on our coast, and I have seen it at Point Pleasant, Ocean City, Anglesea, and Stone Harbor. My specimens from Atlantic City Inlet and Sea Isle City. Mr. W. T. Davis says it is common on the south shore of Staten Island, N. Y.

Tribe GRAPSOIDEA.

The Grapsoid Crabs.

Carapace broad anteriorly, often subquadrate, sometimes subglobose, truncate or arcuate anteriorly, but not rostrate. Front bent downward. Epistome short, often almost linear. Pairs of branchiæ usually less than nine, efferent channels opening at sides of endostome. Male verges inserted either in sternal plastron or in basal joints of last pair of legs, thence passing through channels in sternum beneath pleon.

In this group are included a number of familiar forms, often with quite different habits.

Key to the families.

- a. Carapace often more or less membranous; front, orbits and eye-stalks usually very small; buccal frame arcuate anteriorly; size small. PINNOTHERIDÆ.
- aa. Carapace hard and firm; front, orbits and eye-stalks not very small; buccal frame quadrate anteriorly.
 - b. Third maxillipeds with fifth joint articulated at apex or front outer angle of fourth; front usually broad; eye-stalks of moderate size. greatly elongate. OCYPODIDÆ.
 - bb. Third maxillipeds with fifth joint articulated at front inner angle usually; front of moderate width or very narrow; eye-stalks often greatly elongate. OCYPODIDÆ.

Family PINNOTHERIDÆ.

The Oyster Crabs.

Carapace often more or less membranaceous, antero-lateral edges entire or very slightly dentate. Front, orbit and eye-stalks very small. Buccal frame usually arcuate anteriorly. Outer

maxillipeds with fourth joint well developed, and usually third also, fifth articulating usually at apex or at front inner angle of fourth. Chelipeds in adult male small or moderately developed. Walking legs slender, seventh joint styloform, unarmed. Pleon of male generally not covering whole width of sternum between last pair of legs.

These crabs are easily distinguished by their membranaceous bodies, often soft, small eyes, and small size. They often inhabit the shells of bivalve mollusca, the tests of echini, or the tubes of marine worms. Species belonging to but two genera have as yet been found in New Jersey, but as several others have been found in the same faunal province it is likely that they may also be recorded in the future.

Key to the genera.

- a. Carapace flat, suborbicular, truncate behind; eyes large (for family),
each eye-stalk long as half width of front. ZAOPS
aa. Carapace convex; eyes small. PINNOTHERES

Genus ZAOPS M. J. Rathbun.

Zaops M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 590. Type *Pinnotheres depressum* Say, virtually monotypic.

Carapace flat, suborbicular, truncate behind. Eyes large (for family), each eye-stalk as long as half width of front.

Zaops depressa (Say).

Pinnotheres depressum Say, Journ. Acad. Nat. Sci. Phila., I, 1817, p. 68. *Egg Harbor, New Jersey* (in common oysters?).

——— Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 323 (name only).

Zaops depressa M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 590. Virginian province (Cape Cod to North Carolina).

Pinnotheres ostreum (part) De Kay, N. Y. Fauna, Crust., VI, 1844, p. 12 (remarks).

Description.—Thorax flat, polished, with edge raised line of very short dense hair, which broaden behind, straightened over eyes and almost absent on carapace. Latter advanced, truncate.

Eyes conspicuous, moderately large and prominent. Carpus with line little elevated on upper side within. Hands suboval, on elevated obtuse line on exterior side. Fingers short. Penultimate joint of all feet dilated, compressed, with minute crenæ on inner edge. Tarsi incurved at tip, very acute. Abdomen gradually attenuated, joints transverse, terminal one much smaller than preceding, rounded. Length not quite 2.5 mm., and breadth a little over same. (Say.)

Remarks.—Known only from Say's account. His examples were procured several years previous to 1817, at Egg Harbor, and he thought they may possibly be the male of the common oyster crab. He was also uncertain whether it inhabits oysters or not. No specimens appear to have been obtained, at least in New Jersey, since Say's time.

Genus PINNOTHERES Latreille.

The Oyster Crabs.

Pinnotheres Latreille, Hist. Nat. Crust., III, 1802, p. 25. Type *Cancer pisum* Fabricius, monotypic.
Pinnothera, *Pinnoteres*, auct.

Carapace smooth, subglobose, more or less membranaceous, very little wider than long. Front narrow, with anterior edge nearly straight. Orbits small, nearly circular. Antennules obliquely transverse, large merus curved, last joint of palp joined to inner edge of preceding one. Ambulatory legs not differing remarkably in length, of moderate extent.

Two species on our coast, commensals in oysters, mussels and scallops. The common oyster crab, perhaps the best known, is often cooked and eaten with oysters.

Key to the species.

- a. Carapace thicker and firmer; surface covered with a dense pubescence. *maculatus*
 aa. Carapace of female very thin and membranaceous; surface smooth and shining. *ostreum*

***Pinnotheres maculatus* Say.**

PLATES 136 AND 137.

Mussel Crab.

- Pinnotheres maculatus* Say, Journ. Acad. Nat. Sci. Phila., I, pt. 2, 1818, p. 450. *Inhabits the muricated Pinna of our coast.*
- Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850 (1851), p. 179. East Coast; New York; South Carolina.
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), pp. 434, 459 (in *Mytilus edulis*) Southern New England.
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 546. Cape Cod to South Carolina.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 323. Cape Cod to South Carolina.
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 766. In shells of *Pecten* and *Mytilus*.
- M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 590. Cape Cod to Florida and Gulf of Mexico.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 5. Cape Cod and Southward.
- Pinnotheres maculatum* De Kay, N. Y. Fauna, Crust., VI, 1844, p. 13. Southern coast in *Pinna muricata*.
- White, Cat. Crust. Brit. Mus., XXV, 1847, p. 33. United States (Say's material).
- Mayer, Sea Shore Life, 1906, p. 105. Atlantic coast near New York in mussel and scallop shells.
- ?*Pinnotheres byssomia* De Kay, N. Y. Fauna, Crust., IV, 1844, p. 13. In *Saxicava distorta* of Southern Coast (U. S.).
- Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850 (1851), p. 179. Philadelphia collection, Say's example.
- Pinnotheres ostreum* (nec Say) S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), Pl. 1 fig. 2 (male).

Description.—Carapace membranaceous, though a little firmer than in next species, covered with a dense pubescence, more distinct in males usually, form subglobose, about broad as long in male and a little broader than long in female. Dorsal furrows obsolete. Front quite broad, equal to about one-third width of carapace, slightly produced and with very slight median notch as seen from above, edge generally a little convex. Orbits rounded, small. Antennules large, robust, much longer than antennæ. Latter slender, with rather tapering short filamentous

flagellum, and robust peduncle with basal joint largest. Eye-stalk short, with much more robust base than small eye. Outer maxillipeds fit in oblique chambers, conceal buccal mass, ischium largest joint, carpus a little longer than merus and with setæ distally, also long slender flagella from lower edge with filamentous tip extending much beyond end of carpus. Chelipeds subequal, larger and stronger than in next species, fingers conic and a little over one-third length of propodus, cutting-edges approximated and with several rather strong teeth. Carpus and merus smooth, subequal. Ambulatory legs similar, middle pair longest and last shortest. Dactyls of last pair conspicuously longer in female than any of other dactyls, in male only slightly so. Lower edges of all carpal and propodal joints densely setous, though apparently more so in male than in female. Segments of post-abdomen not quite equal to greatest width of carapace in female, broader in females with ovâ, and third and fourth broadest. Post-abdomen in male narrow, width about one-third greatest body width, and slightly graduated wider from telson to basal segment. Color dull brownish, paler below, and tints nearly uniform. Length of carapace 9 mm., width 8 mm., in female, and male smaller.

Remarks.—Distributed along our coast from Cape Cod to Florida and the Gulf of Mexico. It lives in the mussel (*Mytilus edulis*). Though very similar to the oyster-crab, it is distinguished by the firmer shell and wide-set eyes. My examples from off Anglesea, and others labeled New Jersey with a query. I have also seen examples from Sea Isle City, Corson's Inlet and Cape May. Adult spawning females have the post-abdomen equally broad as in the oyster-crab.

***Pinnotheres ostreum* Say.**

PLATE 138.

Oyster Crab.

Pinnotheres ostreum Say, Jour. Acad. Nat. Sci. Phila., I, 1817, p. 67, Pl. 4, fig. 5 (female). *Inhabits the common oyster of our markets.*

— De Kay, N. Y. Fauna, Crust., VI, 1844, p. 12, Pl. 7, fig. 16 (female). Found in the common oyster.

- White, Cat. Crust. Brit. Mus., XXV, 1847, p. 32. United States (Say's material).
- Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850 (1851), p. 179. New York and Charleston collections.
- Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 149. Absecon and Great Egg Harbor, New Jersey.
- Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 1860, p. 67. Coasts of the Virginia province.
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), pp. 367, 459 (nec Pl. 1, fig. 2). Wherever oysters occur.
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 546 (nec Pl. 1, fig. 2). Massachusetts to South Carolina.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 323. Salem, Mass., to South Carolina.
- Uhler, Ches. Zoöl. Lab. J. Hopkins Univ., I, 1878, p. 25. Fort Wool, Virginia.
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 765. Massachusetts to South Carolina.
- Kingsley, Standard Nat. Hist., II, 1884, p. 64, fig. 80. Our coast.
- Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, N. J.
- Heilprin, An. Life of Our Sea Shore; 1888, p. 88, fig. New Jersey and Southern Long Island.
- M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 599. Cape Cod to Florida.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 4. Salem, Mass., and southward.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1905), p. 149. New York City, in oysters.
- Mayer, Sea Shore Life, 1906, p. 104, fig. 72. Atlantic coast, Long Island Sound.

Description.—Carapace membranaceous, smooth, subglobose, little broader than long, and widest a little behind middle. Dorsal furrows obsolete. Front very narrow, nearly straight, or but slightly convex. Orbits rounded, and small. Antennules rather large, robust, much larger than antennæ. Latter attenuated from rather robust peduncle to short flagella, and basal joint largest. Eye-stalk short, much more robust than eye. Outer maxillipeds fit in oblique chambers, concealing buccal mass, large ischia somewhat curved ovoid, and carpus and merus subequal with tuft of setæ on outer end of carpus. Lower carpal flagella moderate. Chelipeds subequal, weak, slender, dactyl small or about one-third length of propodus, and pollex much more robust, both hirsute, with approximated cutting-edges. Carpus and merus smooth,

latter longer. First ambulatory leg stouter than remaining ones, propodus a little swollen, with very short dactyl, and merus much longer than those of chelipeds. Of remaining ambulatory feet second pair longest, slender, all joints elongated and slender, so that dactyl of second pair nearly four times longer than that of first pair. Segments of post-abdomen much broader than carapace in female and third and fourth broadest. Color translucent whitish generally. Upper surface of carapace and median region of post-abdomen red to pinkish. Minute eyes brownish. All limbs whitish. Length of carapace 11 mm., width of carapace 14 mm., and greatest width of post-abdomen 17.5 mm.

Remarks.—Distributed along the eastern coast of the United States from Cape Cod to Florida. I have examined many examples from Great Bay, Corson's Inlet, Cape May, Green Creek and Dias Creek, besides various other places along the shores of Delaware Bay. In all these cases I have only seen the female, as found commonly in the oyster (*Ostrea virginica*).

Outside of New Jersey I have met with it, along the coast of Delaware at Rehoboth, various places in Maryland about Chesapeake Bay, and at Chincoteague, Watchapreague and Norfolk in Virginia. Mr. W. T. Davis has found it near New York City.

Family GRAPSIDÆ.

Carapace depressed or moderately convex, mostly quadrilateral edges straight or slightly arcuate. Front never very narrow, generally decidedly broad. Orbits and eye-stalks of moderate size. Third maxillipeds with palp articulated at apex or at front outer angle of merus. Chelipeds in adult male usually subequal, moderately developed. Seventh joint of walking legs styli-form, compressed, either smooth or spiniferous. Pleon at base usually covers whole width of sternum between last pair of legs.

Many forms included in this family burrow in muddy banks, others live under logs and drift about wharves, wood piles, etc. Still others are abundant under stones, on mud flats in salt or brackish water.

Key to the genera.

a. Carapace broader than long.

SESARMA

aa. Carapace long as, or longer, than broad.

PLANES

Genus SESARMA Say.

Sesarma Say, Journ. Acad. Nat. Sci. Phila., I, 1817, p. 76. Type *Sesarma reticulata* Say, monotypic.

Pachysoma Haan, Faun. Japon. Crust., 1850, p. 33. Type *Grapsus bidens* Haan, first species.

Holometopus Milne-Edwards, Ann. Sci. Nat. Zoöl., (3) XX, 1853, p. 187 (153). Type *Grapsus (Pachysoma) hamatocheir* Haan, monotypic.

Carapace depressed, thick subtrapezoidal, broader than long, antero-lateral margins straight or nearly so, entire or unidentate, and slightly convergent to posterior margins. Carapace somewhat convex, usually very distinctly plicated over whole of dorsal surface. Front very broad, deflexed, anterior margin straight and slightly sinuated. Orbits small, interior subocular lobe not reaching front, little developed, so that produced antero-external lobe of basal antennal joint usually enters slightly within orbital hiatus. Epistoma very short, almost linear-transverse. Endostome with longitudinal ridges usually (but not always) distinctly developed. Post-abdomen (in male) distinctly seven-jointed, covers whole sternum width at base. Eye-peduncles short, robust. Antennules transversely plicated in short wide fossettes. Antennæ with basal joint very short, entering orbit, more or less produced at antero-external angle and flagellum short. Exterior maxillipeds with rhomboidal gape, merus joints longer than broad with rounded apices, and bearing next joint medianly or internally. An external piliferous ridge crosses ischium and merus. Chelipeds subequal, moderately developed, with merus joints trigonus and their anterior margins distally dentate, palms somewhat turgid, rounded above and below, and fingers excavated at distal extremity. Ambulatory legs of moderate length, merus joints dilated and compressed, anterior margins with subterminal spine, posterior margins with several spines at distal extremity, and rather short dactyli spiniferous.

Species widely distributed on warm or tropical shores.

Sesarma reticulatum (Say).

PLATE 139.

Ocyropode reticulatus Say, Journ. Acad. Nat. Sci. Phila., I, pt. I, 1817, pp. 73, 76, 442, Pl. 4, fig. 6. *Inhabits muddy salt marshes.*

——— Desmarest, Dict. Sci. Nat., XXVIII, 1823, p. 249 (on Say).

——— Desmarest, Consid. Crust., 1825, p. 123 (on Say).

Ocyropode (*Sesarma*) *reticulatus* Say, l. c., I, 1818, p. 442 (name only).

Sesarma reticulata Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850, p. 180. New York and Philadelphia collections. New Jersey coast.

——— Milne-Edwards, Ann. Sci. Nat. Zoöl., (3) XX, 1853, p. 182 (on Say).

——— Leidy, Journ. Acad. Nat. Sci. Phila., (2), III, 1855, p. 149. Absecon and Great Egg Harbor, New Jersey.

——— Stimpson, Ann. Lyc. N. Hist. N. Y., VII, 1860, p. 66 (material in Smithsonian Institution).

——— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 546. Long Island Sound to Florida.

——— Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 323. Long Island Sound to Florida.

——— Kingsley, l. c., 1879, p. 401. Northampton Co., Va.

——— Kingsley, l. c., 1880, p. 217. Virginia to Florida.

——— R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 763 (associated with *Gelasimus pugnax*).

Sesarme reticulata Heilprin, An. Life of Our Sea Shore, 1888, p. 87. New Jersey and Southern Long Island.

Sesarma reticulatum M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 587. Cape Cod to Gulf of Mexico.

——— M. J. Rathbun, Occas Papers Boston Soc. N. Hist., VII, 1905, p. 4. Massachusetts and Long Island Sound.

?*Ocyropoda pusilla* Rafinesque, Amer. Month. Mag. Crit. Rev., II, Nov. 1817, p. 42. *Common in salt marshes on the south shores of Long Island.*

Sesarma cinerea (nec Bosc) DeKay, N. Y. Fauna, Crust., VI, 1844, p. 15. (Southern States.)

——— White, Cat. Crust. Brit. Mus., XXV, 1847, p. 38. United States (Say's material).

Description.—Carapace quadrate, surface rather evenly convex or rolling up from in front to hind edge. Front lateral edge of carapace very slightly convex and hind lateral edge very slightly concave. Slight notch close below anterior terminal angle of lateral edge. Carapace surface finely punctate, and along lateral portions, or branchial regions, some rather irregular oblique series of minute beadings, each with very short hairs. Front very broad, slightly deflexed with median edge a little concave. Orbits moderately small, deep.

Eyes globular, slightly smaller than peduncle. Antennules robust, a little longer than short antennæ, and two basal joints forming peduncle about equal. Antennæ attenuated, basal joint largest. Outer maxillipeds moderately broad, merus longer than broad, and piliferous ridge extends obliquely inward from outer edge of ischium across merus to its anterior inner edge. Lateral regions of body above articulations of legs with even series, longitudinally and transversely, of short even hairs. Chelipeds about equal, rather large and robust. Fingers robust, slightly compressed, approximate only at tips, which about even. Cutting-edges with rather obsolete tubercles, upper series as small uniform row with one slightly enlarged at each end, and lower series with several tubercles somewhat or irregularly enlarged. Row of several small tubercles on upper edge basally of dactyl. Inner surface of palm with cluster of somewhat large tubercles on convexity near middle, rest of surface more or less granular. Outer surface of palm finely punctate. Carpus and merus with short irregular series transversely, often broken and quite short, of minute bead-like tubercles. Merus robust, front edge with about five very indistinct spines. Ambulatory legs with dactyls sharply pointed, all joints well compressed, and merus joints of each with distinct short series of tubercles as on meri of chelipeds. Dactylus, propodus and carpus all more or less hairy and velvety. Post-abdomen in male rather elongately bell-shaped.

Color (in alcohol) warm brownish on carapace, mostly uniform. All limbs more reddish-brown, chelipeds pale or pinkish below. Lower surface of body and other legs pale. Length of carapace 23 mm., width 28 mm.

Remarks.—This crab has been found at Absecon and Cape May (W. Zantlinger). The example described above was secured at Cape May, in 1904, by Mr. H. L. Viereck. Along the Atlantic coast of the United States the species ranges southward from Massachusetts to Florida. Previously in New Jersey it has been recorded only from Absecon and Great Egg Harbor. It is sometimes associated with *Uca pugar*, living in holes like the latter. The holes, of course, are much larger, being an

inch or more in diameter, and not so numerous as those of the *Uca*. It can pinch, however, quite effectively with the large chelipeds, unlike *Uca*, though it is less active in its movements.

I have examined Say's type, of which only the imperfect dried carapace remains. It is labeled from New Jersey. Besides this is also a dried example from Dennis Creek, obtained many years ago.

Genus **PLANES** Bowdich.

The Gulf-weed Crabs.

*Planes*¹ (Leach) Bowdich, Excursion to Madeira, 1825, p. 15. Type *Planes clypeatus* Bowdich, monotypic.

Nautilograpsus Milne-Edwards, Hist. Nat. Crust., II, 1837, p. 89. Type *Cancer minutus* Linnæus, monotypic.

Carapace subquadrate, with postero-lateral margins somewhat convergent, dorsally smooth and slightly convex, and usually with slightly indicated lateral postorbital tooth. Front broad, usually about half width of carapace, and anterior margin slightly projecting and nearly straight. Orbits small, margins entire or with only very small notch beneath eye-peduncles near exterior orbital tooth. Epistoma short, broadly transverse. Longitudinal ridges of endostome distinct and well defined. Post-abdomen in male distinctly seven-jointed, its basal segments occupying whole width of sternum between coxæ of ambulatory legs. Eye-peduncles short and thick. Antennules transversely plicated. Basal joint of antennæ short and robust, produced to edge antero-external of orbit, flagellum short. Exterior maxillipeds have rhomboidal gape, merus joints distally truncated and their anterior margins even slightly concave, and carpal joints articulated near rounded antero-external angles of merus joints. Chelipeds (in adult males) rather robust, subequal, of moderate size, merus trigonous, with anterior margins dentated, carpi with tooth or spine on interior margins, palms somewhat turgid and rounded above, and

¹Also used by Rondani 1864, and Saussure 1883, in Insects.

distally acute fingers dentated on interior margins. Ambulatory legs short, joints compressed and (merus joints especially) somewhat dilated, penultimate joints ciliated on superior margins, and with spinuliferous inferior margins, and short spinuliferous dactyli compressed.

Probably a single world-wide species, living on floating weed in temperate and tropical seas.

Planes minutus (Linnæus).

PLATES 140 AND 141.

Gulf-weed Crab.

Cancer minutus Linnæus, Syst. Nat., Ed. X, 1758, p. 625. *Pelagic, living in fucus.*

Grapsus minutus Latreille, Hist. Nat. Crust., VI, 1803, p. 68. The Ocean, in fucus.

Nautilograpsus minutus Milne-Edwards, Hist. Nat. Crust., III, 1837, p. 90. High seas.

— De Kay, N. Y. Fauna, Crust., VI, 1844, p. 15. Off New York harbor.

— Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850 (1851), p. 182. Gulf Stream from Gulf of Mexico to New York.

— Stimpson, Proc. Acad. Nat. Sci. Phila., 1858, p. 103. In North Atlantic Ocean, common in Sargassum.

— S. I. Smith and O. Harger, Trans. Conn. Acad., III, 1874, p. 26. N. Lat. 41°, W. Long. 65°.

— Kingsley, Proc. Acad. Nat. Sci. Phila., 1880, p. 202. Gulf Stream, mundane.

— Heilprin, Proc. Acad. Nat. Sci. Phila., 1888, p. 320. (Shelly Bay, Bermuda.)

— Howe, Bull. U. S. F. Com., XIX, 1899 (1901), p. 240. N. Lat. 39°–40°, W. Long. 70°, at the surface.

Planes minutus White, List Crust. Brit. Mus., 1847, p. 42. Gulf of Florida and Atlantic Ocean.

Grapsus cinereus (nec Bosc) Say, Journ. Acad. Nat. Sci., I, 1817, p. 99. Gulf Stream.

Description.—Carapace quadrate, surface rather evenly convex, front lateral edge slightly convex, also slightly converging posteriorly, and with notch short space below anterior terminal angle, which sharp and triangular, though not projecting far beyond hind edge of orbit. Surface of carapace with very indistinct hollow broken transverse plicæ, becoming oblique on

branchial region. Front broad, slightly deflexed, with median edge slightly concave. Orbits rather small and deep.

Eyes globular, little smaller than stout peduncle. Antennules robust, much longer than short antennæ, and two basal joints forming peduncle subequal. Antennæ greatly attenuated, basal joint largest. Outer maxillipeds broad, merus much wider than long. Left cheliped larger, moderate in size, fingers large and rather conic. Dactyl curved down and over at tip of pollex, in male, with a series of rather strong tubercles along cutting-edge of which several basally enlarged. Pollex with series of rather large tubercles, also an enlarged median tubercle or tooth. Palm smooth, rather robustly convex, and inner surface with transverse plicæ, though these rather indistinct, except towards carpus. Latter moderate, surface convex, with transverse plicæ, and rounded tubercle at inner angle. Merus robust, front edge with several spines, about four distinctly developed, upper and lateral surfaces with transverse plicæ, and lower surface smooth. Right cheliped with joints more or less smooth, only merus with traces of transverse plicæ, and tubercles along edges of dactyl, and pollex rather small and obsolete. Female with chelipeds similar to those of male, only correspondingly much smaller. Ambulatory legs with dactyls sharply pointed, all joints well compressed and merus-joints of each with distinct transverse plicæ. Dactylus, propodus and carpus with more or less hairs, especially along posterior edges. Post-abdomen in female twice as long as in male.

Color (in alcohol) largely warm brownish above, variegated with deeper or chestnut-brown streaks. Eyes dusky or blackish. Lower surface of body and legs all pale brown, much lighter than dorsal surface. Legs brown above, mottled on upper portions, especially of meral joints, with darker. Length of carapace 17 mm., width 16 mm.

Remarks.—A species evidently of world-wide distribution, living in the open sea in the Gulf weed. In the Gulf Stream it has been recorded as far north as 41° North Latitude. Before it had not been noticed in New Jersey waters. My specimens are a male, and female with ova, secured at Cape May on Sep-

tember 20th, 1904, by Mr. H. L. Viereck. These examples closely resemble *Pachygrapsus transversus* in the outer faces of the maxillipeds, but differ at once in the quadrate carapace. From *Sesarma reticulatum* they differ at once in having the maxillipeds with smooth surfaces, *Sesarma* having a piliferous ridge crossing the merus and ischium on their external faces. Mr. Viereck tells me that these specimens, as far as he can recollect, were picked up on the beach, doubtless waifs from some more tropical region. This addition to the fauna of New Jersey is, therefore, of interest.

Family OCYPODIDÆ.

The Ghost Crabs.

Carapace generally moderately convex, either cancrroid or trapezoidal, with antero-lateral edges straight or arcuate, branchial regions not generally dilated. Front of moderate width or very narrow. Orbits and eye-stalks of moderate size or greatly developed. Chelipeds in adult male generally of moderate size, sometimes slender and elongate. Seventh joint in walking legs styliform, without strong spines. Pleon not always covering whole width of sternum between last pair of legs.

Crabs inhabiting our sandy beaches, or muddy or marshy flats near the sea.

Key to the genera.

- | | |
|---|---------|
| a. Eye-stalks slender; chelæ in male extremely unequal. | UCA |
| aa. Eye-stalks stout; chelæ in male somewhat unequal. | OCYPODE |

Genus *Uca* Leach.

The Fiddler Crabs.

- Uca* Leach, Edinb. Encycl., VII, 1814, p. 430. Type *Ocyroda heterochelos* Lamarck. (Not consulted.) This, however, designated by M. J. Rathbun, Ann. Inst. Jamaica, I, 1897, p. 28.
- Gelasimus* (Buffon) Latreille, Nouv. Dict. Hist. Nat., XII, 1817, p. 517. Type *Ocyroda maracoani* Latreille, first species.

Orbits extending all along front edge of carapace on either side of comparatively narrow front. Eye-stalks long and slender. Chelipeds in adult male strikingly unequal, in female small and equal.

The fiddler crabs may be distinguished by the modified claw of the male, it being much larger than the other. Many species have been described, most of which burrow in sandy beaches or flats, muddy banks of streams and ditches in the salt marshes, and one species (*Uca minax*) extends up rivers quite into fresh waters.

Key to the species.

- a. Inner surface of palm of large cheliped without an oblique ridge. *pugilator*
- aa. Inner surface of palm of large cheliped with an oblique ridge.
- b. Front between eyes very shallow and broad; claws with red spots at articulations. *minax*
- bb. Front between eyes very narrow, its sides oblique; claws without red. *pugnax*

Uca pugilator (Bosc).

PLATES 142 and 143.

Fiddler Crab.

- Ocyroda pugilator* Bosc, Hist. Nat. Crust., I, 1802, p. 197. *Carolina*.
- Ocyrode pugilator* Latreille, Hist. Nat. Crust., VI, 1803, p. 47 (on Bosc).
- Say, Journ. Acad. Nat. Sci. Phila., I, 1817, pp. 71, 443 (note).
- Gelasimus pugilator* Latreille, Nouvelle Dict. Hist. Nat., XII, 1817, p. 519. *Carolina*.
- Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 149. Absecon and Great Egg Harbor, N. J.
- Stimpson, Ann. Lyc. N. Hist. N. Y., VII, 1860, p. 62. *Virginia*.
- S. I. Smith, Trans. Conn. Acad., II, 1870, p. 136, Pl. 4, fig. 7. *Gulf States to Massachusetts*.
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 336. *Sandy beaches near high water*.
- S. I. Smith, Rep. U. S. F. Com., 1871-72 (1873), p. 545. *Cape Cod to Florida*.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 322. *Cape Cod to Florida*.

- Uhler, Ches. Zool. Lab. J. Hopkins Univ., I, 1878, p. 25. Ft. Monroe, Va.
- S. I. Smith, Trans. Conn. Acad., V, 1879, p. 33. Massachusetts to Florida.
- Kingsley, l. c., 1880, p. 150. Greenpoint, Long Island; New Jersey.
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 763. Cape Cod to Florida.
- Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, N. J.
- Young, Stalk-Eyed Crust. W. Indies, 1900, p. 274. Boston Harbor to Cayenne.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1905), p. 147, fig. 16c. New York City.
- Gelasimus pugillator* Kingsley, Standard Nat. Hist., II, 1884, p. 65, fig. 81. Our coasts.
- Uca pugilator* M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 585, figs. 3-4. Cape Cod to Gulf of Mexico.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 2. Boston harbor and southward.
- Mayer, Sea Shore Life, 1906, p. 107. Cape Cod to Florida.
- ?*Ocyropa pusilla* Rafinesque, Amer. Month. Mag. Crit. Rev., II, Nov. 1818, p. 42. Salt marshes and south shores of Long Island.
- Gelasimus vocans* (nec Linnaeus 1766) De Kay, N. Y. Fauna, Crust., VI, 1844, p. 14, Pl. 6, fig. 9. Whole Atlantic coast far as Cape Cod. (Part.)
- White, Cat. Crust. Brit. Mus., XXV, 1847, p. 36. North America (Say's material).

Description.—Carapace broad, surface smooth, with dorsal furrows usually distinctly deeper than in other two species, and contour narrows moderately to hind edge. Front lateral angles of carapace sloping convexly outwards, ridges well defined and distinct. As seen from above supraorbital plate nearly vertical and little in view. Supraorbital plate narrow, surface slightly convex, and greatest width a little outside eye-stalk bases. Lower edge of supraorbital plate minutely granular, and inferiorly hairy. Front narrow, surface convex with slight median depression evident, and where extending forward between eye-stalks with edge rather evenly convex. Lateral edges of front widely convex, then abruptly concave and turned slightly forward in broad external angle. Lower orbital edge with series of large truncate tubercles, with those external somewhat enlarged. Lower surface of body anterior to chelipeds, and lateral regions above ambulatory legs, greatly villose in both sexes.

Antennules short, slender, three-jointed. Antennæ with large basal joint of peduncle, inner edge hairy, second joint equally long, though much more slender, and slender third joint smallest. Flagellum slender, attenuated, a little shorter than peduncle. Maxillipeds conceal buccal mass, and rather oblong in form as retracted. Chelipeds either dextral or sinistral in their enlargement. Adult or full-grown males with long, slender fingers, dactyl about two-thirds length of propodus. Propodus with lower edge usually very slightly double convex, and pollex curved slightly up distally. Dactylus with its tip extending to and usually over tip of pollex. Tubercles on inner edges of fingers usually sub-equal, though sometimes somewhat or slightly irregular, or alternating. About middle of pollex along inner edge, and usually near tip along same edge, an enlarged or conspicuous tubercle, also sometimes additional ones. Frequently several tubercles on inner edge of dactyl basally also enlarged more or less. Dactyl nearly smooth, or mostly at best minutely granular dorsally at base, and groove longitudinally at same place often short and variably obsolete. Palm with outer dorsal surface tuberculate, tubercles becoming smaller over median area, and very minute below. Upper and lower edges of palms externally with ridges made up of minute tubercles. Inner surface of palm with smooth ridge extending slightly up and forward, its terminus not defined, and no other ridges on this region, its area tuberculous, though tubercles smaller or region of lower posterior bevelled surface granular. No distinct superior ridge issuing from inner carpal cavity, though surface tuberculous. Though inner edge of palm close to articulation of dactylus granulated and with small tubercles, usually none of latter arranged in distinct series. Internally and continued forward on inner edge of pollex its entire length, a series of rather conspicuous tubercles, most enlarged at the bend below articulation of dactylus. Inner surfaces of fingers smooth. Merus and carpus long, granulated on outer surfaces, smooth on inner. Smaller cheliped elongate, fingers two-thirds length of propodus, and touching at tips. Ambulatory feet of second pair longest, and all rather less villose than in our other species. Legs of females but little less villose than those of males.

Abdominal segments in female two and one-half times broader than in male.

Color with carapace largely olivaceous above, paler below. Large chelipeds often olive tinted, pale, pinkish, brownish or yellowish on fingers. Legs brownish, spotted or dotted with darker, and become paler on dactyls. Eye-stalks brown, eyes darker. Abdominal segments pale brown, often dotted with darker. Length of carapace 16 mm., width 22 mm.

Remarks.—Distributed from Cape Cod to the Gulf of Mexico. It lives along our sandy beaches near high-water mark, usually in somewhat sheltered locations and where the sand is compact or rather hardened. Great numbers are sometimes met with in favored localities. They live in burrows or holes, which they dig in the sand. The holes are dug by carrying up little pellets of moist sand, and running several feet from the burrow before they drop it. Before proceeding back to their burrow they usually pause a short time as if to apprehend danger, then run back to the burrow, and after giving a last look about, disappear in the hole. Their work is carried on at all favorable hours of the day or night, according to the weather and as the tide is out. The colonies of these animals are quite interesting, the little creatures moving about actively over the sand sidewise, suddenly halting and retracing their steps as any disturbance may require, or others may be seen looking out cautiously from their burrows. Sometimes these communities extend for several acres. The diameter of the burrow is usually small, or just enough to admit the body of the crab. They extend down a foot or more in a vertical direction, and become more or less horizontal with an excavation at the lower end. Often if the under strata of soil, or that below the sand is dark or black, the pellets carried up from the burrows form in contrast to the general pale surroundings. When leaving the burrow the male usually emerges with the large cheliped folded and forward. According to Prof. S. I. Smith it is a vegetarian, feeding upon the minute algæ which grow upon the moist sand. The males use only the small claw in feeding, picking up the bits of algæ very daintily. The

females use either of their small claws indifferently for this purpose. More or less sand is also always swallowed with the food. The crabs have also been seen engaged in scraping up the surface of the sand where their favorite algæ was covered, and this was formed into pellets and carried into their holes, in the same way that the sand was brought out. This was thought to be stored until needed for food, for large quantities were often found stored in the terminal chambers of the burrows.

In New Jersey I have seen it at a number of places, as Cape May, Ocean City, Atlantic City and Sea Isle City. The specimens before me are from Cape May, Atlantic City and the southern side of Townsend's Inlet. I also found it abundant at Lewes in Delaware, and Chincoteague in Virginia. Mr. W. T. Davis found it at Center Island in Oyster Bay, Long Island, N. Y.

Uca minax (Le Conte).

PLATES 144 AND 145.

Red-jointed Fiddler Crab. Fiddler Crab.

- Gelasimus minax* Le Conte, Proc. Acad. Nat. Sci. Phila., VII, 1855, p. 403. *Beesley's Point, New Jersey.*
- Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 149. Great Egg Harbor and Dennis Creek, Cape May County, New Jersey.
- S. I. Smith, Trans. Conn. Acad., II, 1870, p. 128, Pl. 2, fig. 4. Pl. 4, figs. 1-1b. Connecticut, New Jersey, South Carolina, Florida.
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 467 (note on habits).
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 545. Southern New England to Florida.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 321. New Haven to Florida.
- Kingsley, l. c., 1879, p. 399. Northampton Co., Va.
- Kingsley, l. c., 1880, p. 148. Beesley's Point and Dennis Creek, New Jersey; Virginia.
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 763. Southern New England to Florida.
- Heilprin, An. Life of Our Sea Shore, 1888, p. 84. New Jersey coast and southern Long Island.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1905), p. 147, fig. 16b. New York City.

- Uca minax* M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 585. Cape Cod to Gulf of Mexico.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 2. Connecticut.
- Mayer, Sea Shore Life, 1906, p. 107. Southern New England to Florida.
- Uca sp.* Fowler, Proc. Acad. Nat. Sci. Phila., 1911, p. 3. Armstrong's Creek, Newcastle Co., Delaware.

Description.—Carapace broad, surface rather evenly and noticeably convex, smooth, narrowing moderately to posterior edge. Anterior lateral angles of carapace slope convexly outwards, ridges well defined and distinct. As seen from above supraorbital plate almost vertical, and scarcely or not visible. Supraorbital plate narrow, surface a little convex, and greatest width a little external to bases of eye-stalks. Lower margin of supraorbital plate minutely granulated, and inferiorly hairy. Front broad, surface nearly evenly convex, scarcely any median depression evident above, and where extending forward between eye-stalks with outline broadly convex. Lateral edges of front widely convex, then abruptly concave and turned forward in pronounced though rather broad external angle. Lower orbital edge with series of large truncate tubercles, of which external ones somewhat enlarged. Lower surface of body anterior to chelipeds, and lateral regions above ambulatory legs, greatly villose in both sexes.

Antennules small, three-jointed, robust. Antennæ with large basal joint to peduncle, inner edge villose, and other two joints slender, with second larger, about equal to basal, in width. Flagellum slender, attenuated, shorter than peduncle. Maxillipeds conceal buccal mass, of oblong form when retracted. Left chelipeds usually larger, though right ones often so, quite robust and enlarged. Full-grown or large males with very long slender finger, dactyl being three-fourths length of propodus while in smaller ones dactyl about three-fifths length of robust propodus. Propodus with lower edge variously sinuate, and pollex curved slightly up distally. Dactylus with its tip extending to and usually over tip of pollex. Tubercles on inner edges of fingers usually subequal, seldom

alternating, though sometimes with quite irregular appearance. About middle of pollex along inner edge, and often also near tip along same edge, an enlarged or slightly elevated tubercle. Often several enlarged tubercles on inner edge of dactyl basally, and nearly smooth or very slightly roughened or granular along base dorsally, though very short or obsolete longitudinal groove variable. Palm with outer dorsal surface coarsely tuberculate or rugose, at least over most of upper half, more granular over median area, and minutely granular to obsolete or smooth below. Upper and lower edges of palms externally with ridges, of which former better defined and formed of larger wide-spaced tubercles. Inner surface of palm with smooth broad ridge extending forward toward dactyl, but as it turns down toward lower basal edge of pollex strongly marked by irregular large tubercles, especially about angle. Series of small tubercles extending along upper edges of inner carpal cavity in slightly curved line. Along inner edge of palm at articulation of dactylus series of small tubercles. Internally and extending down on inner edge of pollex, along latter of which it also continues forward more or less, a series of rather enlarged tubercles, most conspicuous just below articulation of dactylus. Inner surfaces of fingers smooth. Upper anterior inner portion of palm largely tuberculate, though below it, and also below strongly marked obliquely tuberculate ridge, smooth. Merus and carpus long, rough or tuberculated on outer surfaces, and smooth on inner. Smaller cheliped elongate, fingers a little longer than palm, also touching tips. Ambulatory feet with second pair of feet longest, and all feet more or less hairy in males, less so in females. Abdominal segments in females two and one-half times wider than in male.

Color mostly olive, paler or more or less brownish below. Chelipeds of large development, often grayish or yellowish to olive, and distinct red spots on processes at articulations, very distinct in males. Feet olivaceous basally and become brownish distally. Length of carapace 18 mm., width 25 mm.

Remarks.—Distributed along our coastwise streams from Cape Cod to Florida. According to Verrill it lives on the marshes farther up the estuaries than the other species, as along

the mouths of rivers and brooks, and extends up even to places where the water is quite fresh. It usually reaches a large size and is marked with red at the joints of the chelipeds. It is a vegetarian, feeding on the algæ which grow in muddy salt-marshes. This is often a minute-green algaoid plant covering the surface of the mud. The male uses its small claw exclusively in obtaining its food and conveying it to the mouth. The female uses either of her small ones indifferently. In enlarging its burrows the crabs were seen to scrape off the mud from the inside by means of the claws of the ambulatory legs, and having formed the mud into a pellet, pushed it up out of the hole by means of the elbow-joint at the base of the great claw, when this is folded down. The crab was also found to construct a regular oven-like arch of mud over the mouth of its burrow. This archway is horizontal and large enough to contain the crab, who quietly sits in this curious doorway on the outlook for his enemies of all kinds.

This species is the only one found in or about our lower fresh water tidal regions, though it ranges down to perfectly brackish water and is sometimes found associated with *Uca pugnax*. The burrows are much larger than those made by the latter, often reaching two inches or less in diameter. They are very tenacious and active animals. In New Jersey I have as yet only met with it in the tributaries of Delaware Bay, especially along the banks of Dennis Creek, in Cape May county, near South Dennis. It was also secured at Beesley's Point by S. Ashmeade. I have found it in fresh-water tributaries of the Delaware river just below Newcastle, in the state of Delaware, which seems to be its uppermost range in that river-basin.

Mr. W. T. Davis found it at Dennisville, N. J., on September 5th, 1908, in considerable numbers. He also says that he has found it on several occasions in the meadows along Staten Island Sound side of Staten Island, N. Y. Mr. Alanson Skinner found examples at Watchogue on Staten Island in July, 1907.

Leidy's examples from Dennis Creek, now dried, are among the largest specimens I have seen.

Uca pugnax (S. I. Smith).

PLATES 146 AND 147.

Marsh Fiddler Crab. Fiddler Crab.

- Gelasimus pugnax* S. I. Smith, Trans. Conn. Acad. Sci., II, 1870, p. 131, Pl. 2, fig. 1, Pl. 4, figs. 2-2d. *New Haven, Connecticut; St. Augustine, Florida; Bahamas; Hayti.*
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 545. Cape Cod to West Indies.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 322. Cape Cod to Florida and West Indies.
- S. I. Smith, Trans. Conn. Acad., V, 1879, p. 33. Massachusetts to Florida and Hayti.
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 763. Cape Cod to West Indies.
- Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, N. J.
- Paulmier, 58 An. Rep. N. Y. State Mus., IV, 1904 (1905), p. 147, fig. 16a. New York City.
- Uca pugnax* M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 585. Cape Cod to Gulf of Mexico.
- M. J. Rathbun, Occas. Papers Boston Soc. Nat. Hist., VII, 1905, p. 1. Massachusetts southward.
- Mayer, Sea Shore Life, 1906, p. 107, fig. 74. Massachusetts to Georgia.
- ?*Cancer vocator* Herbst, Nat. Krab. Krebs., III, 1804, p. 1, Pl. 59, fig. 1. *America.*
- Gelasimus vocator* Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 400. Northampton Co., Virginia, to Florida.
- Kingsley, l. c., 1880, p. 147. Cape Cod to Pará.
- Heilprin, An. Life of Our Sea Shore, 1888, p. 84, fig. New Jersey, coast and southern Long Island.
- Ortmann, Zoöl. Jahrb. Syst., VII, 1894, p. 757. Wood's Holl, Florida and Hayti.
- Young, Stalk-Eyed Crust. W. Indies, 1900, p. 272. Cape Cod to Brazil.
- Gelasimus vocans* (nec Linnæus, 1766) Milne-Edwards, Hist. Nat. Crust., II, 1837, p. 54. (Brazil.)
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 14, Pl. 6, fig. 10. Whole Atlantic coast far as Cape Cod.
- Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850 (1851), p. 180. New York to Key West.
- Gelasimus pugilator* (nec Bosc) Le Conte, Proc. Acad. Nat. Sci. Phila., 1855, p. 403. Beesley's Point, N. J.
- Gelasimus palustris* Stimpson, Ann. Lyc. N. Hist. N. Y., VII, 1860, p. 62. Old Point Comfort, Potomac River and New Jersey.
- S. I. Smith, Trans. Conn. Acad., II, 1870, p. 127. New Jersey.

Description.—Carapace quite broad, surface well convex and smooth, narrowing moderately to hind edge. Anterior lateral angles of carapace slope vertically inwards, ridges quite distinct and well defined. As viewed above supraorbital plate almost vertical and not visible. Supraorbital plate narrow, slightly convex over surface, widest slightly external to base of eye-stalks. Lower edge of supraorbital plate finely granulated, and inferiorly hairy. Front narrow, with slight median transverse depression above where extending forward between eye-stalks and with outline rather evenly convex. Lateral margins of front slightly convex and concave, ending externally in sharp lateral angle. Lower orbital edge with series of large truncate tubercles, and external ones a little enlarged. Lower surface of body anterior to chelipeds, also lateral regions above ambulatory legs, quite villose in males.

Antennules small. Antennæ with rather enlarged basal joint in peduncle, its hind edge hairy. Other two joints in peduncle of antennæ more slender than basal joint and second longer, about equals basal joint. Flagellum short, tapers to slender point, little shorter than peduncle. Maxillipeds cover buccal mass, oblong in shape as retracted. Left cheliped usually larger, though right frequently so, heavy and elongate. Males when full-grown with very long fingers, these about two-thirds length of propodus, latter with lower edge somewhat sinuous, and pollex straight distally. Dactylus with its tip extending to and usually over tip of pollex. Tubercles on inner edges of fingers usually subequal, sometimes alternating with larger or smaller ones more or less uniformly in same series, and never conspicuously irregular. About middle of pollex, along inner edge, one or several slightly enlarged tubercles. Often several slightly enlarged tubercles on inner edge of dactyl basally, and very slightly roughened or granular along base dorsally, though very short variable longitudinal groove obsolete. Palm with outer dorsal surface rather coarsely tuberculate and granular, at least over most of upper half, and granules becoming minute and finely obsolete below. Upper and lower edges of palms externally with well-defined ridges. Inner surface of palm with

superior strong ridge, at first smooth, but where it turns down toward lower basal edge of pollex strongly set off by irregular large tubercles. Series of small tubercles extend along upper edge of inner carpal cavity in slightly curved row. Along inner edge of palm at articulation of dactylus series of small tubercles, internal to it and extending down on inner edge of pollex, along latter of which it also continues to tip, series of large distinct tubercles, most conspicuous or enlarged just below articulation of dactylus. Inner surfaces of fingers mostly smooth. Upper anterior portion of palm wide, largely tuberculate, and below oblique ridge granular for short area, while still inferior bevelled surface largely smooth. Merus and carpus elongated, roughened on outer surfaces and more or less smooth on inner, no spines along edges. Smaller cheliped elongate, fingers slightly longer than palm and touching at tips. Ambulatory feet of second pair longest, and with outer joints more hairy in males. Abdominal segments in female two and one-half times wider than in male.

Color olivaceous largely above or on carapace. Eye-stalks olive, with eyes dusky. Feet all leaden-olive, becoming pale brownish on distal joints. Enlarged cheliped brownish, pale or darker, often with olive or buff tints. Length of carapace 16 mm., breadth 24 mm.

Remarks.—This species is distributed, like our others, along the Atlantic Coast of the United States, from Cape Cod to the Gulf of Mexico. This is a very common species, living along the banks of our salt-water ditches, which places are often found more or less honeycombed by their burrows. The burrows vary in size and length, though they are generally well short of an inch in diameter, while the depth may be two feet or over. When leaving the burrows, as at low-water, they often move like an army, and if disturbed quicken their movements in their eagerness to get into the shelter of their holes.

I have met with it at Point Pleasant, Great Bay, Absecon, Atlantic City, Spray Beach on Long Island, Ocean City, Corson's Inlet, Sea Isle City, Townsend's Inlet, Stone Harbor, Grassy Sound, Cape May and Dias Creek. From many of

these places series of specimens were taken. I also found it at Lewes in Delaware, and at Chincoteague in Virginia. It sometimes occurs associated with *Uca pugilator*. Mr. W. T. Davis says it is common along all of the meadow creeks of Staten Island, N. Y.

Genus OCYPODE Fabricius.

The Ghost Crabs.

Ocypode Fabricius, Entom. Syst. Suppl., 1798, pp. 312, 347. Type *Cancer ceratophthalmus* Pallas, first species.

Ocypoda, *Ocypete*, auct.

Monolepis Say, Journ. Acad. Nat. Sci. Phila., I, 1817, p. 155. Type *Monolepis inermis* Say, first species.

Orbits very large and open, extending all along front edge on either side of narrow and deflexed front. Eye-stalks large, and large corneæ covering much of lower surface of this terminal joint. Chelipeds in adult male unequal and well developed, palm with vertical series of short raised lines or tubercles on inner surface which form stridulating ridge.

Crabs living on sandy beaches, where they dig holes in the sand, though occasionally retreat to the water when disturbed. They are protected by their very swift movements and their coloration closely resembling that of the sand.

Ocypode albicans (Bosc).

PLATES 148 AND 149.

Ghost Crab.

Ocypoda albicans Bosc, Hist. Nat. Crust., I, 1802, p. 196 (nec Pl. 4, fig. 1).
Carolina coast.

Ocypode albicans Latreille, Hist. Nat. Crust., VI, 1803, p. 48. *Carolina.*

—— M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 585, figs. 1-2 (carapace and chela). Cape Cod to Gulf of Mexico.

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 1. Massachusetts and Rhode Island.

—— Fowler, Proc. Acad. Nat. Sci. Phila., 1911, p. 3. Beaches of Delaware.

- Ocyhode arenarius* Say, Journ. Acad. Nat. Sci. Phila., I, 1817, p. 69. *Inhabits sandy beaches of the sea, in holes of considerable depth.*
- Leidy, Journ. Acad. Nat. Sci. Phila., (2) III, 1855, p. 149. Great Egg Harbor, New Jersey.
- Ocyhode arenaria* White, Cat. Crust. Brit. Mus., XXV, 1845, p. 34. Georgia (Say's material).
- Young, Stalk-Eyed Crust. W. Indies, 1900, p. 267. United States to Rio Janeiro.
- Ocyhoda arenaria* Milne-Edwards, Hist. Nat. Crust., II, 1837, p. 44, Pl. 19, figs. 13-14. North America.
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 13. South Carolina and Florida.
- Gibbes, Proc. Acad. Nat. Sci. Phila., 1850, p. 24 (name only, Philadelphia collection).
- Guerin, Hist. N. Cuba, Crust., 1857, p. 7. North America.
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 337. Fire Island, Block Island and Great Egg Harbor.
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 535. Fire Island and Block Island; p. 545, New Jersey and southward.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 322. Long Island and southward.
- Uhler, Ches. Z. Lab. J. Hopkins Univ., I, 1878, p. 25. Ft. Monroe, Va.
- Leidy, Proc. Acad. Nat. Sci. Phila., 1878, p. 337. Ocean Grove, N. J.
- Kingsley, l. c., 1879, p. 400. Beach opposite Ft. Monroe, Va.
- Kingsley, l. c., 1880, p. 184. Great Egg Harbor to Rio Janeiro.
- Miers, Ann. Mag. Nat. Hist. London, (5) X, 1882, p. 384, Pl. 17, figs. 7, 7a, 7b. Eastern U. S.
- Kingsley, Standard Nat. Hist., II, 1884, p. 65. Our coasts.
- Heilprin, An. Life of Our Sea Shore, 1888, p. 87. New Jersey coast.
- Leidy, Proc. Acad. Nat. Sci. Phila., 1888, p. 333. Beach Haven, N. J.
- Mayer, Sea Shore Life, 1906, p. 105, fig. 73. Brazil to New Jersey.
- Ocyhoda quadrata* S. I. Smith, Trans. Conn. Acad. Sci., IV, 1880, p. 254. New Jersey. Megalops in Long Island and Vineyard Sounds.
- Monolepis inermis* Say, Journ. Acad. Nat. Sci. Phila., I, 1817, p. 157. *Eastern Shore of Maryland.*
- Milne-Edwards, Hist. Nat. Crust., II, 1837, p. 264. Maryland.
- White, List. Crust. Brit. Mus., 1847, p. 65. Maryland. (Say's material.)
- Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850, p. 192. In *Thynnus vulgaris* from between New York and Charleston.
- S. I. Smith, Amer. Journ. Sci. Art., (3) VI, 1873, p. 67. Fire Island Beach, Long Island.

Description.—Carapace as seen above of oblong contour, thick, surface finely granulated medianly and posteriorly, becoming coarsely granulated towards sides, and with front lateral angles acute. Front edge of carapace double-concave, with each

outer concavity a little larger and more shallow than inner, and rather narrow median projection prominently curving down. Lateral superior ridges of carapace only very slightly approximating posteriorly. Anteriorly each lateral ridge of carapace sends down an inferior less prominent ridge on side of body toward base of third pair of ambulatory legs. Area this encloses above rather coarsely granulated, and region below it smooth. Body in lateral profile nearly evenly ellipsoid with deepest part about two-thirds width of carapace. Eye-socket elongate, deeply concave, smooth, and lower edge evenly and rather finely granulated. Area between this and chela all rather coarsely granulated. Eyes rounded convexly at ends, tapering slightly narrowly at bases of stalks. Buccal cavity a little narrower above, posterior width about equals its length, and entirely covered by outer maxillipeds. Chelæ not longer than last pair of legs, left much more developed, merus larger and tubercular, and lower outer edges of subbasal joint rather coarsely tuberculated or serrated. First three pairs of ambulatory legs subequally longer than fourth pair, and second pair longest of all. All well compressed, roughened somewhat along upper edges, upper surfaces somewhat rugose or uneven, and all edges more or less with rather long pale brown hairs, forming fringe-like appearance. Telson of six free segments of which fifth deepest, fourth widest, and sixth smallest. Four pairs of concealed slender bifurcated appendages below each side. Color in life pale sandy-brown. In alcohol the eyes become blackish, the telson olive, the tissues connecting basal articulations of ambulatory legs rather deep brownish and chelæ and maxillipeds tinged with pale bluish. Length of carapace 35 mm., width 41 mm.

Remarks.—The Ghost Crab is abundant along most of the sandy shores of the sea. In New Jersey I have observed it at Seaside Park, Atlantic City, Somer's Point, Ocean City, Beesley's Point, Corson's Inlet, Sea Isle City, Avalon, Peermont, Stone Harbor, Anglesea, Wildwood and Cape May. Mr. W. T. Davis found small examples at Manasquan on September 23d, 1906. About Cape May I have also seen it near

Cape May Point, though not up the shores of Delaware Bay. It inhabits the broad sandy beaches and sand dunes, living in holes. These holes or burrows are often well above the tide, and may be found scattered here and there, either in level places or sometimes in declivous places where the sands have drifted. Thus they may be located either where the flattened and hardened wet portion of the beach is continually bathed with the tides, or up among the loose dry sand among the tough beach grass. Frequently, in the latter locations, I have found that they have well-worn runways. On the open beaches their recent travels may often be traced by the tracks they make, these radiating in all directions from their burrow. The holes are made or dug, to a corresponding size of the individual, and thus one finds the little crabs have quite small burrows while those of large crabs are quite pretentious. These burrows remind one somewhat of a prairie dog colony, only they are more scattered and spread over a greater area in proportion to the size of the animals. The aperture of the burrow of a large crab will be sometimes about two inches in diameter, and as the animal throws out the sand in all directions, it is sometimes quite conspicuous. When digging the sand is thrown out suddenly, and if windy may be blown about in any direction. I have never seen any of the large crabs with burrow down on the wet portion of the beach where the tides flow, though the young are often abundant there.

The Ghost Crab is the most active and vigilant, perhaps, of all our crustaceans. In its movements it is also swift, agile and deliberate, scurrying over the sands with great swiftness if pursued. Sometimes when pursuing a large one I have seen them scamper in a straight line through a large and very shallow sheet of water, left by the tide, directly to their burrow. Again when intercepted in such a way they will usually make a short detour around the still shallower end of the "pond," especially if the latter is large. They appear always to make for their burrow if possible, though, if intercepted, will often use another burrow when available, or again scurry further away, sometimes hiding among the beach débris. To capture a large

Ghost Crab without a hand net or other contrivance, when on the run, provided it has a fair start is often rather difficult. So extremely vigilant is this species, that even when sitting quietly on the sand one is sure to set them scampering in all directions into their burrows should the slightest movement be made. As their coloration almost harmonizes with the sands in which they live, they would often be difficult to detect, if they remained perfectly quiet. Though the young ones do sometimes sink down, or in the sand in such fashion, the adults usually trust to their speed to escape.

The Ghost Crab is carnivorous in its habits of feeding, and quite a scavenger. I have frequently seen them feeding on fish offal, or where the viscera, heads and scales have been thrown out by the fishermen. They also feed on dead alewives, mossbunkers, hickory shad, or in fact most any dead fish washed up on the beach or to be found carried in among the débris. According to S. I. Smith they were found to feed largely on beach fleas (*Talitrus*), the crab remaining quiet and then suddenly springing upon its prey, similar to a cat capturing a mouse.

Say's example, dried, and labeled New Jersey, I have examined, besides another old example from Absecon.

South of New Jersey the Ghost Crab is also abundant along the shores of Delaware, where I found it at Lewes, Dewey and Rehoboth Beaches to Indian River Inlet. It is also very abundant on down to Ocean City in Maryland and I have met with it at Cedar Island, Chinoteague and Assateague Islands, and near Cape Charles in Virginia. Below it is also common about Ocean View near Norfolk and Virginia Beach.

A List of the Crustacea of New
Jersey,

Including the Adjacent Region or that of the
Middle Atlantic States.

(463)

A List of the Crustacea of New Jersey

Including the Adjacent Region or that of the Middle Atlantic States.

The present New Jersey crustacea fauna, while admittedly incompletely studied, as may be noted in the preceding pages, will inevitably have other and numerous accessions, both in genera and species, also likely in the higher groups as well. It is therefore of great use to have reference to those which belong to the zoölogical province, of which New Jersey forms an important part, of easy access. The references to these are scattered through a wide variety of publications, sometimes as special works, though mainly in transactions, journals or proceedings of scientific societies, government reports, etc. The plan followed is perhaps contrary to some, or perhaps the majority of writers, in beginning with the lower forms and proceeding to the higher. Those already treated are not duplicated, except by necessary captions to show their position. As in the preceding portion of this work references to the genera and species are given. The former include synonymy, with the type designated for each name, as far as can be determined. Under the species the original reference is always given with the type locality, besides all the references pertinent to the fauna of the Middle Atlantic States, and occasionally the few encountered for Virginia, have also been added. Under each species not included in the descriptive part of this work, the localities are summed up under their respective States, or as the case demands. The off-shore forms are also included, mostly within the limits of North Latitude 38° and 40° , and west of 70° West Longitude.

Order PHYLLOPODA.

Sub-Order BRANCHIOPODA.

Family LIMNADIDÆ.¹

Sub-Family LIMNETINÆ.

Genus LIMNETIS Loven.

Limnetis Loven, Konig. Vet. Ak. Handlig., 1845, p. 203, Pl. 4. Type *Limnetis wahlbergii* Loven, monotypic. (Not consulted.)

Hedessa Liévin, Neuest. Schrift. Naturf. Ges. Danz. (Branch. Danzig), IV, 1848, p. 4, Pl. 1-2. Type *Hedessa sieboldii* Liévin, monotypic.

Limnetis gouldii Baird.

Limnetis gouldii Baird, Ann. Mag. N. Hist. London, (3) X, 1862, p. 393. *St. Ann's, twenty miles from Montreal, Canada.*

1.

Family BINOCULIDÆ.

Genus BINOCULUS Geoffroy.

Binoculus Geoffroy, Hist. Nat. Insects, II, 1762, p. 658. (Species nonbinomial.) Type *Monoculus apus* Linnæus. (If this work is not considered available the genus next occurs in Müller, Zoöl. Dan. Prodom., 1776, p. 200, with *Binoculus palustris* Müller, first species, the type.)

Apos Scopoli, Introd. N. Hist., 1777, p. 404. Type *Monoculus apus* Linnæus, monotypic. (*Apos* Scopoli is proposed for a genus of birds on p. 483.)

Apus, auct.

Triops Schrank, Faun. Boie., III, 1803, pp. 180, 250. Type *Binoculus palustris* Müller, monotypic.

Triopes, auct.

Phyllopus Rafinesque, Amer. Month. Mag. Crit. Rev., III, August, 1818, p. 271. Type *Monoculus apus* Linnæus, virtually, as name proposed as synonym of *Apus* Latreille.

Possibly some members of this genus may be discovered in our limits.

——— Packard, Twelfth An. Rep. U. S. Geol. Geogr. Surv. Terr., 1878 (1883), p. 299, fig. 1. Glendale, Long Island.

——— Underwood, Bull. Ill. Lab. N. Hist., II, October, 1886, p. 350. New York.

NEW YORK (Glendale, Long Island).

Sub-Family ESTHERINÆ.

Genus LIMNADELLA Girard.

Limnadella Girard, Proc. Acad. Nat. Sci. Phila., 1854, p. 3. Type *Limnadella kilei* Girard, monotypic.

Eulimnadia Packard, Rep. Peabody Acad. Sci. Salem, June, 1874, p. 55. Type *Limnadia agassizii* Packard, first species.

Limnadella coriacea (Haldeman).

Limnadia coriacea Haldeman, Proc. Acad. Nat. Sci. Phila., 1842, p. 181. *Ditches along the Susquehanna, in quiet water.*

——— Underwood, Bull. Ill. Lab. N. Hist., II, October, 1886, p. 352. Pennsylvania.

PENNSYLVANIA (ditches along the Susequehanna).

Family BRANCHIPODIDÆ.

Genus EUBRANCHIPUS Verrill.

Eubbranchipus vernalis (Verrill).

Genus INO Schrank.

Ino holmanii (Ryder).

Genus STREPTOCEPHALUS Baird.

Streptocephalus sealii Ryder.

Sub-Order CLADOCERA.

The Water Fleas.

Super-Tribe CALYPTOMERA.

Tribe ANOMOPODA.

Family LYNCEIDÆ.*Sub-Family* EURYCERCINÆ.**Genus EURYCERCUS** Baird.**Eurycercus lamellatus** (Müller).*Sub-Family* LYNCEINÆ.**Genus LYNCEUS** Müller.

Lynceus Müller, Zoöl. Dan. Prodröm., 1776, p. 199. Type *Lynceus brachyurus* Müller, seventh or last species, designated as "example" by Latreille, Hist. Nat. Crust., III, 1802, p. 17.

Lynceus, auct.

Alona Baird, Ann. Mag. N. Hist. London, XI, 1843, p. 92. Type *Lynceus quadrangularis* Müller, first species.

Lynceus affinis Leydig.

Lynceus affinis Leydig, Naturg. Daphn., 1860, p. 223, figs. 68-69. *Friedrichshafen*.

Alona affinis Turner, Geol. N. Hist. Surv. Minn., Zoöl. Ser., II, 1895, p. 275. Kent County, Delaware.

DELAWARE (Kent County).

Genus PLEUROXUS Baird.

Pleuroxus Baird, Ann. Mag. N. Hist. London, XI, 1843, p. 93. Type *Lynceus trigonellus* Müller, first species.

Phypophilus Schœdler, N. Beitr. Nat. Cladoc., 1863, p. —. Type *Pleuroxus bairdii* Schœdler. (Not consulted.)

Pleuroxus denticulatus Birge.

Pleuroxus denticulatus Birge, Trans. Wis. Acad. Sci., IV, 1878, p. 96, Pl. 1, fig. 21. *Glacialis*, Cambridge, Massachusetts; Madison, Wisconsin.

——— Turner, Geol. N. Hist. Surv. Minn., Zoöl. Ser., II, 1895, p. 275. Kent County, Delaware.

DELAWARE (Kent County).

Genus CHYDORUS Leach.**Chydorus sphæricus** (Müller).**Chydorus bicornutus** Doolittle.*Family* LEPTODORIDÆ.**Genus LEPTODORA** Lilljeborg.

Leptodora Lilljeborg, Ofvers. Vet. Ak. Forhandl., XVII, 1860, p. 265. Type
Leptodora hyalina Lilljeborg, monotypic.

Leptodora hyalina Lilljeborg.

Leptodora hyalina Lilljeborg, l. c., Pl. 7, figs. 1-22. *Ostergothland and Ringsjon, Sweden.*

—— Fellows, Proc. Amer. Soc. Micros., IX, 1886, p. 176. Lake Chautauqua, N. Y.

—— Fellows, l. c., X, 1887, p. 248 (same record).

NEW YORK (Lake Chautauqua).

Family DAPHNIDÆ.**Genus DAPHNE** Müller.**Daphne pulex** (Linnæus).*Daphnia.***Daphne kerusses** (Cox).

Daphnia kerusses Cox, Amer. Month. Micros. Journ., IV, 1883, p. 88, fig. 17.
Fox River, Appleton, Wisconsin.

—— Kellicott, Proc. Amer. Soc. Micros., 1884, p. 129. Creek at Hamburg, New York.

—— Underwood, Bull. Ill. Lab. N. Hist., II, October, 1886, p. 342. New York.

NEW YORK (Hamburg).

Daphne kahlbergiensis (Schoedler).

Hyalodaphnia kahlbergiensis Schœdler, Arch. Naturg., XXII, I, 1866, p. 18,
 Pl. 1, figs. 1-3. *Ostseebade Kahlberg.*

Daphnia cederstromii Fellows, Proc. Amer. Soc. Micros., IX, 1886, p. 176.
 Lake Chautauqua, N. Y.

—— Fellows, l. c., X, 1887, p. 249 (same record).

NEW YORK (Lake Chautauqua).

Genus SIMOSA Norman.

Simosa Norman, Ann. Mag. N. Hist. London, (7) II, 1903, p. 367. Type
Daphne vetula Müller, virtually, as name proposed to replace *Simocephalus*.

Simocephalus (nec Günther 1858) Schoedler, Die Branchipod. Berlin, 1858, p. 17. Type *Daphne vetula* Müller. (Not consulted.)

***Simosa vetula* (Müller).**

Daphne vetula Müller, Zoöl. Dan. Prodröm., 1776, p. 199. *Denmark*.

Simocephalus vetulus Turner, Geol. N. Hist. Surv. Minn., Zoöl. Ser., II, 1895, p. 272. Kent County, Delaware.

DELAWARE (Kent County).

***Simosa serrulata* (Koch).**

Daphnia serrulata Koch, Deutschl. Crust., 1835-41, p. —. *Germany*. (Not consulted.)

Simocephalus serrulatus Turner, l. c. Kent County, Delaware.

DELAWARE (Kent County).

***Simosa abrupta* (Haldeman).**

Daphnia abrupta Haldeman, Proc. Acad. Nat. Sci. Phila., 1842, p. 184. *Ditches along the Susquehanna*.

— Underwood, Bull. Ill. Lab. N. Hist., II, Oct., 1886, p. 340. Pennsylvania.

PENNSYLVANIA (ditches along the Susquehanna).

Genus SCAPHOLEBERIS Schoedler.

***Scapholeberis mucronata* (Müller).**

***Scapholeberis armata* Herrick.**

Genus CERIODAPHNIA Dana.

Ceriodaphnia Dana, Crust. U. S. Expl. Exped., 1852, pp. 1265, 1273. Type *Daphnia rotundata* (Straus) Milne-Edwards, first species, virtually designated.

***Ceriodaphnia cristata* Birge.**

Ceriodaphnia cristata Birge, Trans. Wisconsin Acad. Sci., IV, 1876-77 (1878), p. 82 (6), Pl. 2, figs. 8-9. *Southampton, Massachusetts*.

Ceriodaphnia megops (nec? Sars) Turner, Geol. N. Hist. Surv. Minn., Zoöl. Ser., II, 1895, p. 271. Kent County, Delaware.

DELAWARE (Kent County).

Family BOSMINIDÆ.

Genus BOSMINA Baird.

Bosmina Baird, Hist. Berwick. Nat. F. Club, II, 1845, p. 149. Type *Monoculus cornutus* Jurine, monotypic.

***Bosmina longirostris* (Müller).**

Lynceus longirostris Müller, Zoöl. Dan. Prodröm., 1776, p. 199. Denmark.

Bosmina longirostris Fellows, Proc. Amer. Soc. Micros., X, 1887, p. 249. Lake Chautauqua, N. Y.

NEW YORK (Lake Chautauqua).

Tribe CTENOPODA.

Family SIDIDÆ.

Genus SIDA Milne-Edwards.

***Sida crystallina* (Müller).**

Genus DAPHNELLA Baird.

Daphnella Baird, N. Hist. Brit. Entomost., 1850, p. 109. Type *Daphnella wingii* Baird, monotypic.

Diaphanosoma Fischer, Mem. Savant. Étrang. Acad. St. Petersburg, VII, 1850, pp. 1-14. Type *Diaphanosoma brandtianum* Fischer. (Not consulted.)

***Daphnella brachyura* (Levin).**

Sida brachyura Levin, Branchiopod. Danzig. Emgeg., 1848, p. 20, Pl. 4, figs. 3-9. Danzig.

Daphnella brachyura Fellows, Proc. Am. Soc. Micros., IX, 1885, p. 176. Lake Chautauqua, N. Y.

— Fellows, l. c., X, 1886, p. 249 (same record).

NEW YORK (Lake Chautauqua).

Order OSTRACODA.

Tribe PODOCOPA.

Family CYTHERIDÆ.

Genus CYTHERE Müller.

Cythere Müller, Entomost. Dan. Norv., 1785, p. 63. Type *Cythere lutea* Müller, second species, designated by Brady and Norman, Trans. Roy. Dublin Soc., (2) IV, 1889, p. 125.¹

¹In Hist. Nat. Crust., III, 1802, p. 17, Latreille gives as an "example" *Cythere viridis* Müller.

Cythere americana Sharpe.

Cythere americana Sharpe, Proc. U. S. Nat. Mus., XXXV, 1909, p. 420, Pl. 60, figs. 1-6. *Brighton Beach and Jamaica Bay, New York.*

NEW YORK (Brighton Beach and Jamaica Bay, Long Island).

Cythere papillosa Sharpe.

Cythere papillosa Sharpe, l. c., p. 421, Pl. 61, figs. 1-4. *Brighton Beach, New York.*

NEW YORK (Brighton Beach, Long Island).

Family CYPRIDIDÆ.

Sub-Family CANDONINÆ.

Genus CANDONA Baird.

Candona Baird, Trans. Berw. Nat. F. Club, II, 1845, p. 152. Type *Cypris candida* Müller, first species, designated by Brady and Norman, l. c., p. 98.

Candona delawarensis Turner.

Candona delawarensis Turner, Bull. Sci. Lab. Den. Univ., VIII, pt. 2, 1894, p. 21, Pl. 8, figs. 35-40. *Jones Creek, Delaware.*

——— Turner, Geol. N. Hist. Surv. Minn., Zoöl. Ser., II, 1895, p. 30 (types).

DELAWARE (Jones Creek).

Genus Paracandona Hartwig.

Paracandona euplectella (Brady and Norman).

Sub-Family CYPRIDINÆ.

Genus CYPRIDOPSIS Brady.

Cypridopsis vidua (Müller).

Genus SPIROCYPRIS Sharpe.

Spirocypris passaica Sharpe.

Genus CYPRIS Müller.**Cypris reticulata Zaddach.****Cypris fuscata (Jurine).**

Monoculus fuscatus Jurine, Hist. Monoc., 1820, p. 174, Pl. 19, figs. 1-2.
Geneva, Switzerland.

Cypris fuscata Sharpe, Proc. U. S. Nat. Mus., XXXV, 1909, pp. 400, 410, Pl. 53, figs. 1-4. Common in United States (world-wide).

MIDDLE ATLANTIC STATES (included as common in the United States and world-wide).

Cypris burlingtonensis Turner.

Cypris burlingtonensis Turner, Bull. Sci. Lab. Denis. Univ., VIII, pt. 2, 1894, p. 17, Pl. 7, figs. 14-23. Burlington, Ohio; Atlanta, Georgia; Jones Creek, Delaware.

Cyprinotus burlingtonensis Turner, Geol. N. Hist. Surv. Minn., Zoöl. Ser., II, 1895, p. 333, Pl. 70, figs. 14-23. Jones Creek, Delaware.

DELAWARE (Jones Creek).

Cypris incongruens Ramdohr.

Cypris incongruens Ramdohr, Mag. Ges. Naturf. Fr. Berlin, II, 1808, p. 86, Pl. 3, figs. 1-12, 15-16, 18-20. Vorstadt Neumarkt vor Halle.

——— Sharpe, Proc. U. S. Nat. Mus., XXXV, 1909, p. 405, Pl. 54, figs. 1-3. Carlisle, Pennsylvania.

PENNSYLVANIA (Carlisle).

Cypris agilis Haldeman.

Cypris agilis Haldeman, Proc. Acad. Nat. Sci. Phila., 1841, p. 53, fig. a. Ditches in Lancaster County, Pa.

——— De Kay, N. Y. Fauna, Crust., VI, 1844, p. 65 (from Haldeman).

——— Underwood, Bull. Ill. Lab. N. Hist., II, Oct., 1886, p. 336. Pennsylvania.

PENNSYLVANIA (ditches in Lancaster County).

Cypris discolor Haldeman.

Cypris discolor Haldeman, l. c., 1841, p. 166. Long pond at mouth of Chiquesalunga, on the Susquehanna.

——— Underwood, l. c. Pennsylvania.

PENNSYLVANIA (Long pond at mouth of Chicquesalunga, on the Susquehanna).

Cypris simplex Haldeman.

Cypris simplex Haldeman, l. c., 1841, p. 53, fig. b. *Spring in Lancaster County, Pa.*

—— De Kay, l. c., p. 65 (from Haldeman).

—— Underwood, l. c., p. 337. Pennsylvania.

PENNSYLVANIA (spring in Lancaster County).

Cypris vitrea Haldeman.

Cypris vitrea Haldeman, l. c., 1841, p. 166. *Long pond at mouth of Chicquesalunga, on the Susquehanna.*

—— Underwood, l. c. Pennsylvania.

PENNSYLVANIA (Long pond at mouth of Chicquesalunga, on the Susquehanna).

Sub-Family CYCLOCYPRIDINÆ.

Genus CYCLOCYPRIS Brady and Norman.

Cyclocypris lævis (Müller).

Genus CYPRIA Zenker.

Cypria dentifera Sharpe.

Cypria exculpta (Fischer).

Cypris (Cypria) exculpta Fischer,¹ Abhandl. K. Bay. Ak. Wiss., VII, 1855, p. 652, Pl. 1, figs. 36-38. *No locality.*

Cypria exculpta Turner, Bull. Sci. Lab. Dennison Univ., VIII, pt. 2, 1894, p. 13, Pl. 7, figs. 2-8. Jones Creek, Delaware.

—— Turner, Geol. N. Hist. Surv. Minn., Zoöl. Ser., II, 1895, p. 305, Pl. 60, figs. 1-8, Pl. 72, fig. 3. Kent County, Delaware.

—— Sharpe, Proc. U. S. Nat. Mus., XXXV, 1909, p. 400. Common everywhere.

DELAWARE (Jones Creek).

¹*Cypris punctata* var. *striata* Zenker, Anat. Syst. Stud. (prior to 1855), p. 77?, is quoted as a synonym by Fischer, and if identical, and not preoccupied, may supersede the name *exculpta*?

Order COPEPODA.

Sub-Order EUCOPEPODA.

Tribe GYMNOPLA.

Family LERNÆOPODIDÆ.

Genus NAOBRANCHIA Hesse.

Naobranhia pomolobi Fowler.

Genus ACHTHERES Nordmann.

Achtheres Nordmann, Mikrog. Beitr., 1832, p. 63. Type *Achtheres percarum* Nordmann, monotypic.

Achtheres lacæ Kröyer.

Achtheres lacæ (Kollar) Kröyer, Naturh. Tidssk., (3) II, 1863, pp. 348, 349, Pl. 17, fig. 6. North America (in "*Perca lacæ*" possibly identical with *?Stizostedion vitreum*).

—— Underwood, Bull. Ill. Lab. N. Hist., II, October, 1886, p. 335. North America.

MIDDLE ATLANTIC STATES (included as possibly occurs on *Stizostedion vitreum*, likely the intended host?).

Family CHONDRACANTHIDÆ.

Genus CHONDRACANTHUS Delaroche.

Chondracanthus Delaroche, Bull. Soc. Philomath. Paris, 1811, p. 270. Type *Chondracanthus zci* Delaroche, monotypic.

Entomoda Lamarck, An. San. Verteb., III, 1818, p. 68. Type *Lernæa cornuta* Müller, second species.

Anops Oken, Lehrbuch Naturg., I, 1815, p. 358. Type *Anops radiatus* Oken, monotypic.

Chondracanthus cottunculi R. Rathbun.

Chondracanthus cottunculi R. Rathbun, Proc. U. S. Nat. Mus., IX, 1886, p. 322, Pl. 11, figs. 1-7. Off Georges Bank, off Martha's Vineyard and South of Block Island (on *Cottunculus torvus*, *C. microps* and sp.)

GULF STREAM.

Chondracanthus¹ phycidis R. Rathbun.

Chondracanthus phycidis R. Rathbun, Proc. U. S. Nat. Mus., IX, 1886, p. 320, Pl. 9, figs. 1-6, Pl. 10, figs. 8-13. *Off Martha's Vineyard* (in gills of *Phycis tenuis*).

GULF STREAM.

Genus ANTEACHERES M. Sars.

Anteacheres M. Sars, Forh. Skand. Naturf. Christiania, 1856, p. 175. Type *Anteacheres duebenii* M. Sars, monotypic. (Not consulted.)

Anteacheres duebenii M. Sars.

Anteacheres duebenii M. Sars, Forh. Skand. Naturf. Christiania, 1856, p. 175. *Norway*. (Not consulted.)

— M. Sars, Nyt. Mag. Naturv. Christiania, 1870, p. 128, Pl. 9, figs. 24-34, Pl. 10, figs. 35-53. *Christiania fjords, Norway*.

— R. Rathbun, Proc. U. S. Nat. Mus., VII, 1884, p. 490. N. Lat. 39° W Long. 70° in 225-245 fathoms (in *Bolocera tuedia*).

GULF STREAM.

Family LERNÆIDÆ.¹**Genus LERNEÆNICUS** Le Sueur.**Lerneænicus radiatus** (Le Sueur).**Genus PENNELLA** Oken.**Pennella filosa** (Linnæus).**Pennella sagitta** (Linnæus).**Genus LERNEOCEROPSIS** Fowler.**Lerneoceropsis septemramosus** Fowler.**Genus LERNEOCERA** Blainville.

Lerneocera Blainville, Journ. Phys. H. Nat. Paris, XCV, 1822, p. 337. Type

Lernæa cyprinacea Linnæus, fourth and last species.

Lerneocera, auct.

¹*Lernentoma* Blainville, Journ. Phys. Chem. H. Nat. Paris, XCV, 1822, p. 441. Type *Lernentoma trigla* Blainville, fifth species. This would then have priority over *Oralien* Bassett-Smith, Proc. Z. Soc. London, 1899, p. 490. Type *Lernæa asellina* Linnæus, monotypic.

Lerneocera cruciata Le Sueur.

Lerneocera cruciata Le Sueur, Journ. Acad. Nat. Sci. Phila., III, 1824, p. 286, Pl. II, fig. 4. *Erie, Pennsylvania* (on "*Cichla anca*" identical with *Ambloplites rupestris*).

— De Kay, N. Y. Fauna, Crust., VI, 1844, p. 59 (from Le Sueur).

Lerneocera cruciata Underwood, Bull. Ill. Lab. N. Hist., II, October, 1886, p. 334. *Lake Erie*.

PENNSYLVANIA (*Erie*).

Lerneocera tortua (Kellicott).

Lerneocera tortua Kellicott, Proc. Amer. Micros. Soc., II, 1880, p. 41, Pl. figs. 1-3. *Grindstone Creek, a few miles above its entrance into Lake Ontario* (on "*Amiurus catus* Gill" identical with *Amiurus nebulosus*).

— Underwood, Bull. Ill. Lab. N. Hist., II, October, 1886, p. 334. *Tributaries of Lake Ontario, New York*.

NEW YORK (*Grindstone Creek*).

A lernean, evidently this species was secured from an example of *Amiurus nebulosus* on May 9th, 1912, while fishing in the Pocomoke River, near Willards, Maryland. Six of the fish were secured by angling, though only one contained the lernean, which was protruding from the pectoral axil, though one also had a leech clinging to its abdomen. I damaged the lernean so badly, in attempting to remove it from the fish, that the identification cannot be positively verified.

Family DICHELESTHIIDÆ.**Genus** ANTHOSOMA Leach.

Anthosoma Leach, Encycl. Brit. Suppl., I, 1816, 1816, p. 406. Type *Anthosoma smithii* Leach, monotypic.

Anthosoma crassum (Abildgaard).

Caligus crassus Abildgaard Skrivt. Naturh. Selsk., III, pt. 2, 1794, p. 49, Pl. 5, figs. 1-3. *Poa Giellerne of en Hai ved Helgoland*.

Anthosoma crassum M. J. Rathbun, Occas. Papers. Boston Soc. N. Hist., VII, No. 5, 1905, p. 97. *South of Martha's Vineyard 125 miles*.

GULF STREAM.

Family CALIGIDÆ.

Sub-Family CECROPINÆ.

Genus PHILORTHRAGORISCUS Horst.

Philorthragoriscus serratus (Kröyer).

Genus ORTHAGORISCICOLA Poche.

Orthagoriscicola muricata (Kröyer).

Genus CECROPS Leach.

Cecrops latreillii Leach.

Sub-Family PANDARINÆ.

Genus SPECILLIGUS Dana.

Specilligus Dana, U. S. Expl. Exped. Crust., XIII, 1852, p. 1374. Type
Specilligus curticaudis Dana, monotypic.

Nesippus Heller, Reis. Freg. Novara, Crust., 1865, p. 193. Type *Nesippus orientalis* Heller, first species.

Specilligus curticaudis Dana.

Specilligus curticaudis Dana, U. S. Expl. Exped. Crust., XIII, 1852, p. 1375,
Pl. 95, figs. 6a-h. *Northeast of New Zealand* (from body of a shark).

Nogagus curticaudis R. Rathbun, Proc. U. S. Nat. Mus., VII, 1884, p. 489. N.
Lat. 39° 32' W. Long. 72° (on *Eulamia obscura*).

Nesippus curticaudis Wilson, Proc. U. S. Nat. Mus., XXXIII, 1908, p. 434,
Pl. 36. N. Lat. 37° 8' 30", W. Long. 74° 33' 30" (from ten-foot shark).

GULF STREAM.

Specilligus alatus (Wilson).

Nesippus alatus Wilson, Proc. Biol. Soc. Wash., XVIII, 1905, p. 130. *Buzards Bay, Massachusetts* (on common sand shark).

— Wilson, Proc. U. S. Nat. Mus., XXXIII, 1908, p. 442 (note on Bureau of Fisheries Coll. Albatross).

Nogagus latreillii (nec Leach) R. Rathbun, Proc. U. S. Nat. Mus., VII, 1884,
p. 489 (see under *Pandarus cranchii*).

GULF STREAM.

Genus PANDARUS Leach.**Pandarus sinuatus** Say.**Pandarus cranchii** Leach.

Pandarus cranchii Leach, Suppl. Encyclop. Brit., I, 1816, p. 535. (Not consulted.)

— R. Rathbun, l. c., p. 488. N. Lat. $39^{\circ} 32'$ W. Long. 72° (on *Eulamia obscura*); N. Lat. $39^{\circ} 12' 17''$ W. Long. $72^{\circ} 9' 30''$ (on large shark).

— Wilson, l. c., p. 403, Pl. 28. N. Lat. $39^{\circ} 32'$ W. Long. 72° (Rathbun's material); N. Lat. $39^{\circ} 12' 17''$ W. Long. $72^{\circ} 9' 30''$ (Rathbun's material); N. Lat. $37^{\circ} 8' 30''$ W. Long. $74^{\circ} 33' 30''$.

Nogagus latreillii R. Rathbun, l. c. N. Lat. $39^{\circ} 32'$ W. Long. 72° (on *Eulamia obscura*) (belongs here if males); N. Lat. $39^{\circ} 12' 17''$ W. Long. $72^{\circ} 9' 30''$ (on large shark).

— Wilson, l. c., p. 422 (note).

GULF STREAM.

Pandarus smithii R. Rathbun.

Pandarus smithii R. Rathbun, Proc. U. S. Nat. Mus. IX, 1886, p. 315, Pl. 5, fig. 3, Pl. 7, fig. 9. Off Noank, Connecticut (on *Eulamia obscura*).

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 95. Long Island Sound.

NEW YORK (Long Island Sound).

Genus DINEMOURA A. Milne-Edwards.

Dinemoura (Latreille) A. Milne-Edwards, La Règne animal, Crust., IV, 1829, p. 197. Type *Caligus productus* Müller, first species.

Dinematura, auct.

Dinemoura latifolia (Steenstrup and Lütken).

Dinemoura latifolia Steenstrup and Lütken, Kon. Dansk. Vidensk. Selsk. Skrift., (5) V, 1861, p. 378, Pl. 8, fig. 16. " 27° N. Bog. 23° V L." (on *Isurus glaucus*.)

— Wilson, Proc. U. S. Nat. Mus., XXXIII, 1908, p. 383, Pls. 24-25. Off Woods Holl 120 miles (on *Lamna cornubica*).

GULF STREAM.

Dinemoura producta (Müller).

Caligus productus Müller, Entomost. Dan. Norveg., 1785, p. 132, Pl. 21, figs. 3-4. Denmark and Norway (on sharks and salmon).

Dinematura producta Wilson, l. c., p. 380, Pl. 23. N. Lat. 38° 7', W. Long. 74° 21' (from large shark).

GULF STREAM.

Genus **PERISSOPUS** Steenstrup and Lütken.

Perissopus communis R. Rathbun.

Sub-Family CALIGINÆ.

Genus **LEPEOPHTHEIRUS** Nordmann.

Lepeophtheirus edwardsi Wilson.

Genus **ECHETUS** Krøyer.

Echetus Krøyer, Naturh. Tidssk., (3) II, 1863, p. 389. Type *Echetus typicus* Krøyer, monotypic.

Echetus typicus Krøyer.

Echetus typicus Krøyer, Naturh. Tidssk., (3) II, 1863, p. 389, Pl. 15, fig. 6a-c. New Orleans, Louisiana (on "*Corvina unimaculata*," identical with *Scianops ocellatus*).

— Wilson, Proc. U. S. Nat. Mus., XXVIII, 1905, p. 611, Pl. 17. Washington City markets (on *Scianops ocellatus*).

WASHINGTON, D. C. (markets).

Genus **CALIGUS** Müller.

Caligus curtus Müller.

Caligus curtus Müller, Entomotr. Dan. Norveg., 1785, p. 130, Pl. 21, fig. 1. Denmark and Norway (on "*Gadus merlangus*").

— Wilson, Proc. U. S. Nat. Mus., XXVIII, 1905, p. 578, Pl. 10, figs. 8, 24, 28 in text. New England to New York, and on off-shore fishing banks (on *Gadus callarias*).

GULF STREAM.

Caligus rapax Milne-Edwards.

Caligus rapax Milne-Edwards, Hist. Nat. Crust., III, 1840, p. 453, Pl. 38, figs. 9-12. Sur la peau d'un squalc.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 89. Off Martha's Vineyard.

GULF STREAM.

Caligus productus Dana.

Caligus productus Dana, U. S. Expl. Exped. Crust., XIII, 1853, p. 1354, Pl. 94, fig. 4. N. Lat. 27° W. Long. 19° 30' (on bonito).

— Wilson, l. c., p. 597, Pl. 14, figs. 162-170. N. Lat. 38° 19' 26" W. Long. 68° 20' 20" (on *Coryphæna hippurus*).

GULF STREAM.

Caligus tenuis (Leidy).*Sub-Family* EURYPHORINÆ.**Genus ALEBION** Kröyer.

Alebion Kröyer, Naturh. Tidssk., (3) II, 1863, p. 239. Type *Alebion carcharia* Kröyer, monotypic.

Alebion glaber Wilson.

Alebion glabrum Wilson, Proc. Biol. Soc. Wash., XVII, 1905, p. 129. Woods Holl, Massachusetts (on sand shark and smooth dog fish).

Alebion glaber Wilson, Proc. U. S. Nat. Mus., XXXI, 1907, p. 708, Pl. 19, figs. 49-61, 17, 18, pp. 695, 696. Long Island Sound (on *Mustelus canis*).

NEW YORK (Long Island Sound)

Family ERGASILIDÆ.**Genus LERNEONEMA** Milne-Edwards.**Lerneonema procera** Leidy.**Genus ERGASILUS** Nordmann.**Ergasilus labracis** Kröyer.**Ergasilus chautauquensis** Fellows.

Ergasilus chautauquensis Fellows, Proc. Amer. Soc. Micros., X, 1887, p. 246, figs. 1-8. Lake Chautauqua, N. Y.

— Wilson, Proc. U. S. Nat. Mus., XXXIX, 1911, p. 343, Pl. 46, figs. 26-28 (types) (Madison, Wis.).

Ergasilus sp. Fellows, l. c., IX, 1886, p. 175. Lake Chautauqua, N. Y. (name only).

NEW YORK (Lake Chautauqua).

Family CYCLOPIDÆ.**Genus OITHONA** Baird.

Oithona Baird, Zoölogist, 1843, p. 59. Type *Oithona plumifera* Baird, monotypic.

Scribella Dana, Ann. Mag. N. Hist. London, XVIII, 1846, p. 183. Atypic. (Type *Scribella scriba* Dana, U. S. Expl. Exped. Crust., 1852, p. 1045, monotypic.)

Oithonella Sars, Norsk. Nordh. Exped. Crust., II, 1885 (1885), p. 79. Type *Oithonella helgolandica* Claus, monotypic.

Oithona plumifera Baird.

Oithona plumifera Baird, l. c., fig. b. N. Lat. 3° 24' W. Long. 27° 7'.

—— Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 186, fig. 22. Gulf Stream 70 miles south of Martha's Vineyard.

—— Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 407 (on Wheeler).

GULF STREAM.

Genus CYCLOPS Müller.*Cyclops*.

I am greatly indebted to Mr. R. A. Spaeth for the opportunity of examining his MSS., and here recording the species of this variable and difficult genus. Mr. Spaeth spent several years in studying the species in the vicinity of Haverford, Pennsylvania. His researches are incorporated in an excellent and elaborate MS. memoir, well illustrated by his own hand. In view of the absence of any work on the Pennsylvania species it is hoped he will allow it to pass through the press at an early date. The arrangement of the species is thus in accordance with Mr. Spaeth's list, though several forms he has not found, which have been recorded elsewhere within the limits of the Middle Atlantic States, are placed provisionally under the various subgenera. The precise locality where Mr. Spaeth's material was obtained is a single small pond on the estate of Mr. McFadden, directly on the south side of the Philadelphia and Western Railroad tracks and to the right of the bridge that crosses these tracks at "Haverford" station.

Sub-genus CYCLOPS Müller.

Cyclops leuckarti Claus.

Cyclops leuckarti Claus, Arch. Naturgesch., pt. 1, 1857, p. 35, Pl. 1, fig. 4, Pl. 2, figs. 13-14. *No locality.*

—— Marsh, Trans. Wis. Acad. Sci., XVI, pt. 2, No. 3, 1909, p. 1081, Pl. 74, figs. 4-11, Pl. 75, figs. 1-3. *Cosmopolitan.*

—— Marsh, Proc. U. S. Nat. Mus., XLII, 1912, p. 245, Sodus Bay; p. 246. Rock and Pickerel Pond, New York.

NEW YORK (Sodus Bay on Lake Ontario; Rock Pond and Pickerel Pond).

Cyclops insignis Claus.

Cyclops insignis Claus, Arch. Naturgesch., XXIII, 1857, p. 209, Pl. 11, figs. 8-12. *No locality.*

—— Herrick and Turner, Geol. N. Hist. Surv. Minn. (Second Rep. State Zool.), II, 1895, p. 110, Pl. 22, figs. 11-14, Pl. 23, figs. 6-7. Long Island
NEW YORK (Long Island).

Cyclops viridis (Jurine).

Monoculus quadricornis viridis Jurine, Hist. Monoc. Geneva, 1820, p. 46, Pl. 3, fig. 1. *Geneva.*

Cyclops viridis Marsh, Trans. Wis. Acad. Sci., XVI, pt. 2, No. 3, 1909, p. 1072, Pl. 74, figs. 7-8, Pl. 74, figs. 1-2, Pl. 79, figs. 6-7. Northern hemisphere.

?*Cyclops ingens* Byrnes, Cold S. Harbor Monogr., VII, 1909, p. 22, Pl. 8. Cold Spring Harbor, Long Island.

?NEW YORK (Cold Spring Harbor, Long Island).

Cyclops viridis brevispinosus (Herrick).

Cyclops brevispinosus Herrick, Twelfth An. Rep. Geol. N. Hist. Surv. Minn., XII-XIII, 1883, p. 148, Pl. S. figs. 7-11. *Minnesota* (larger lakes).

—— Byrnes, Cold Spring Harbor Monogr., VII, 1909, p. 16, Pl. 7. Cold Spring Harbor, Long Island.

Cyclops viridis var. *brevispinosus* Marsh, Proc. U. S. Nat. Mus., XLII, 1912, p. 245. Sodus Bay, New York.

NEW YORK (Cold Spring Harbor, Long Island; Sodus Bay, Lake Ontario).

Cyclops viridis insectus (S. A. Forbes).

Cyclops insectus S. A. Forbes, Amer. Nat., XVI, 1882, p. 649, Pl. 9, fig. 6.
Northern Illinois.

Cyclops americanus Byrnes, Cold Spring Harbor Monogr., VII, 1909, p. 13,
Pl. 5, figs. 1-3. Cold Spring Harbor, Long Island.

Cyclops parvus Byrnes, l. c., p. 14, Pl. 6. Cold Spring Harbor, Long Island.
NEW YORK (Cold Spring Harbor, Long Island).

PENNSYLVANIA (an abundant form in the vicinity of Haverford—*Spaeth*).

Cyclops bicuspidatus Claus.

Cyclops bicuspidatus Claus, Arch. Naturgesch., XXIII, 1857, p. 209, Pl. 11,
figs. 6-7. No locality.

—— Byrnes, Cold Spring Harbor Monogr., VII, 1909, p. 25, Pl. 10. Cypress
Hills, Long Island.

—— Marsh, Trans. Wis. Acad. Sci., XVI, pt. 2, No. 3, 1909, p. 1078, Pl. 73,
figs. 1-11, Pl. 79, fig. 11. Northern states north of Ohio River.

Cyclops thomasi Fellows, Proc. Amer. Soc. Micros., IX, 1885, p. 175. Lake
Chautauqua, N. Y.

Cyclops pulchellus Byrnes, l. c., p. 24, Pl. 10. Cold Spring Harbor, Long
Island.

NEW YORK (Lake Chautauqua; Cypress Hills and Cold
Spring Harbor, Long Island).

PENNSYLVANIA (Haverford—*Spaeth*).

Cyclops strenuus Fischer.

Cyclops strenuus Fischer, Bull. Soc. Imp. Nat. Moscou, XXIV, 1851, p. 419,
Pl. 9, figs. 12-22. Russia. (Not consulted.)

—— Marsh, Proc. U. S. Nat. Mus., XLII, 1912, p. 249, figs. 1-14. Rock
Pond, Axton, New York.

NEW YORK (Rock Pond, Axton).

Sub-genus **MACROCYCLOPS** Claus.**Cyclops fuscus** (Jurine).

Monoculus quadricornis fucus Jurine, Hist. Monoc. Geneva, 1820, p. 47, Pl.
2, fig. 2. Geneva.

Cyclops signatus Byrnes, Cold Spring Harbor Monogr., VII, 1909, p. 8. Cold
Spring Harbor, Long Island.

—— Marsh, Trans. Wis. Acad. Sci., XVI, pt. 2, No. 3, 1909, p. 1090, Pl. 77,
figs. 1-7. Widely distributed in the northern continents.

Cyclops signatus var. *coronatus* Byrnes, l. c., p. 9, Pls. 2-3. Cold Spring Harbor, Long Island.

NEW YORK (Cold Spring Harbor, Long Island).

PENNSYLVANIA (Haverford—*Spaeth*).

***Cyclops albus* (Jurine).**

Monoculus quadricornis albus Jurine, Hist. Monoc. Geneva, 1820, p. 44, Pl. 2, figs. 10-11, Pl. 3, fig. 24. (Les mares oisines du chateau-Blanc) Switzerland.

Cyclops albidus Marsh, Trans. Wis. Acad. Sci., XVI, pt. 2, No. 3, 1909, p. 1087, Pl. 76, figs. 1-9. Universally distributed in North America.

— Marsh, Proc. U. S. Nat. Mus., XLII, 1912, p. 245. Sodus Bay, New York.

Cyclops signatus var. *annulicornis* Byrnes, Cold Spring Harbor Monogr., VII, 1909, p. 10, Pl. 4. Cold Spring Harbor, Long Island.

Cyclops virido-signatus Byrnes, l. c., p. 23, Pl. 9. Jamaica, Long Island.

NEW YORK (Sodus Bay, Lake Ontario; Cold Spring Harbor, and Jamaica, Long Island).

PENNSYLVANIA (Haverford—*Spaeth*).

Sub-genus HOMOCYCLOPS E. B. Forbes.

***Cyclops ater* Herrick.**

Cyclops ater Herrick, Tenth Rep. Geol. Minn., IX-XI, 1881 (1882), p. 228. Pl. 3, figs. 9-12. *Mud Lake, Hennepin County, Minnesota.*

— Byrnes, Cold Spring Harbor Monogr., VII, 1909, p. 5, Pl. 1. Cold Spring Harbor, Long Island.

NEW YORK (Cold Spring Harbor, Long Island).

Sub-genus ORTHOCYCLOPS E. B. Forbes.

***Cyclops modestus* Herrick.**

Cyclops modestus Herrick, Amer. Nat., XVII, 1883, p. 500. *Cullman County, Alabama.*

— Byrnes, Cold Spring Harbor Monogr., VII, 1909, p. 26, Pl. 11, figs. 4-5. Cold Spring Harbor, Long Island.

— Marsh, Trans. Wis. Acad. Sci., XVI, pt. 2, No. 3, 1909, p. 1093, Pl. 78, figs. 1-4. Haverford, Pa.

NEW YORK (Cold Spring Harbor, Long Island).

PENNSYLVANIA (Haverford—*Spaeth*).

Sub-genus MICROCYCLOPS Claus.

Cyclops varicans G. O. Sars.

Cyclops varicans G. O. Sars, Forh. Vidensk. Selsk. Christiania, 1862, p. 252.
Norway.

Cyclops bicolor Byrnes, Cold Spring Harbor Monogr., VII, 1909, p. 29, Pl. 13.
Cold Spring Harbor, Long Island.

NEW YORK (Cold Spring Harbor, Long Island).

PENNSYLVANIA (Haverford—*Spaeth*).

Sub-genus EUCYCLOPS Claus.

Cyclops serrulatus Fischer.**Cyclops prasinus** Fischer.

Cyclops prasinus Fischer, Abhandl. K. Bayer. Ak. Wiss., VIII, 1860, p. 652,
Pl. 20, figs. 19-26a. *Funchal, Madeira; Baden-Baden.*

Cyclops fluviatilis Byrnes, Cold Spring Harbor Monogr., VII, 1909, p. 28, Pl.
15, figs. 1-2. Cold Spring Harbor, Long Island.

NEW YORK (Cold Spring Harbor, Long Island).

PENNSYLVANIA (Haverford—*Spaeth*).

Sub-genus PARACYCLOPS Claus.

Cyclops phaleratus Koch.

Cyclops phaleratus Koch, Deutsch. Crust., XXI, 1838, p. 8, Pl. 9. *Regens-
burg.*

— Byrnes, Cold Spring Harbor Monogr., VII, 1909, p. 31, Pl. 14, figs.
1-9. Cold Spring Harbor, Long Island.

— Marsh, Trans. Wis. Acad. Sci., XVI, pt. 2, No. 3, 1909, p. 1099.
World-wide.

NEW YORK (Cold Spring Harbor, Long Island).

PENNSYLVANIA (Haverford—*Spaeth*).

Cyclops fimbriatus Fischer.

Cyclops fimbriatus Fischer, Bull. Soc. Imp. Moscou, XXIV, 1851, p. 419, Pl.
9, figs. 12-21. *Russia.* (Not consulted.)

Cyclops fimbriatus poppei (Rehberg).

Cyclops poppei Rehberg, Abhandlung. Naturwiss. Ver. Bremen, VI, heft 3, 1880, p. 550, Pl. 6, figs. 9-11. *Bremen*.

Cyclops fimbriatus Byrnes, Cold Spring Harbor Monogr., VII, 1909, p. 33, Pl. 15. Jamaica, Long Island.

NEW YORK (Jamaica, Long Island).

PENNSYLVANIA (Haverford—*Spachth*).

Family ONCÆIDÆ.

Genus ONCÆA Philippi.

Oncæa Philippi, Arch. Naturg., 1843, p. 62. Type *Oncæa venusta* Philippi, monotypic.

Oncæa, auct.

Antaria Dana, Proc. Amer. Acad. Sci., II, 1849, p. 39. Type *Antaria crassimana* Dana, first species.

Oncæa venusta Philippi.

Oncæa venusta Philippi, Arch. Naturg., 1843, p. 62, Pl. 3, fig. 2. *Palermo*.

——— Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 190, fig. 27. Gulf Stream 60 miles south of Martha's Vineyard.

——— Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 408 (from Wheeler).

GULF STREAM.

Family CORYCÆIDÆ.

Genus CORYCÆUS Dana.

Corycæus Dana, Proc. Acad. Nat. Sci. Phila., 1845, p. 285. Atypic. (Type *Corycæus gracilis* Dana, U. S. Expl. Exped. Crust., 1852, p. 1207, first species.)

Corycæus, auct.

Agetus Kröyer, Naturh. Tidssk., II, 1848-49, pp. 592, 603. Type *Agetus typicus* Kröyer, monotypic.

Corycæus elongatus Claus.

Corycæus elongatus Claus, Die Friel. Copepod., 1863, p. 157, Pl. 24, figs. 3-4. *Messina, Italy*.

- Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 192, fig. 29. Gulf Stream 70 miles south of Martha's Vineyard.
- Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 409 (on Wheeler).
- GULF STREAM.

Corycæus carinatus Giesbrecht.

- Corycæus carinatus* Giesbrecht, Atti Accad. Lincei Roma, VII, 1891, p. 481.
 "108° *Or.* Eq. (700 m.) 119° *Or.* 9° N. (100 m.)."
- Wheeler, l. c., p. 192, fig. 30. Gulf Stream 70 miles south of Martha's Vineyard.
- Sharpe, l. c. (on Wheeler).
- GULF STREAM.

Family SAPHIRINIDÆ.

Genus SAPHIRINA I. V. Thompson.

- Saphirina* I. V. Thompson, Zoöl. Researches, 1829, p. —. Type *Saphirina gemma* Dana. (Not consulted.)
- Saphirina*, auct.
- Edwardsia* Costa, Faun. Napoli Crost., 1838-40, p. 1, (Ent. Poecil). Type *Edwardsia fulgens* Costa, monotypic.
- Pyromma* Haeckel, Jena Zeits. Med. Nat., XXV, 1864, p. 102. Type *Saphirina gegenbauri* Haeckel, first species.
- Cyanomma* Haeckel, l. c., p. 105. Type *Saphirina darwinii* Haeckel, first species.
- Saphiridina* Haeckel, l. c. Type *Saphirina darwinii* Haeckel, first species.

Saphirina gemma Dana.

- Saphirina gemma* Dana, U. S. Expl. Exped. Crust., 1852, p. 1252; atlas 1855, Pl. 88, figs. 1, 2. *Off Cape of Good Hope and New Zealand.*
- Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 191, fig. 28. Gulf Stream 70 miles south of Martha's Vineyard.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 108. Gulf Stream 70 miles south of Martha's Vineyard. with chains of *Salpa cordiformis*.
- Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 409 (on Wheeler).
- GULF STREAM.

Family PELTIDIIDÆ.

Genus ALTEUTHA Baird.

- Alteutha* Baird, Trans. Berwick Nat. F. Club. II, 1845, p. 155. Type *Cyclops depressus* Baird, monotypic.

- Sterope* Goodsir, Ann. Mag. N. Hist. London, XVI, 1845, p. 325. Type *Sterope ovalis* Goodsir, first species.
Carrillus Goodsir, l. c., p. 326. Type *Carrillus oblongus* Goodsir, monotypic.
Carillus, auct.

***Alteutha depressa* (Baird).**

- Cyclops depressus* Baird, Mag. Zoöl. Bot., 1837, p. 331, Pl. 10, figs. 9-12.
 Berwick Bay.
Alteutha depressa Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, pp. 408, 416, fig. 8. Sheepshead Bay, New York.
 NEW YORK (Sheepshead Bay, Long Island).

Family TACHIDIIDÆ.

Genus TACHIDIUS Lilljeborg.

- Tachidius* Lilljeborg, Crust. Ord. Scania, 1853, p. 195. Type *Cyclops brevicornis* Müller, monotypic.

***Tachidius brevicornis* (Müller).**

- Cyclops brevicornis* Müller, Zoöl. Dan. Prodröm., 1776, p. 200. Denmark.
Tachidius brevicornis Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, pp. 408, 422, fig. 17. Old Mill, Jamaica Bay, Long Island.
 NEW YORK (Old Mill, Jamaica Bay, Long Island).

Family ARPACTICIDÆ.

Genus ARPACTICUS Milne-Edwards.

- Arpacticus* Milne-Edwards, Hist. Nat. Crust., III, 1840, p. 430. Type *Arpacticus chauseica* Milne-Edwards, evidently monotypic, and at least first species.
Harpacticus, auct.

***Arpacticus chelifer* (Müller).**

- Cyclops chelifer* Müller, Zoöl. Dan. Prodröm., 1776, p. 200. Denmark.
Harpacticus chelifer Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 407. Sheepshead Bay and Hunter's Island, New York.
 NEW YORK (Sheepshead Bay and Hunter's Island).

Genus CLYTEMNESTRA Dana.

Clytemnestra Dana, Proc. Amer. Acad. Sci., I, 1847, p. 154. Type *Clytemnestra scutellata* Dana, monotypic.

Goniopsyllus Brady, Rep. Voy. Challenger, XXIII, 1883, p. 107. Type *Goniopsyllus rostratus* Brady, monotypic.

Sapphir Car, Arch. Naturg., LVI, 1890, pp. 263, 268. Type *Sapphir rostratus* Car, monotypic.

Goniopelte Claus, Arb. Z. Inst. Wien, IX, 1891, p. 151. Type *Goniopelte gracilis* Claus, monotypic.

Clytemnestra rostrata (Brady).

Goniopsyllus rostratus Brady, l. c., Pl. 42, figs. 9-16. S. Lat. $42^{\circ} 32'$, W. Long. $56^{\circ} 27'$.

Clytemnestra rostrata Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 189, fig. 26. Gulf Stream about 60 miles south of Martha's Vineyard.

— Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 407 (from Wheeler).

GULF STREAM.

Genus MIRACIA Dana.

Miracia Dana, Proc. Amer. Acad. Sci., 1849, p. 46. Type *Miracia efferata* Dana, first species.

Miracia efferata Dana.

Miracia efferata Dana, Proc. Amer. Acad. Sci., 1849, p. 46. N. Lat. $4^{\circ}-7^{\circ}$ W. Long. $20^{\circ}-21^{\circ} 30'$; S. Lat. $4^{\circ} 30'$ W. Long. 25° .

— Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 188, fig. 25. Gulf Stream about 60 miles south of Martha's Vineyard.

Miracia efferata Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 407 (from Wheeler).

GULF STREAM.

Genus SETELLA Dana.

Setella Dana, Ann. Mag. N. Hist. London, XVIII, 1846, p. 182. Atypic. (Type *Setella tenuicornis* Dana, U. S. Expl. Exped. Crust., 1852, p. 1196, monotypic.)

Setella gracilis Dana.

Setella gracilis Dana, U. S. Expl. Exped. Crust., 1852, p. 1198, Pl. 34, fig. 3a-g. Near Kermadec Islands, Pacific Ocean.

— Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 188, fig. 24. Gulf Stream 70 miles south of Martha's Vineyard.

—— Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 407 (from Wheeler).

GULF STREAM.

Tribu PODOPLEA.

Family ACARTIIDÆ.

Genus ACARTIA Dana.

Acartia Dana, Amer. Journ. Sci. Art., (2) I, 1846, p. 183. Atypic. (Type *Acartia limpida* Dana, Proc. Amer. Acad., II, 1849, p. 25, first species.)

Dias Lilljeborg, Crust. Ord. Trib. Scania, 1853, p. 181. Type *Dias longiremis* Lilljeborg, monotypic.

Acartia tonsa Dana.

Acartia tonsa Dana, Amer. Journ. Sci. Art., (2) IX, 1849, p. 280 (name only).
—— Dana, U. S. Expl. Exped. Crust., 1852, p. 1123, Pl. 79. *Port Jackson, New South Wales.*

—— Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 183, fig. 20. Gulf Stream 70 miles south of Martha's Vineyard.

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 106. Gulf Stream 70 miles south of Martha's Vineyard.

—— Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 407, 414, fig. 5. Jamaica Bay, New York.

NEW YORK (Jamaica Bay, Long Island).

GULF STREAM.

Genus PONTELLINA Dana.

Pontellina Dana, U. S. Expl. Exped. Crust., 1852, pp. 1131, 1135. Type *Pontellina regalis* Dana, fifteenth species.

Monops Lubbock, Ann. Mag. N. Hist. London, (2) XII, 1853 (August), pp. 116, 122. Type *Monops grandis* Lubbock, monotypic.

Pontellopsis Brady, Rep. Voy. Challenger, VIII, 1883, p. 85. Type *Pontellopsis villosa* Brady, monotypic.

Pontellina regalis Dana.

Pontellina regalis Dana, l. c., p. 1154, Pl. 81. *Sulu Sea, 15 miles west of Panay.*

Monops regalis Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 182, fig. 19. Gulf Stream 70 miles south of Martha's Vineyard.

Pontellopsis regalis Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, pp. 407, 413 (on Wheeler).

GULF STREAM.

Genus ANOMALOCERA Templeton

- Anomalocera* Templeton, Trans. Ent. Soc. London, II, 1837, p. 35. Type
Anomalocera patersonii Templeton, monotypic.
Irenæus Goodsir, Edinb. New Phil. Jour., XXXV, 1843, p. 339. Type *Irenæus
splendidus* Goodsir, monotypic.

Anomalocera patersonii Templeton.

- Anomalocera patersonii* Templeton, Trans. Ent. Soc. London, II, 1837, p. 35.
Pl. 5, figs. 13, 18 in text. *Larne Lough, County Antrim, Ireland.*
Anomalocera pattersonii Templeton, l. c. (emend. in explanation of plate).
—— Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 181, fig. 18. Gulf
Stream about 70 miles south of Martha's Vineyard.
—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 105.
Gulf Stream about 70 miles south of Martha's Vineyard.
Anomalocera patersoni Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 407
(on Wheeler).

GULF STREAM.

Family CANDACIIDÆ.

Genus CANDACE Dana.

- Candace* Dana, Ann. Mag. N. Hist., London, XVIII, 1846, p. 184. Atypic.
(Type *Candace ornata* Dana, Proc. Amer. Acad. Sci., II, 1849, p. 22, first
species.)
Candacia, auct.
Iphonyx Kröyer, Naturh. Tidssk., II, 1849, p. 382. Type *Iphonyx typicus*
Kröyer, monotypic.
Iphonyx, auct.

Candace pectinata Brady.

- Candace pectinata* Brady, Monogr. Copepod. Brit. Is., I, 1878, p. 49, Pl. 10,
figs. 1-12. Pl. 8, figs. 14-15. *Southwest of St. Agnes, Scilly.*
—— Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 177, fig. 15. Gulf
Stream 60-80 miles south of Martha's Vineyard.
Candace armata Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 407 (on
Wheeler).

GULF STREAM.

Genus DIAPTOMUS Westwood.

- Diaptomus* Westwood, Cyclop. N. Hist. Partington (in article Cyclops), 1836,
p. —. (Not consulted.) Type *Monoculus castor* Jurinc, designated
and virtual monotype understood, in Entomol. Text Book, 1838, p. 115.
Glaucæa (nec Menke in Mollusca, 1828) Koch. Crust. Deutschl., 1835-41, p.
——. (Not consulted.)

Diaptomus sicilis Forbes.

Diaptomus sicilis Forbes, Am. Nat., XVI, 1882, p. 645, Pl. 8, figs. 9-20. *Lake Michigan*.

— Fellows, Proc. Amer. Soc. Micros., IX, 1886, p. 175. *Lake Chautauqua, N. Y.*

NEW YORK (*Lake Chautauqua*).

Diaptomus sanguineus Forbes.

Diaptomus sanguineus Forbes, Bull. Ill. Lab. N. Hist., I, 1876, p. 15. *Normal, Illinois*.

— Gissler, Amer. Nat., XV, 1881, p. 689, figs. 1-10. *Glendale, Long Island*.

NEW YORK (*Glendale, Long Island*).

Diaptomus reighardi Marsh.

Diaptomus reighardi Marsh, Bull. Michigan F. Com., No. V, 1895, p. 9, Pl. 1, figs. 1-4. *Michigan*. (Not consulted.)

— Marsh, Proc. U. S. Nat. Mus., XLII, 1912, pp. 245, 248. *Sodus Bay, New York*.

NEW YORK (*Sodus Bay*).

Family CENTROPAGIDÆ.**Genus CENTROPAGES** Kröyer.

Centropages Kröyer, Naturh. Tidsskr., II, 1846-49, p. 602. Type *Centropages typicus* Kröyer, first species.

Catopia Dana, Proc. Amer. Acad. Sci., II, 1849, p. 25. Type *Catopia furcata* Dana, monotypic.

Ichthyophorba Lilljeborg, Crust. Ord. Trib. Scania, 1853, p. 184. Type *Ichthyophorba hamata* Lilljeborg, monotypic.

Centropages typicus Kröyer.

Centropages typicus Kröyer, Naturh. Tidsskr., (2) II, 1846-49, pp. 588, 603. Pl. 6, figs. 22-26. "*Nogle Mile fra Kap Finisterre*."

— Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 173, fig. 10. *Gulf Stream 70 miles south of Martha's Vineyard*.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 104. *Gulf Stream 70 miles south of Martha's Vineyard*.

— Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 406 (from Wheeler).

GULF STREAM.

Centropages bradyi Wheeler.

Centropages bradyi Wheeler, l. c., p. 174, fig. 12. *Gulf Stream 70 miles south of Martha's Vineyard.*

— Sharpe, l. c. (from Wheeler).

GULF STREAM.

Genus SCOPIPHORA De Kay.

Scopiphora (Pickering) De Kay, N. Y. Fauna, Crust., VI, 1844, p. 62. Type

Scopiphora vagans (Pickering) De Kay, monotypic.

Epischura Forbes, Amer. Nat., XVI, 1882, p. 647. Type *Epischura lacustris* Forbes, monotypic.

Scopiphora vagans De Kay.

Scopiphora vagans (Pickering) De Kay, N. Y. Fauna, Crust., VI, 1844, p. 62.

Deep water of Lake Ontario.

Epischura lacustris Fellows, Proc. Amer. Soc. Micros., IX, 1885, p. 175.

Niagara River at Buffalo, N. Y.

— Fellows, l. c., X, 1887, p. 248 (same record).

NEW YORK (Niagara River at Buffalo, and Lake Ontario).

Family PSEUDOCALANIDÆ.**Genus CLAUSOCALANUS** Giesbrecht.

Clausocalanus Giesbrecht, Atti Accad. Lincei Roma, (4) IV, 1888, p. 334.

Type *Calanus mastigophorus* Claus, first species.

Clausocalanus arcuicornis (Dana).

Calanus arcuicornis Dana, U. S. Expl. Exped., Crust., 1852, p. 1056, Pl. 74.

S. Lat. 32° 42', E. Long. 78° 15', Pacific Ocean.

Clausocalanus arcuicornis Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 171, fig. 9 *Gulf Stream 60-80 miles south of Martha's Vineyard.*

— Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 406 (on Wheeler).

GULF STREAM.

Family PARACALANIDÆ.**Genus CALOCALANUS** Giesbrecht.

Calocalanus Giesbrecht, Atti Accad. Lincei Roma, (4) IV, 1888, p. 333. Type

Calanus pavo Dana, first species.

Calocalanus pavo (Dana).

Calanus pavo Dana, U. S. Expl. Exped., Crust., 1852, p. 1061, Pl. 72. *N. Lat.* 12°, *W. Long.* 24°, in *Atlantic Ocean*.

Calocalanus pavo Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 169, fig. 7. Gulf Stream 60-80 miles south of Martha's Vineyard.

— Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 406 (on Wheeler).

GULF STREAM.

Calocalanus plumulosus Claus.

Calocalanus plumulosus Claus, Die Freileb. Copepod. Deutschl. Mittelmeer., 1863, p. 174, Pl. 26, figs. 15-16. *Messina*.

— Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 170, fig. 8. Gulf Stream 60-80 miles south of Martha's Vineyard.

— Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 406 (on Wheeler).

GULF STREAM.

Genus PARACALANUS Boeck.

Paracalanus Boeck, Vid. Selsk. Forhandl. Christiania, 1864, p. 232. Type *Calanus parvus* Claus, monotypic.

Paracalanus parvus (Claus).

Calanus parvus Claus, Die Friel. Copepod., 1863, p. 173, Pl. 26, figs. 10-14, Pl. 27, figs. 1-4. *Helgoland*.

Paracalanus parvus Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 168, fig. 6. Gulf Stream, about 70 miles south of Martha's Vineyard.

— Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 406 (on Wheeler).

GULF STREAM.

Family CALANELLIDÆ.**Genus MECYNOCERA** J. C. Thompson.

Mecynocera J. C. Thompson, Journ. Linn. Soc. London, Zoöl. XX, (November 1st, 1888) 1890, p. 150. Type *Mecynocera clausii* J. C. Thompson, monotypic.

Leptocalanus Giesbrecht, Atti Accad. Lincei Roma, (4) IV, 1888, p. 334. Type *Leptocalanus filicornis* Giesbrecht, monotypic.

Mecynocera clausii J. C. Thompson.

Mecynocera clausii J. C. Thompson, Journ. Linn. Soc. London, Zoöl. XX, (November 1st, 1888) 1890, p. 150, Pl. 11, figs. 1-4. *Canaries*.

— Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 168, fig. 5. Gulf Stream 60-80 miles south of Martha's Vineyard.

— Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 406 (on Wheeler).

GULF STREAM.

Genus *CALANELLA* Claus.

Calanella Claus, Die Friel. Copepod., 1863, pp. 168, 174. Type *Calanella mediterranea* Claus, monotypic.

Eucalanus Streets, Bull. U. S. Nat. Mus., No. 7, 1877, p. 139. Type *Calanus elongatus* Dana, first species.

Calanella elongata (Dana).

Calanus elongatus Dana, U. S. Expl. Exped., Crust., 1852, p. 1079, Pl. 75, fig. 1. Sulu Sea southwest of Mindanao.

Eucalanus attenuatus Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 167, fig. 3. Gulf Stream 60-80 miles south of Martha's Vineyard.

— Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 406 (on Wheeler).

GULF STREAM.

Calanella monacha (Giesbrecht).

Eucalanus monachus Giesbrecht, Atti Accad. Lincei Roma, (4) IV, 1888, p. 333. "Gibilterra."

— Wheeler, l. c., fig. 4. Gulf Stream 60-80 miles south of Martha's Vineyard.

— Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, p. 406 (on Wheeler).

GULF STREAM.

Family CALANIDÆ.

Genus *CALANUS* Leach.

Calanus finmarchicus (Gunner).

Calanus minor (Claus).

Cetochilus minor Claus, Die Friel. Copepod., 1863, p. 172. Messina, Italy.

Calanus minor Wheeler, Bull. U. S. F. Com., XIX, 1899 (1901), p. 165, fig. 2. Gulf Stream (off southern New England).

— Sharpe, Proc. U. S. Nat. Mus., XXXVIII, 1911, pp. 406, 409. Grampus Station 345 off Delaware Bay.

GULF STREAM.

Calanus princeps Brady.

Calanus princeps Brady, Rep. Voy. Challenger, VIII, 1883, p. 36, Pl. 4, figs. 3-7. Station 45 in N. Lat. 38° 34' W. Long. 72° 10' in 1240 fathoms.

GULF STREAM.

Sub-Order BRANCHIURA.

Family ARGULIDÆ.

Genus ARGULUS Müller.

Argulus catostomi Dana and Herrick.

Argulus catostomi Dana and Herrick, Amer. Journ. Sci. Art., (1) XXX, 1836, p. 338. *Mill River, Whitneyville, Connecticut* (on *Catostomus bostoniensis* Le Sueur).

— Dana and Herrick, l. c., XXXI, 1837, p. 297, Pl. (type).

— Kellicott, Proc. Amer. Soc. Micros., VII, 1886, p. 144. *Cayuga Lake, New York.*

NEW YORK (Cayuga Lake).

Argulus trilineatus Wilson.*Goldfish Louse.***Argulus maculosus** Wilson.

Argulus maculosus Wilson, Proc. U. S. Nat. Mus., XXV, 1903, p. 715, Pls. 19, 26, fig. 82. *Clayton, New York* (on *Esox masquinonge*).

NEW YORK (Clayton).

Argulus versicolor Wilson.*Pike Louse.***Argulus lepidostei** Kellicott.

Argulus lepidostei Kellicott, Bull. Buffalo Soc. Nat. Sci., III, 1877, p. 214. *Niagara River, Buffalo, N. Y.* (on *Lepisosteus osseus*).

— Kellicott, Amer. Journ. Micros., III, 1878, p. 1 (copied).

— Underwood, Bull. Ill. Lab. N. Hist., II, Oct., 1886, p. 334. *Niagara River.*

— Wilson, Proc. U. S. Nat. Mus., XXV, 1903, p. 712, Pl. 16 (types).

NEW YORK (Niagara River, Buffalo).

Argulus funduli Kröyer.

Argulus funduli Kröyer, Naturh. Tidsskr., (3) II, 1863, p. 94, Pl. 2, fig. 1a-e. *New Orleans, Louisiana* (on *Fundulus limbatus*).

— Wilson, Proc. U. S. Nat. Mus., XXV, 1903, p. 710, Pl. 14. *Long Island Sound.*

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 87. *Long Island Sound.*

LONG ISLAND SOUND.

Argulus alosæ Gould.

Herring Louse.

Argulus stizostethii Kellicott.

Argulus stizostethii Kellicott, Amer. Journ. Micros. Pop. Sci., V, 1880, p. 53, figs. 1-5. *Buffalo, Niagara River, New York* (on *Stizostedion salmoneum*).

—— Underwood, Bull. Ill. Lab. N. Hist., II, Oct., 1886, p. 334. *Niagara River.*

—— Wilson, Proc. U. S. Nat. Mus., XXV, 1903, p. 713, Pl. 17 (Ohio State University material).

NEW YORK (Niagara River, Buffalo).

Order CIRRIPIEDIA.

The Barnacles.

Sub-Order EUCIRRIPIEDIA.

Family VERRUCIDÆ.

Genus VERRUCA Schumacher.

Verruca Schumacher, Essai d'un nouv. syst. Vers Testacés, 1817, p. 91. Type *Lepas verruca* Spengler, by tautonomy.

Verruca darwini Pilsbry.

Verruca darwini Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 111, Pl. 10, figs. 4, 7, 8. *N. Lat. 39° 33', W. Long. 68° 26' 45"*, in 1555 fathoms. GULF STREAM.

Family LEPADIDÆ.

The Goose Barnacles.

Sub-Family ALEPADINÆ.

Genus CONCHODERMA Olfers.

Conchoderma virgata (Spengler).

Conchoderma aurita (Linnæus).

Lepas aurita Linnæus, Syst. Nat., Ed. 12, 1767, p. 1110. *In O. septentrionali.*
Conchoderma aurita Darwin, Monogr. Cirriped., 1851, p. 141, Pl. 3, fig. 4. Mundane.

— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 580. All the seas.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 85. (Massachusetts.)

Though no locality in the limits of the Middle States region has been given, the species is included as it occurs along the Atlantic coast to Massachusetts at least.

Sub-Family LEPADINÆ.

Genus SCALPELLUM Leach.

Scalpellum Leach, Journ. Phys. Chim. H. Nat. Paris, LXXXV, 1817, p. 68.

Atypic. (Type *Lepas scalpellum* Linnæus, understood by tautonymy.)

Smilium Gray, Ann. Philos., (n. s.), X, 1825, p. 100. Type *Smilium peronii* Gray, monotypic.

Calantica Gray, l. c., p. 101. Type *Calantica homii* Gray, monotypic.

Holoscaphellum Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 25. Type *Scalpellum velutinum* Hoek, designated, first species.

Neoscaphellum Pilsbry, l. c., p. 69. Type *Scalpellum dicheloplax* Pilsbry, designated, first species.

***Scalpellum velutinum* Hoek.**

Scalpellum velutinum Hoek, Rep. Voy. Challenger, Cirrip., 1883, p. 96, Pl. 4, figs. 10-11. *Off Cape Vincent and Tristan da Cunha* (N. Lat. 37° 2', W. Long. 9° 14', in 900 fathoms; S. Lat. 32° 24', W. Long. 13° 5', in 1425 fathoms).

— Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 26, Pl. 3, figs. 2-3. N. Lat. 38°-41°, W. Long. 65°-73°, in 351-1073 fathoms.

GULF STREAM.

***Scalpellum regium* W. Thompson.**

Scalpellum regium W. Thompson, The Voyage of the Challenger (The Atlantic), II, 1877, p. 4, fig. 2 (♀), p. 7, fig. 3 (♂). *Atlantic Ocean*.

— Hoek, Rep. Voy. Challenger, Cirrip., 1883, p. 106, Pl. 4, figs. 3-5, Pl. 9, fig. 12, Pl. 10, figs. 1-2. (N. Lat. 34° 54', W. Long. 56° 38', in 2850 fathoms; N. Lat. 35° 29', W. Long. 50° 53' in 2,750 fathoms.)

— Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 28, Pl. 3, figs. 4-5. N. Lat. 37°, W. Long. 71°, in 2,045 fathoms.

GULF STREAM.

Scalpellum latidorsum Pilsbry.

Scalpellum latidorsum Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 29, Pl. 2, figs. 2, 37. Pl. 4, figs. 10-12, 14. N. Lat. $39^{\circ} 3'$, W. Long. $70^{\circ} 51'$, in 1537 fathoms. N. Lat. 39° , W. Long. 68° - 71° , in 991-1608 fathoms.

GULF STREAM.

Scalpellum sinuatum Pilsbry.

Scalpellum sinuatum Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 50, fig. 16. N. Lat. $38^{\circ} 53'$, W. Long. $69^{\circ} 23''$, in 1731 fathoms.

GULF STREAM.

Scalpellum formosum Pilsbry.

Scalpellum formosum Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 58, fig. 22. N. Lat. $37^{\circ} 56' 20''$, W. Long. $70^{\circ} 57' 30''$, in 1917 fathoms. N. Lat. $39^{\circ} 35'$ south of Martha's Vineyard.

GULF STREAM.

Scalpellum aurivillii Pilsbry.

Scalpellum aurivillii Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 64, fig. 26. N. Lat. $36^{\circ} 45'$, W. Long. $74^{\circ} 28'$, in 781 fathoms. N. Lat. $40^{\circ} 6'$, W. Long. $68^{\circ} 1' 30''$, in 984 fathoms.

GULF STREAM.

Scalpellum dicheloplax Pilsbry.

Scalpellum dicheloplax Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 70, fig. 28. N. Lat. $38^{\circ} 59'$, W. Long. $70^{\circ} 7'$, in 1544 fathoms. Also in same general region in 1525-1537 fathoms.

GULF STREAM.

Scalpellum dicheloplax benthophila Pilsbry.

Scalpellum dicheloplax benthophila Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 73. N. Lat. $39^{\circ} 33'$, W. Long. $68^{\circ} 27'$, in 1555 fathoms.

GULF STREAM.

Scalpellum imperfectum Pilsbry.

Scalpellum imperfectum Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 75, fig. 30. N. Lat. $36^{\circ} 45'$, W. Long. $78^{\circ} 28'$, in 781 fathoms. N. Lat. 39° , W. Long. 69° , in 1230 fathoms.

GULF STREAM.

Genus **LEPAS** Linnæus.**Lepas fascicularis** Ellis and Solander.**Lepas anatifera** Linnæus.**Lepas anserifera** Linnæus.**Lepas pectinata** Spengler.Genus **PÆCILASMA** Darwin.*Pæcilasma* Darwin, Monogr. Cirrip. Lepad., 1851, p. 99. Type *Pæcilasma hæmpheri* Darwin, first species.*Pæcilasma*, auct.*Temnaspis* Fischer, Bull. Soc. Z. France, IX, 1884, p. 357. Type *Pæcilasma fissa* Darwin, monotype, designated.**Pæcilasma inæquilaterale** Pilsbry.*Pæcilasma inæquilaterale* Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 85, Pl. 6, figs. 6-8, 11-12. N. Lat. $38^{\circ} 85'$, W. Long. $73^{\circ} 5' 15''$ in 554 fathoms. Also in N. Lat. 37° - 39° , chiefly on carapace of *Geryon quinquedens*, besides off Martha's Vineyard and Hampton Roads.

GULF STREAM.

Genus **MEGALASMA** Hoek.*Megalasma* Hoek, Rep. Voy. Challenger, Cirrip., VIII, 1883, p. 50. Type *Megalasma striatum* Hoek, monotypic.*Glyptelasma* Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 87. Type *Megalasma subcarinatum* Pilsbry, designated, fourth species.**Megalasma rectum** Pilsbry.*Megalasma rectum* Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 90, Pl. 7, figs. 10-14. N. Lat. $39^{\circ} 22' 50''$, W. Long. $68^{\circ} 25'$ in 1555-1608 fathoms.

GULF STREAM.

Megalasma subcarinatum Pilsbry.*Megalasma subcarinatum* Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 91, Pl. 7, figs. 1-5. N. Lat. $39^{\circ} 22' 50''$, W. Long. $68^{\circ} 25'$ in 1555-1608 fathoms.

GULF STREAM.

Genus OCTOLASMIS Gray.

Octolasmis Gray, Ann. Philos., X, 1825, p. 100. Type *Octolasmis warwickii* Gray, monotypic.

Heptalasmis (Leach) Gray, l. c. Type *Octolasmis warwickii* Gray, monotypic.

Dichelaspis Darwin, Monogr. Cirrip. Lepad., 1851, p. 115. Type *Dichelaspis orthogonia* Darwin, fifth species.

Paradolepas Macdonald, Proc. Z. Soc. London, 1869, p. 442. Type *Paradolepas neptuni* Macdonald, monotypic.

Trichelaspis Stebbing, Ann. Mag. N. Hist. London, (6) XIII, 1894, p. 443. Type *Trichelaspis forresti* Stebbing, monotypic.

Octolasmis geryonophila Pilsbry.

Octolasmis geryonophila Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 94, fig. 32. N. Lat. 37°-39°, W. Long. 69°-73°, in 435-1043 fathoms.

GULF STREAM.

Octolasmis americanum Pilsbry.

Octolasmis americanum Pilsbry, Bull. U. S. Nat. Mus., No. 60, 1907, p. 96, fig. 33. N. Lat. 36° 23', W. Long. 68° 25" in 1608 fathoms. N. Lat. 40°, W. Long. 67° in 866 fathoms.

GULF STREAM.

Family BALANIDÆ.*Sub-Family* BALANINÆ.*Section* BALANÆ.**Genus** BALANUS Da Costa.

Balanus balanoides (Linnæus)

Balanus crenatus Bruguière.

Balanus eburneus Gould.

Balanus improvisus Darwin.

Balanus improvisus Darwin, Monogr. Cirriped., 1854, p. 250, Pl. 6, figs. 1a-1c. England, Scotland, Belgium?, Nova Scotia, United States, West Indies, Rio Plata, Southern Patagonia, Guayaquil, West Columbia.

MARYLAND (I have examined examples in the Academy taken at Betterton, in the Chesapeake Bay region. They were identified as this species by Dr. Pilsbry).

Genus **CHELONOBIA** Leach.

Turtle Barnacles.

Chelonobia testudinaria (Linnæus).

Turtle Barnacle.

Section **CORONULÆ.**

Genus **CORONULA** Lamarek.

Coronula diadema (Linnæus).

Sub-Class MALACOSTRACA.

Order ARTHROSTRACA.

Sub-Order AMPHIPODA.

The Amphipods.

Tribe CAPRELLIDÆ.

Family CYAMIDÆ.

The Whale Lice.

Genus **CYAMUS** Latreille.

Cyamus Latreille, Hist. Nat. Crust., III, 1802, p. 39. Type *Oniscus ceti* Linnæus, monotypic.

Cyamus ceti (Linnæus).

Oniscus ceti Linnæus, Syst. Nat., Ed. X, 1758, p. 636. *Habitat in Balænis.*
Cyamus ceti De Kay, N. Y. Fauna, Crust. VI, 1844, p. 40, Pl. 6, fig. 4. New York coast (on whales).

— Kingsley, Standard Nat. Hist., II, 1884, p. 73, fig. 97. (United States intended?)

NEW YORK (coast, on whales).

Cyamus abbreviatus Say.

Cyamus abbreviatus Say, Journ. Acad. Nat. Sci. Phila., I, pt. 2, 1818, p. 393.
United States (on *Balana*).

—— De Kay, l. c., p. 40 (on Say).

—— Bate, Cat. Amph. Crust. Brit. Mus., 1862, p. 367, Pl. 58, fig. 4 (Say's examples).

UNITED STATES.

Included as described by Say from the "United States" on whales. His specimens may have been obtained somewhere off our shores, though no definite locality has been assigned to them.

Family CAPRELLIDÆ.

The Skeleton Shrimps.

Genus CAPRELLA Latreille.

*Skeleton Shrimps.***Caprella acutifrons** Latreille.**Caprella unica** Mayer.

Caprella unica Mayer, Caprell. Siboga. Exp., 1903, p. 127, Pl. 5, fig. 39, Pl. 8, figs. 28-29. *N. Lat.* 40° 34' 30", *W. Long.* 69° 50' 45", in 32 fathoms

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 79.
 (Off Nantucket Shoals in 32 fathoms.)

? GULF STREAM (off Nantucket Shoals).

Genus AEGINELLA Boeck.

Aeginella Boeck, Forh. Skand. Naturf., VIII, 1860, p. 673. Type *Aeginella spinosa* Boeck, monotypic.

Ægina (nec Eschschricht, 1829) Krøyer, Naturhist. Tidssk., IV, 1843, p. 509.
 Type *Ægina longicornis* Krøyer, monotypic.

Aeginella longicornis (Krøyer).

Ægina longicornis Krøyer, l. c., Pl. 7, figs. 1-12. *Narsalik, 6 miles south of Frederickshaab 12-16 fathoms, Godthaab 25-60 fathoms.*

Aeginella longicornis Holmes, Am. Nat., XXXVII, 1903, p. 291. Arctic America to Capes Cod and Hatteras.

—— Paulmier, 58 Rep. N. Y. State Mus., VI, 1904 (1906), p. 169, fig. 39.
 Great South Bay, N. Y.

NEW YORK (Great South Bay).

Tribe GAMMARIDEA.

Family AMPELISCIDÆ.

Genus AMPELISCA Kröyer.

Ampelisca Kröyer, Naturhist. Tidsskr., IV, 1842, p. 154. Type *Ampelisca eschrichtii* Kröyer, monotypic.

Araneops Costa, Rend. della Soc. R. Borb., II, 1853, pp. 169, 171. Type *Araneops diadema* Costa, monotypic.

Pseudophthalmus Stimpson, Smithson. Contrib. Knowledge, VI, 1853, p. 57. Type *Pseudophthalmus pelagicus* Stimpson, first species.

Pseudophthalmus, auct.

Tetromatus Bate, Ann. Mag. N. Hist. London, (2) XIX, 1857, p. 139. Type *Tetromatus typicus* Bate, first species.

***Ampelisca macrocephala* Lilljeborg.**

Ampelisca macrocephala Lilljeborg, Ofvers. K. Vet. Ak. Förh., IX, 1852 (1853), p. 7. *Kullaberg, in Scania*

—— Holmes, Am. Nat., XXXVII, 1903, p. 273. Arctic America to Capes Cod and Hatteras.

—— Paulmier, 58th Rep. N. Y. State Mus., VI, 1904, p. 158, fig. 26. Jamaica Bay, N. Y.

NEW YORK (Jamaica Bay).

***Ampelisca compressa* Holmes.**

Ampelisca compressa Holmes, Am. Nat., XXXVII, 1903, p. 273. *Cape Cod to Hatteras.*

—— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 480, figs. Vineyard Sound, Newport, off Block I., Long I. Sound.

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 57. Long Island Sound.

LONG ISLAND SOUND.

***Ampelisca spinipes* Boeck.**

Ampelisca spinipes Boeck, Forh. Ved. Skand. Naturf., VIII, 1860 (1861), p. 653. *Farsund, Bergen.*

—— Holmes, Am. Nat., XXXVII, 1903, p. 274. Arctic America to Cape Hatteras region.

—— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 480, figs. Long Island Sound, Newport and Wood's Holl.

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 57. Long Island Sound (off Sea-flower Key; Fishers Island).

LONG ISLAND SOUND.

Family COROPHIIDÆ.

Genus CERAPUS Say.

Cerapus tubularis Say.*Tube Shrimp.*

Genus COROPHIUM Latreille.

Corophium cylindricum (Say).

Genus UNCIOLA Say.

Uncicola irrorata Say.*Family* PHOXOCEPHALIDÆ.

Genus HARPINIA Boeck.

Harpinia Boeck, Skand. Ark. Amphipoder, 1872, p. 218. Type *Phoxus plumosus* (Holboell) Kröyer, designated, first species.*Harpinia* (nec Burmeister) Boeck, Forh. Selsk. Christiania, 1870, p. 135. Type *Phoxus plumosus* (Holboell) Kröyer, monotypic.*Harpinia plumosa* (Kröyer).*Phoxus plumosa* (Holboell) Kröyer, Naturhist. Tidssk., IV, 1842, p. 152. Greenland.*Harpinia plumosa* Holmes, Amer. Nat., XXXVII, 1903, p. 276. Arctic America to Cape Hatteras.

—— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 478. Albatross Station 2212, N. Lat. 39° 59' 30", W. Long. 70° 30' 45", in 428 fathoms.

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 56. South of Martha's Vineyard.

GULF STREAM.

Family PONTOPOREIIDÆ.

Genus HAUSTORIUS P. L. S. Müller.

Haustorius arenarius (Slabber).

*Family CALLIOPIIDÆ.***Genus CALLIOPIUS** Lilljeborg.

Calliopius Lilljeborg, Nov. Act. Sci. Upsala, VI, 1865, pp. 18, 19. Type
Calliope leachii Bate, virtually monotypic.

Calliope (nec Ogilby 1836, Gould 1836, Hal 1840) (Leach) Bate, Rep. Brit.
Assoc. Adv. Sci., 1855, pp. 40, 58, Pl. 17, fig. 3. Type *Calliope leachii* Bate,
monotypic.

Calliopius læviusculus (Krøyer).

Amphithæ læviuscula Krøyer, K. Dansk. Vid. Sels. Natur., VII, 1838, p. 281
(53), Pl. 3, fig. 13. *Fiskenæsset* (Greenland).

Calliopius læviusculus Benedict, Rep. U. S. F. Com., XI, 1883 (1885), p. 176.
Off Montauk Point, Long Island.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 64
(New England).

— Paulmier, 58th Rep. N. Y. State Mus., VI, 1904, p. 158, fig. 27. South
Beach, Staten Island.

NEW YORK (off Montauk Point, Long Island, and South
Beach, Staten Island.

*Family GAMMARIDÆ.***Genus MELITA** Leach.

Melita nitida S. I. Smith.

Genus CARINOGAMMARUS Holmes.

Carinogammarus mucronatus (Say).

Genus GAMMARUS Fabricius.*Scuds.*

Gammarus locusta (Linnæus)

Scuds.

Gammarus fasciatus Say

*Fresh Water Shrimp***Genus ELASMOPUS** A. Costa.

Elasmopus levis (S. I. Smith).

Family PODOCERIDÆ.

Genus ERICTHONIUS Milne-Edwards.

Ericthonius minax (S. I. Smith).

Genus AMPITHOE Leach.

Ampithoe longimana (S. I. Smith).*Ampithoe rubricata* (Montagu).

Genus PODOCERUS Leach.

Podocerus Leach, Edinburgh Encyclop., VII, 1813, p. 433. Type *Podocerus variegatus* Leach, monotypic.¹*Jassa* Leach, l. c. Type *Jassa pulchella* Leach, first species.¹

Genus PODOCERUS Leach.

Jassa marmorata Holmes, Am. Nat., XXXVII, 1903, p. 289. *Arctic America to Capes Cod and Hatteras.*

— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 511, figs. (Narragansett Bay.)

— Paulmier, 58th Rep. N. Y. State Mus., VI, 1904 (1906), p. 165, fig. 35. Bayshore, Great South Bay and City Island.

NEW YORK (Bayshore, Great South Bay and City Island).

Genus GRUBIA Czerniavski.

Grubia Czerniavski, Material. Z. Pontic. Camp., 1868, p. 60. Type *Grubia taurica* Czerniavski, monotypic. (Not consulted.)

Genus GRUBIA Czerniavski.

Amphithoe compta (S. I. Smith) Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 370 (among eel-grass).— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 564. *North Carolina to Cape Cod.**Grubia compta* Holmes, Amer. Nat., XXXVII, 1903, p. 289. *Cape Cod to Cape Hatteras.*— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 510, figs. *Cape Cod to Cape Hatteras.*— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 73. *Cape Cod southward.*¹ Am. Ed., VII, 1815, p. 272.

Included as it ranges from Cape Cod southward along the Atlantic coast of the United States. No record has ever been given, so far as I know, of its capture within the limits of the Middle Atlantic States. It will likely be found to occur along the coasts of Long Island, New Jersey, Delaware, Maryland and Virginia, when exhaustive collections have been made.

Family PHOTIDÆ.

Genus MICRODEUTOPUS Costa.

Microdeutopus Costa, Rend. Soc. R. Borbon. II, 1853, p. 171. Type *Microdeutopus gryllotalpa* Costa, monotypic.

Microdeutopus gryllotalpa Costa.

Microdeutopus gryllotalpa Costa, Rend. Soc. R. Borbon. II, 1853, p. 178. Naples.

— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 514, figs. Long Island Sound.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 70. Long Island Sound.

— Paulmier, 58th Rep. N. Y. State Mus., VI, 1904 (1906), p. 163, fig. 33. Bayshore and Bartow, N. Y.

Microdeutopus minax S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 562 (479). Long Island Sound and Vineyard Sound.

LONG ISLAND SOUND.

NEW YORK (Bayshore and Bartow).

Genus PTILOCHEIRUS Stimpson.

Ptilocheirus Stimpson, Smithson. Contrib. Knowledge, VI, 1853, p. 55. Type *Ptilocheirus pinguis* Stimpson, monotypic.

Ptilocheirus pinguis Stimpson.

Ptilocheirus pinguis Stimpson, Smithson. Contrib. Knowledge, VI, 1853, p. 56. Whole coast of New England to Grand Manan.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 71. Whole coast of New England.

— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 522, fig. Whole coast of New England.

Ptilochirus pinguis Benedict, Rep. U. S. F. Com., XI, 1883 (1885), p. 176. Off Montauk Point, Long Island.

NEW YORK (off Montauk Point, Long Island).

Family IPHIMEDIDÆ.

Genus ACANTHONOTOZOMA Boeck.

Acanthonotozoma sayi (Bate).*Family* ORCHESTIIDÆ.

Genus ORCHESTIA Leach.

Orchestia agilis S. I. Smith.*Orchestia palustris* S. I. Smith.

Genus TALITRUS Latreille.

Talitrus longicornis Say.*Talitrus megalophthalmus* (Bate).

Genus HYALE Rathke.

Hyle Rathke, Mem. Ac. Sci. St. Petersb., III, 1837, p. 371. Type *Hyle pontica* Rathke, designated by Stebbing, Rep. Voy. Challenger, Amph., LXVII, pt. 1, 1888, p. 172. (Not consulted in original.)

Allorchestes Dana, Amer. Journ. Sci. Art., (2) VIII, 1849, p. 136 Atypic. (Type *Allorchestes compressa* Dana, Proc. Amer. Acad. Sci., II, 1852, p. 201, first species.)

Nicea Nicolet, Hist. Chile Gay, III, 1849, p. 237. Type *Nicea lucasii* Nicolet, monotypic.

Hyle littoralis (Stimpson).

Allorchestes littoralis Stimpson, Smiths. Contrib. Knowledge, VI, 1853, p. 49, Pl. 3, fig. 36. *Our whole coast from Massachusetts Bay to Grand Manan.*

——— Bate, Cat. Amph. Crust. Brit. Mus., 1862, p. 48, Pl. 8, fig. 2 (on Stimpson's material).

——— Holmes, Am. Nat., XXXVII, 1903, p. 274. Arctic America to Hatteras.

——— Holmes, Bull. Bur. Fisher, XXIV, 1904 (1905), p. 472 figs. Grand Manan to Long Island.

——— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 53 (New England).

——— Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1905 (1906), p. 153, fig. 20. Chimney Sweeps near City Island, N. Y. City.

NEW YORK (Long Island, Chimney Sweeps near City Island, New York City).

Genus HYALELLA S. I. Smith.

Hyalella S. I. Smith, Rep. U. S. F. Com., II, 1872-73 (1874), p. 645. Type *Hyalella dentata* S. I. Smith, first species.

***Hyalella dentata* S. I. Smith.**

Hyalella dentata S. I. Smith, Rep. U. S. F. Com., II, 1872-73 (1874), p. 645, Pl. 2, figs. 8-10. *New Haven, Connecticut; Wisconsin; Lake Superior; Oregon; Nebraska; Iowa; Massachusetts; Michigan; Maine; Florida.*
 — M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 53. (New England, in fresh water.)

Allorchestes dentata Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1904 (1906), p. 152, fig. 19. New York City.

Gammarus minimus (nec Say) White, List Crust. Brit. Mus., 1847, p. 88 (on some of Say's material). United States.

? *Allorchestes knickerbockerii* Bate, Cat. Amph. Crust. Brit. Mus., 1862, p. 36, Pl. 6, fig. 1. *North America* (on specimens from Say labeled as *Gammarus minus* "in brooks, under stones").

— S. I. Smith, Rep. U. S. F. Com., II, 1873-74 (1875), p. 654 (remarks).

? *Allorchestes sayi* Bate, l. c., p. 39, Pl. 6, fig. 5. *North America.* (Based on material from Say.)

NEW YORK (New York City).

Doubtless many localities in other of the Middle States. Possibly *Allorchestes knickerbockerii* Bate may refer to specimens from New York or Philadelphia?

Tribe HYPERIIDÆ.

Family HYPERIIDÆ.

Genus PARATHEMISTO Boeck.

Parthemisto Boeck, Forh. Vid. Selsk. Christiania, 1870, p. 87. Type *Parthemisto abyssorum* Boeck, second species, designated by Boeck, Skand. Arkt. Amphipoder, 1872, p. 84.

Lestrigonus Bate, Ann. Mag. N. Hist. London, (5), I, 1878, p. 411. Type *Lestrigonus spinidorsalis* Bate, monotypic.

***Parthemisto oblivia* (Kröyer).**

Hyperia oblivia Kröyer, Grönland Amphipoder, 1838, p. 70, Pl. 4, fig. 19. *Greenland.*

Parathemisto oblivio Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 465. Albatross Sta. 2029, N. Lat. $39^{\circ} 42'$, W. Long. $70^{\circ} 47'$, in 1168 fathoms; Albatross Sta. 2101, N. Lat. $39^{\circ} 18' 30''$, W. Long. $68^{\circ} 24'$, in 1686 fathoms.

GULF STREAM.

Genus EUTHEMISTO Bovallius.

Euthemisto Bovallius, Bih. K. Svensk. Vet. Ak. Handl., XI, No. 16, 1887, p. 21. Type *Themisto gaudichaudii* Guérin-Méneville, virtually, as name proposed to replace *Themisto*, and designated by Boeck, Skand. Arkt. Amphipoder, 1872, p. 86.

Themisto (nec Guérin-Méneville 1828) Milne-Edwards, Hist. Nat. Crust., III, 1840, p. 85. Type *Themisto gaudichaudii* Guérin-Méneville, first species.

Euthemisto bispinosa (Boeck).

Themisto bispinosa Boeck, Forh. Vid. Selsk. Christiania, 1870 (1871), p. 88 Greenland.

Euthemisto bispinosa Stebbing, Voy. Challenger, Amph., LXVII, 1888, p. 1408. N. Lat. $40^{\circ} 17'$, W. Long. $66^{\circ} 48'$ at surface.

—— Holmes, Am. Nat., XXXVII, 1903, p. 272. Arctic America to Hatteras.

—— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 465. Long I. (and northward). Grampus Sta. 89.

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 51. Off Martha's Vineyard.

GULF STREAM.

Euthemisto compressa (Goes).

Themisto compressa Goes, Ofvers. K. Svensk. Vet. Ak. Förh., XXII, 1865 (1866), p. 533, Pl. 41, fig. 34. *Mari septentrionali Groenlandiam alluente, Davis Strait. Oceano boreali-atlantico gradu lat. $58^{\circ} 4'$ et alibi circa.*

Euthemisto compressa Holmes, Amer. Nat., XXXVII, 1903, p. 271. Arctic America to Hatteras.

—— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 464. Albatross Station 914, N. Lat. $24^{\circ} 7'$, W. Long. $75^{\circ} 32' 30''$, in 515 fathoms; Albatross Station 2029, N. Lat. $39^{\circ} 42'$, W. Long. $70^{\circ} 47'$, in 1168 fathoms; Albatross Station 2095, N. Lat. $39^{\circ} 29'$, W. Long. $70^{\circ} 58' 40''$, in 1342 fathoms; Albatross Station 2101, N. Lat. $39^{\circ} 18' 30''$, W. Long. $68^{\circ} 24'$, in 1686 fathoms; Albatross Station 2255, N. Lat. $40^{\circ} 46' 30''$, W. Long. $69^{\circ} 50' 15''$, in 18 fathoms.

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 50. Off Martha's Vineyard, off Nantucket Shoals.

GULF STREAM.

Genus HYPEROCHE Bovallius.

Hyperoche Bovallius, Bih. K. Svensk Vet. Ak. Handl., XI, 1887, No. 16, p. 18. Type *Hyperoche kroeyeri* Bovallius, first species.

Metoecus (nec Dejean 1833) Krøyer, Grönland Amphipoder, 1838, pp. 60, 63. Type *Metoecus medusarum* Krøyer, monotypic.

Tauria (nec Dana 1852) Boeck, Skand. Ark. Amphipoder, 1872, p. 82. Type *Metoecus medusarum* Krøyer, monotypic.

Hyperoche abyssorum (Boeck).

Metoecus abyssorum Boeck, Forh. Vid. Selsk. Christiania, 1870 (1871), p. 86. *Hardanger-fjord* (Norway).

Hyperoche abyssorum Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 464. Arctic regions to Albatross Sta. 2029, N. Lat. $39^{\circ} 42'$, W. Long. $70^{\circ} 47'$, in 1168 fathoms.

GULF STREAM.

Family CYSTISOMIDÆ.**Genus CYSTISOMA** Guérin-Méneville.

Cystisoma Guérin-Méneville, Rev. Zoöl., 1842, p. 215. Type *Cystisoma nep-
tunus* Guérin-Méneville, monotypic.

Cystosoma, *Cysteosoma*, auct.

Thaumops Willemöes-Suhm, Proc. Roy. Soc. London, XXI, 1873, p. 206. Type *Thaumops pellucida* Willemöes-Suhm, monotypic.

Thaumatops, auct.

Cystisoma spinosum (C. Fabricius).

Oniscus spinosus C. Fabricius, Syst. Entomol., 1775, p. 298. *Atlantic Ocean*.

Cystisoma spinosum Holmes, Am. Nat., XXXVII, 1903, p. 271. Arctic America to Florida.

— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 465. Albatross Sta. 2199, N. Lat. $39^{\circ} 57' 30''$, W. Long. $69^{\circ} 41' 10''$, in 78 fathoms.

GULF STREAM.

Family PHROSINIDÆ.**Genus ANCHYLOMERA** Milne-Edwards.

Anchylomera Milne-Edwards, Ann. Sci. Nat. Zoöl., XX, 1830, pp. 385, 394. Type *Anchylomera blosscvillii* Milne-Edwards, first species.

Hieraconyx Guérin-Méneville, Mag. Zoöl., VII, No. 17, 1836, p. 4. Type *Hieraconyx raccourci* Guérin-Méneville, monotypic.

Cheiropristis de Natale, Crost. Port. Messina, 1850, p. —. Type *Cheiropristis messanensis* de Natale, monotypic. (Not consulted.)

Anchylomera blossevillii Milne-Edwards.

Anchylomera blossevillii Milne-Edwards, Ann. Sci. Nat., XX, 1830, p. 394.
No locality.

—— Holmes, Amer. Nat., XXXVII, 1903, p. 270. Cape Cod to Hatteras.

—— Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 465. Gulf Stream.

GULF STREAM.

Family VIBILIDÆ.

Genus VIBILIA Milne-Edwards.

Vibilia Milne-Edwards, Ann. Sci. Nat. Zoöl., XX, 1830, p. 386. Type *Vibilia peronii* Milne-Edwards, monotypic.

Dactylocera Latreille, Cours d'Entomologie, 1831, p. 398. Type *Vibilia peronii* Milne-Edwards, virtually, as name proposed to replace *Vibilia*.

Thaumalea Templeton, Trans. Entomol. Soc. London, I, pt. 3, 1836, p. 186.
Type *Thaumalea depilis* Templeton, monotypic.

Oratrina de Natale, Crost. Port. Messina, 1850, p. —. Type *Oratrina pulchella* de Natale, monotypic. (Not consulted.)

Elasmocerus (nec Le Conte 1849) Costa, Cat. Crost. Ital. Hope, 1851, p. 22.
Type *Elasmocerus speciosus* Costa, monotypic. (Not consulted.) Type *Vibilia speciosus* Costa, mentioned by Stebbing, Rep. Voy. Challenger Amph., XXIX, pt. 2, 1888, p. 1278.

Vibilia pelagica (Say).

Lanceola pelagica Say, Journ. Acad. Nat. Sci. Phila., I, pt. 2, 1818, p. 317.
Gulf Stream.

Vibilia pelagica Bate, Cat. Amph. Crust. Brit. Mus., 1862, p. 304 (from Say).

Hyperia latreilli De Kay, N. Y. Faun. Crust., VI, 1844, p. 39 (on Say).

?*Vibilia viatrix* Holmes, Bull. U. S. F. Com., XXIV, 1904 (1905), p. 465.
(Off Newport, Rhode Island.)

?—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 49. Off Martha's Vineyard, off Newport.

GULF STREAM.

Family OXYCEPHALIDÆ.

Genus OXYCEPHALUS Milne-Edwards.

Orycephalus Milne-Edwards, Ann. Sci. Nat. Zoöl., XX, 1830, p. 396. Type *Orycephalus piscatoris* Milne-Edwards, monotypic.

Oxycephalus clausi Bovallius.

- Oxycephalus clausi* Bovallius, K. Svensk. Vt. Ak. Handl., XI, No. 16, 1886 (1887), p. 35. *Atlantic, Mediterranean, Indian Ocean, Pacific.*
- Holmes, Am. Nat., XXXVII, 1903, p. 270. Cape Cod to Hatteras or Va. province.
- Holmes, Bull. Bur. Fisher., XXIV, 1904 (1905), p. 465. Albatross Sta. 2095, N. Lat. 39° 29', W. Long. 70° 58' 40'' in 1342 fathoms.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, No. 5, 1905, p. 51. Off Martha's Vineyard.
- GULF STREAM.

Sub-Order ISOPODA.*The Isopods.***Super-Family Oniscoidea.***The Wood Lice.**Family TRICHONISCIDÆ.***Genus TRICHONISCUS** J. F. Brandt.

- Trichoniscus* J. F. Brandt, Bull. Soc. Imp. Nat. Moscou, VI, 1833, pp. 171-193. Type *Trichoniscus pusillus* J. F. Brandt, designated by G. O. Sars, Account Crust., Norway, II, 1899, p. 161. (Not consulted.)
- Itea* Koch, Deutschl. Crust., 1835-44, p. 22. Type *Itea riparia* Koch. (Not consulted.)
- Philougria* Kinahan, Nat. Hist. Rev., IV, 1857, p. 281. Type *Philougria celer* Kinahan, monotypic.

Trichoniscus pusillus J. F. Brandt.

- Trichoniscus pusillus* J. F. Brandt, Bull. Soc. Imp. Moscou, VI, 1833, pp. 171-193, Pl. 4, fig. 9. *Europe.* (Not consulted.)
- Stuxberg, Ofvers. Vet. Ak. Förh., XXXII, 1875, No. 2, p. 49. Niagara.
- Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 364. Canada near Niagara.
- H. Richardson, Am. Nat., XXXIV, 1900, p. 307. North America at Niagara.
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 575. North America.
- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 694, fig. 733. North America.

NEW YORK (Niagara).

PENNSYLVANIA (Mr. E. G. Vannatta secured a number of examples at Toughkenamon, in Chester County, in November, 1912).

Family LIGYDIDÆ.¹

Genus LIGIDIUM J. F. Brandt.

Ligidium J. F. Brandt, Bull. Soc. Imp. Nat. Moscou, VI, 1833, pp. 171-193.

Type *Oniscus hypnorum* Cuvier. (Not consulted.)

Zia Koch, Deutsch. Crust. 1835-44, p. —. Type *Zia agilis* Koch. (Not consulted.)

? *Euphiloscia* Packard, Rep. Peabody Acad. Sci., 1873, p. 96. Type *Euphiloscia elrodii* Packard, monotypic.

Ligidium longicaudatum Stoller.

Ligidium longicaudatum Stoller, 54th An. Rep. N. Y. State Mus., I, 1900 (1902), p. 208, fig. 1. *Schenectady, New York*.

— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 689, fig. 731 (from Stoller). *Schenectady, N. Y.*

NEW YORK (*Schenectady*).

Family SCYPHACIDÆ.

Genus SCYPHACELLA S. I. Smith.

Scyphacella arenicola S. I. Smith.

Family ARMADILLIDIDÆ.

The Pill Bugs.

Genus ARMADILLIDIUM Brandt and Ratzeburg.

The Pill Bugs.

Armadillidium vulgare (Latreille).

Pill Bug.

¹ *Ligyda oceanica* (Linnæus) has been reported from off Newport, Rhode Island, and in lieu of locality cannot be included within the present limits.

Armadillidium quadrifrons Stoller.

- Armadillidium quadrifrons* Stoller, 54th An. Rep. N. Y. State Mus., I, 1900 (1902), p. 211r, fig. 2. *Schenectady, New York*.
 — H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 668, figs. 707-708. *Schenectady, New York*.
 NEW YORK (*Schenectady*).

Family ONISCIDÆ.

*Wood Lice.*Genus **ACTONISCUS** Harger.

- Actoniscus* Harger, Am. Jour. Sci. Art., (3) XV, 1878, p. 373. Type
Actoniscus ellipticus Harger, monotypic.

Actoniscus ellipticus Harger.

- Actoniscus ellipticus* Harger, Amer. Journ. Sci. Art., (3) XV, 1878, p. 373.
Savin Rock, near New Haven, and also at Stony Creek. (Connecticut.)
 — Harger, Proc. U. S. Nat. Mus., II, 1879, p. 164. Only south of Cape Cod.
 — Harger, Rep. U. S. F. Com., VI, 1879 (1880), p. 309, Pl. 1, fig. 3. Stony Creek, Long Island Sound.
 — H. Richardson, Am. Nat., XXXIV, 1900, p. 307. Atlantic coast south to Cape Cod.
 — H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 576. Stony Creek, Long Island Sound.
 — H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 634, fig. 678. Stony Creek, Long Island Sound. (Connecticut and Bermudas.)
 — M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 47. (Connecticut.)

LONG ISLAND SOUND.

Genus **METOPONORTHUS** Budde-Lund.

- Metoponorthus* Budde-Lund, Prosp. Gen. Spec. Crust. Isop. Terrest., 1879, p. 4. Type *Porcellio pruinosus* J. F. Brandt. (Not consulted.)
Porcellionides Miers, Proc. Zoöl. Soc. London, 1877, p. 668. Type *Porcellionides flavovittata* Miers, second species.

Metoponorthus pruinosus (J. F. Brandt).

- Porcellio pruinosus* J. F. Brandt, Bull. Soc. Imp. Nat. Moscou, VI, 1833, pp. 171-193. *Europe.* (Not consulted.)
Metoponorthus pruinosus Stebbing, Hist. Recent Crust. (Internat. Sci. Ser. LXXIV), 1893, p. 429. Cosmopolitan.

- H. Richardson, *Am. Nat.*, XXXIV, 1900, p. 303. North and South America, Europe, North Africa.
- H. Richardson, *Proc. U. S. Nat. Mus.*, XXIII, 1901, p. 569. North and South America, Europe, North Africa, etc.
- Metoponorthus pruinosus* Stoller, 54th An. Rep. N. Y. State Mus., I, 1900 (1902), p. 213r. Schenectady, New York.
- Metaporthus pruinosus* Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1905 (1906), p. 183, fig. 57. New York City.
- H. Richardson, *Bull. U. S. Nat. Mus.*, No. 54, 1905, p. 627, fig. 674. Smith's Island, Va.; Woodside, Md.
- NEW YORK (Schenectady, New York City).
- MARYLAND (Woodside).
- VIRGINIA (Smith's Island).

Genus **PORCELLIO** Latreille.*Sow Bugs.***Porcellio scaber** Latreille.**Porcellio spinicornis** Say.

- Porcellio spinicornis* Say, *Journ. Acad. Nat. Sci. Phila.*, I, 1818, p. 431. *North America.*
- De Kay, *N. Y. Fauna, Crust.*, VI, 1844, p. 51. Cellars and gardens (New York).
- H. Richardson, *Amer. Nat.*, XXXIV, 1900, p. 304. North America.
- H. Richardson, *Proc. U. S. Nat. Mus.*, XXIII, 1901, p. 567. New York, Niagara, Goshen (Connecticut and Europe).
- Stoller, 54th An. Rep. N. Y. State Mus., I, 1900 (1902), p. 213r. Schenectady, New York.
- H. Richardson, *Bull. U. S. Nat. Mus.*, No. 54, 1905, p. 619, figs. 669-670. Niagara, New York (Connecticut and Europe).
- M. J. Rathbun, *Occas. Papers Boston Soc. N. Hist.*, VII, 1905, p. 46. In damp cellars, etc. (New England).
- Porcellio pictus* Budde-Lund, *Crust. Isopod. Terr.*, 1885, p. 123. Niagara, New York.
- NEW YORK (Niagara, Schenectady, Goshen).

Porcellio lævis Latreille.**Porcellio rathkei** J. F. Brandt.

- Porcellio rathkei* J. F. Brandt, *Bull. Soc. Imp. Nat. Moscou*, VI, 1833, p. 177. "Germania." (Not consulted.)
- H. Richardson, *Amer. Nat.*, XXXIV, 1900, p. 304. North America.

- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1900, p. 567. East Coast New York. Syracuse, N. Y.
- Stoller, 54th An. Rep. N. Y. State Mus., I, 1900 (1902), p. 212r. Schenectady, N. Y.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1905 (1906), p. 182, fig. 55. New York City.
- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 617, fig. 668. New York City, Chaumont, Syracuse, Washington, D. C. (United States and Europe).
- Porcello rathkii* Budde-Lund, Crust. Isop. Terr., 1885, p. 85. New York, Niagara.

NEW YORK (Niagara, Syracuse, Schenectady, New York City, Chaumont).

DISTRICT OF COLUMBIA (Washington).

Genus CYLISTICUS Schnitzler.

Cylisticus Schnitzler, De Onisc. Bonnen. (Dissert. Zoöl.), 1853, p. 25. Type *Porcellio leviss* (nec Latreille) Koch=*Oniscus convexus* De Geer.

Cylisticus convexus (De Geer).

- Oniscus (convexus)* De Geer, Mém. Hist. Insects., VII, 1778, p. 553. Pl. 35, fig. 11. "Dans ma chambre." (France.)
- Cylisticus convexus* H. Richardson, Amer. Nat., XXXIV, 1900, p. 303. North America.
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 565. North America (and Europe).
- Stoller, 54th An. Rep. N. Y. State Mus., I, 1900 (1902), p. 213r. Schenectady, New York.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1905 (1906), p. 181, fig. 54. New York City.
- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 609. Norwich, New York City, Piseco, Syracuse and Washington, D. C. (United States and Europe).
- Porcellio convexus* M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 46 (Massachusetts).

NEW YORK (New York City, Piseco, Syracuse, Norwich).

DISTRICT OF COLUMBIA (Washington).

Genus PHILOSCIA Latreille.

Philoscia vittata Say.

Genus ONISCUS Linnæus.

Wood Lice.

Oniscus asellus Linnæus.

Super-Family ASELOIDEA.

The Asels.

Family MUNNOPSISÆ.

Genus MUNNOPSIS M. Sars.

Munnopsis M. Sars, Forh. Vid. Selsk. Christiania, 1860 (1861), p. 84. Type
Munnopsis typica M. Sars, monotypic.

Munnopsis typica M. Sars.

Munnopsis typica M. Sars, Forh. Vid. Selsk. Christiania, 1860 (1861), p. 84.
"50-60 Færne ved Christiansund."

— S. I. Smith, Proc. U. S. Nat. Mus., III, 1880, p. 450. N. Lat. 39°, W.
Long. 70°, in 142 fathoms.

GULF STREAM.

Family JANIRIDÆ.

Genus JANIRA Leach.

Janira Leach, Edinburgh Encyclop., VII, 1813, p. 434. Type *Janira maculosa*
Leach, monotypic.¹ (Not consulted.)

Janira, auct.

Oniscoda Latreille, Règne Animal, Cuv., Ed. 2, IV, 1829, p. 140. Type *Janira*
maculosa Leach, monotypic.

Henopomus Krøyer, Naturh. Tidssk., II, 1846, pp. 366, 379. Type *Henopomus*
muticus Krøyer, first species.

Aselloides Stimpson, Smithson. Contrib. Knowledge, VI, 1853, p. 41. Type
Aselloides alta Stimpson, monotypic.

Janira alta (Stimpson).

Asellodes alta Stimpson, Smithson. Contrib. Knowledge, VI, 1853, p. 41, Pl. 3,
fig. 30. In soft mud in 40 fathoms, off Long Island, Grand Manan.

Janira alta S. I. Smith, Proc. U. S. Nat. Mus., III, 1880, p. 450. N. Lat.
39°-40°, W. Long. 70°-71°, in 65-487 fathoms.

— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 556. Long
Island (New England and northward).

— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 475, figs. 531-532.
Long Island (northward to Nova Scotia and Grand Banks).

NEW YORK (off Long Island).

GULF STREAM.

¹ Am. Ed., VII, 1815, p. 273.

Genus *JÆRA* Leach.

Jæra Leach, Edinburgh Encyclop., VII, 1813, p. 434. Type *Jæra albifrons* Leach, monotypic.¹ (Not consulted.)

Iæra, auct.

Iæridina Milne-Edwards, Hist. Nat. Crust., III, 1840, p. 150. Type *Janira nordmanni* Rathke, monotypic.

Iæridina, auct.

Jæra marina (Fabricius).

Oniscus marinus Fabricius, Faun. Grœnl., 1780, p. 252. *Greenland*.

Jæra marina H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 554. Whole coast of New England to Labrador and Europe.

—— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 450, figs. 503-504. New England to Greenland, and Europe.

—— Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1905 (1906), p. 178, fig. 51. New York City.

Jæra albifrons M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 43. Whole coast of New England.

NEW YORK (New York City).

Family ASELLIDÆ.

The Asels.

Genus ASELLUS G. St. Hilaire.

*The Asels.**Asellus communis* Say.*Water Asel.**Asellus attenuatus* H. Richardson.

Asellus attenuatus H. Richardson, Amer. Nat. XXXIV, 1900, p. 297. *Virginia*.

—— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 552, fig. 26. *Washington Ditch, Dismal Swamp, Virginia*.

—— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 426, figs. 482-485 (types).

VIRGINIA (Washington Ditch in Dismal Swamp).

¹Amer. Ed., VII, 1815, p. 273.

Genus *CÆCIDOTEA* Packard.

Cæcidotea Packard, Amer. Nat., V, 1871, p. 752. Type *Cæcidotea stygia* Packard, monotypic.

Cæcidotea stygia Packard.

Cæcidotea stygia Packard, Amer. Nat., V, 1871, p. 752, figs. 132-133. *Mammoth Cave, Kentucky*.

— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 553. *Graham's Spring, Lexington, Virginia (Kentucky and Indiana)*.

— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 434, figs. 490-491 (above localities).

VIRGINIA (*Graham's Spring at Lexington*).

Genus *MANCASELLUS* Harger.

Mancasellus Harger, Amer. J. Sci. Art., (3) XI, 1876, p. 304. Type *Mancasellus brachyurus* Harger, monotypic.

Mancasellus brachyurus Harger.

Mancasellus brachyurus Harger, Amer. J. Sci. Art., (3) XI, 1876, p. 304. *Rockbridge County, Virginia*.

— Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 359. *Virginia (reference)*.

— Bovallius, Bih. K. Svensk. Vet. Ak. Handl., XI, 1886, No. 15, p. 39. *Lakes in Atlantic Coast region of United States*.

— H. Richardson, Amer. Nat., XXXIV, 1900, p. 296. *McKee's Spring, Lexington, Virginia*.

— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 411, figs. 460-461. *McKee's Spring and Gaylord, Virginia*.

VIRGINIA (*Gaylord in Clarke County, and McKee's Spring, Lexington, Rockbridge County*).

Super-Family BOPYROIDEA.

Family BOPYRIDÆ.

Genus *PROBOPYRUS* Giard and Bonnier.*Probopyrus pandalicola* (Packard).

Præon Louse.

Genus **LEIDYA** Cornalia and Panceri.

Leidya distorta (Leidy).

Genus **PSEUDIONE** Kossmann.

Pseudione Kossmann, Zeitsch. Wiss. Zoöl., XXXV, 1881, p. 665, Pl. 33, fig. 17. Type *Pseudione callianassa* Kossmann, monotypic.

Pseudione furcata H. Richardson.

Pseudione furcata H. Richardson, Proc. U. S. Nat. Mus., XXVII, 1904, p. 79. *Eastern Shore of Virginia* (host unknown).

— H Richardson, Bull. U. S. Nat. Mus., No 54, 1905, p. 529, figs. 571-573 (types).

VIRGINIA (Eastern Shore).

Super-Family IDOTHEOIDEA.

Family IDOTHEIDÆ.

Genus **ERICHSONELLA** H. Richardson.

Erichsonella filiformis (Say).

Erichsonella attenuata (Harger).

Genus **EDOTIA** Guérin-Ménéville.

Edotia triloba (Say).

Edotea montosa (Stimpson).

Edotea montosa Stimpson, Smiths. Contrib. Knowl., VI, 1853, p. 40. *In deep water on sandy and muddy bottom* (at Grand Manan).

Epelys montosus Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 370. (Vineyard Sound.)

— Harger, Rep. U. S. F. Com., I, 1871-72 (1873), p. 571. Bay of Fundy to Long Island Sound.

— Harger, Proc. U. S. Nat. Mus., II, 1879, p. 161. Long Island Sound.

— Harger, Rep. U. S. F. Com., VI, 1879 (1880), p. 359, Pl. 8, figs. 44-47. Near eastern end of Long Island Sound.

Edotea montosa Miers, Journ. Linn. Soc. London, XVI, 1883, p. 72. Bay of Fundy to Long Island Sound.

— H. Richardson, Amer Nat., XXXIV, 1900, p. 228. Atlantic coast south to Cape Cod and North Carolina.

- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 545. Block Island Sound and Long Island Sound to Nova Scotia.
- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 397, figs. 443-444. Long Island Sound and Block Island Sound to Nova Scotia.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 42. Bay of Fundy to Long Island Sound in 16 to 40 fathoms.

LONG ISLAND SOUND.

Genus *IDOTEA* Fabricius.*Idotea phosphorea* Harger.

- Idotea phosphorea* Harger Rep. U. S. F. Com., I, 1871-1872 (1873), p. 569. Long Island Sound to Bay of Fundy.
- Verrill, Rep. U. S. F. Com., I, 1871-1872 (1873), pp. 316, 452. (Southern New England.)
- Harger, Proc. U. S. Nat. Mus., II, 1879, p. 160. Throughout the coast (New England.)
- Harger, Rep. U. S. F. Com., VI, 1878 (1880), p. 347, Pl. 5, figs. 27-29. Long Island Sound to Gulf of St. Lawrence.
- H. Richardson, Amer. Nat., XXXIV, 1900, p. 227. Atlantic coast south to Cape Cod.
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 541. Entire New England coast to Gulf of St. Lawrence.
- Paulmier, 58th An. Rep. N. Y. State Mus., IV, 1905 (1906), p. 176, fig. 48. South Beach, Staten Island.
- Idothea phosphorea* H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 367, fig. 398. New England to Gulf of St. Lawrence.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 41. Bay of Fundy to western end of Long Island Sound. Surface to 30 fathoms.
- Idotea marina* var. *phosphorea* Miers, Journ. Linn. Soc. London, XVI, 1883, p. 31. Entire coast of New England.

LONG ISLAND SOUND.

NEW YORK (South Beach, Staten Island).

Idotea metallica Bosc.*Idotea balthica* (Pallas).Genus *CHIRIDOTEA* Harger.*Chiridotea tuftsii* (Stimpson).

- Idotea tuftsii* Stimpson, Smithsonian. Contrib. Knowl., VI, 1853, p. 39. Sandy bottom in 10 fathoms, off Cheney's Head (Grand Manan).
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 340. (Vineyard Sound.)

—— Harger, Rep. U. S. F. Com., I, 1871-72 (1873), p. 569. Bay of Fundy to Connecticut.

Chiridotea tuftsii Harger, Proc. U. S. Nat. Mus., II, 1879, p. 159. Long Island Sound to Halifax.

—— Harger, Rep. U. S. F. Com., VI, 1878 (1880), p. 340, Pls. 4-5, figs. 20-23. Long Island Sound.

—— H. Richardson, Amer. Nat., XXXIV, 1900, p. 226. Atlantic Coast south to Cape Cod and North Carolina.

—— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 539. Long Island Sound to Nova Scotia.

—— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 354, figs. 382-383. Long Island Sound northward.

Glyptonotus tuftsii Miers, Journ. Linn. Soc. London, XVI, 1883, p. 18. Bay of Fundy to Long Island Sound

LONG ISLAND SOUND.

Chiridotea cæca (Say).

Family ARCTURIDÆ.

Genus ASTACILLA Cordiner.

Astacilla Cordiner, Remarkable Ruins and Romant. Pros. N. Brit., 1795, p. —. Pl., fig. 1. Atypic. (Not consulted.) Type *Oniscus longicornis* Sowerby, virtually designated by Stebbing, Hist. Recent Crust. (Intern. Sci. Ser. LXXIV), 1893, p. 371.

Leacia Johnston, Edinburgh Philos. Journ., XIII, 1825, p. 219. Type *Leacia lacertosa* Johnston, monotypic.

Leachia, auct.

Astacilla cæca Benedict.

Astacilla cæca Benedict, Proc. Biol. Soc. Wash., XII, 1898, p. 51, fig. 11. N. Lat. 38° 22', W. Long. 70° 17' 30", in 1825 fathoms.

—— H. Richardson, Amer. Nat., XXXIV, 1900, p. 230. Atlantic Coast south to Cape Cod.

—— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 550 (type, reference).

—— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 326, fig. 357 (type).

GULF STREAM.

Super-Family CYMOTHOIDEA.

Family SPHÆROMIDÆ.

Genus CILICÆA Leach.

Cilicæa caudata (Say).

Genus SPHÆROMA Latreille.

Sphæroma quadridentatum Say.

Genus CASSIDISCA H. Richardson.

Cassidisca lunifrons (H. Richardson).

Family ANCINIDÆ.

Genus ANCINUS Milne-Edwards.

Ancinus depressus (Say).

Family LIMNORIIDÆ.

The Gribbles.

Genus LIMNORIA Leach.

Limnoria lignorum (Rathke).

Gribble.

Family CYMOTHOIDÆ.

Genus ÆGATHOA Dana.

Ægathoa oculata (Say).

Ægathoa medialis H. Richardson.

Ægathoa medialis H. Richardson, Am. Nat., XXXIV, 1900, p. 220. *Cape Cod to North Carolina in 3 to 25 fathoms.*

— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 527, fig. 11 (type). Barren Island, Chesapeake Bay.

— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 218, fig. 221 (type).

MARYLAND (Barren Island, Dorchester County, Chesapeake Bay).

Genus LIVONECA Leach.**Livoneca ovalis** (Say).**Livoneca redmanni** Leach.

Livoneca redmanni Leach, Dict. Sci. Nat., XII, 1818, p. 352. *Seas of Jamaica*.

—— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 531. New York to Rio Janeiro.

NEW YORK.

Genus CYMOTHOA Fabricius.

Cymothoa Fabricius, Entomol. Syst., II, 1793, p. 503. Type *Oniscus æstrum* Linnæus, sixth species.

Cymothoa æstrum (Linnæus).

Oniscus æstrum Linnæus, Syst. Nat., Ed. 10, 1758, p. 636. *Habitat in Occano*.

Cymothoa æstrum De Kay, N. Y. Fauna, Crust., VI, 1844, p. 48 (on Gould's Massachusetts account).

—— H. Richardson, Amer. Nat., XXXIV, 1900, p. 221. Cape Cod to North Carolina.

—— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 530. Caribbean Sea to shores of Virginia.

—— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 254, figs. 263-264. Caribbean Sea to Virginia.

VIRGINIA.

Cymothoa excisa Spix and Martius.

Cymothoa excisa (Perty) Spix and Martius, Del. Anim. Brasil., 1830-44, p. 211, Pl. 40, fig. 11. *Habitat prope Sebastianopolin*.

—— Schiedte and Meinert, Naturh. Tidssk., (3) XIV, 1883-84, p. 238, Pl. 6, figs. 11-16. Massachusetts to Rio Janeiro.

—— H. Richardson, Amer. Nat., XXXIV, 1900, p. 221. Cape Cod to Gulf of Mexico.

—— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 530. Massachusetts to Rio Janeiro.

—— M. J. Rathbun, Occas. Papers Boston Soc. Nat. Hist., VII, 1905, p. 38. (Massachusetts.)

—— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 248, figs. 259-260. Massachusetts to Rio Janeiro.

Ranges from Massachusetts to Rio Janeiro.

Genus CERATOTHOA Dana.

Ceratothoa impressa (Say).

Genus OLENCIRA Leach.

Olencira prægustator (Latrobe).

Genus ANILOCRA Leach.

Anilacra Leach, Dict. Sci. Nat., XII, 1818, p. 350. Type *Anilocra cuvierii* Leach, first species.

Anilocra, emend.

Epichthys Herklots, Arch. Néerl. Sci. Nat., V, 1870, p. 120. Type *Epichthys giganteus* Herklots, monotypic.

Anilocra laticauda Milne-Edwards.

Anilocra laticauda Milne-Edwards, Hist. Nat. Crust., III, 1840, p. 259. *Sea of the Antilles*.

—— Schiödte and Meinert, Naturh. Tidssk., (3) XIII, 1881-83, p. 126, Pl. 9, figs. 1-3. Maryland to Straits of Magellan.

—— H. Richardson, Amer. Nat., XXXIV, 1900, p. 221. Cape Cod to Florida.

—— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 528. Maryland to Straits of Magellan.

—— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 227, figs. 230-231. Maryland to Magellan Straits.

MARYLAND.

Genus NEROCILA Leach.

Nerocila acuminata Schiödte and Meinert.

Nerocila acuminata Schiödte and Meinert, Naturh. Tidssk., (3), XIII, 1881-83, p. 48, Pl. 3, figs. 5-6. *Biloli, Mississippi; St. Anna, Mexico; Fort Macon, North Carolina*.

—— H. Richardson, Amer. Nat., XXXIV, 1900, p. 220. Cape Cod to Gulf of Mexico.

—— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 527. Newport, Virginia, to Gulf of Mexico.

—— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 220, figs. 222-223. Virginia to Mexico.

VIRGINIA (Newpoint).

Nerocila munda Harger.*Family* ÆGIDÆ.**Genus SYSCENUS** Harger.

Syscenus Harger, Rep. U. S. F. Com., VI, 1878 (1880), p. 387. Type *Syscenus infelix* Harger, monotypic.

Harponyx G. O. Sars, Forhand. Vid. Selsk. Christiania, 1882 (1883), No. 18, p. 60. Type *Harponyx pranizoides* G. O. Sars, monotypic.

Syscenus infelix Harger.

Syscenus infelix Harger, Rep. U. S. F. Com., VI, 1878 (1880), p. 387. *About 15 miles N. E. of Cape Cod in 130 fathoms.*

—— Harger, Bull. Mus. Comp. Zoöl., XI, 1883, No. 4, p. 100, Pl. 3, figs 5-5a, Pl. 4, figs. 3-3h. N. Lat. 41°, W. Long. 65°, in 306 fathoms; N. Lat. 40°, W. Long. 68°, in 304 fathoms.

—— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 560 (compiled).

—— H. Richardson, Amer. Nat., XXXIV, 1900, p. 219. Cape Cod to North Carolina in 231-435 fathoms.

—— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 524. All along Atlantic coast to Delaware Bay.

—— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 212, figs. 216-217. Martha's Vineyard to Delaware Bay (Europe).

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 38. (Fifteen miles N. E. of Cape Cod.)

GULF STREAM.

DELAWARE BAY.

Genus ROCINELA Leach.

Rocinela Leach, Dict. Sci. Nat., XII, 1818, p. 349. Type *Rocinela danmoniensis* Leach, monotypic.

Acherusia Lucas, Expl. Sci. Algérie, Zoöl. I, 1849, p. 78. Type *Acherusia dumerilii* Lucas, monotypic.

Rocinela americana Schiøedte and Meinert.

Rocinela americana Schiøedte and Meinert, Naturh. Tidssk., (3) XII, 1879-80, p. 394, Pl. 10, figs. 16-18. *Ircston America septentrionalis* [Trenton, Maine].

—— Harger, Bull. Mus. Comp. Z. Harvard, XI, 1883, No. 4, p. 98, Pl. 4, figs. 3, 3a, 4, Pl. 4, figs. 2-2a. N. Lat. 32°, W. Long. 77°, in 257 fathoms; N. Lat. 37°-40°, W. Long. 70°-74°, in 85-157 fathoms.

—— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 560 (compiled).

- H. Richardson, Am. Nat., XXXIV, 1900, p. 219. Atlantic coast south to Cape Cod and North Carolina.
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 524. N. Lat. 37°-40°, W. Long. 70°-74°, in 85-157 fathoms.
- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 201, figs. 193-195. Maine S. to N. Lat. 39°, W. Long. 74°.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 37 (Trenton, Maine).

GULF STREAM.

Genus *ÆGA* Leach.

Æga Leach, Trans. Linn. Soc. London, XI, 1815, p. 369. Type *Æga emarginata* Leach, first species.

Æga psora (Linnæus).*Salve Bug.*

- Oniscus psora* Linnæus, Syst. Nat., Ed. 10, 1758, p. 636. Norwegian Sea.
- Æga psora* Harger, Proc. U. S. Nat. Mus., II, 1879, p. 161 (George's Banks).
- Harger, Rep. U. S. F. Com., VI, 1878 (1880), p. 384, Pl. 10, fig. 64. (George's Banks, Gulf of Maine, Davis Straits.)
- Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 559 (compiled).
- H. Richardson, Amer. Nat., XXXIV, 1900, p. 218. Atlantic Coast south to Cape Cod.
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 52. Off Martha's Vineyard to Europe.
- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 168, fig. 148. (Europe) Greenland to Gulf of Mexico in 30-640 fathoms.
- ? GULF STREAM (off Martha's Vineyard).

Family CORALLANIDÆ.

Genus TRIDENTELLA H. Richardson.

Tridentella H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 161. Type *Cirolana virginiana* H. Richardson, monotypic.

Tridentella virginiana (H. Richardson).

- Cirolana virginiana* H. Richardson, Amer. Nat., XXXIV, 1900, p. 216. Cape Cod to North Carolina in 81 fathoms.
- H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 512, fig. 5. Chesapeake Bay.

Tridentella virginiana H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 161, figs. 141-145 (type, and Santa Barbara Islands, California).

CHESAPEAKE BAY.

Family CIROLANIDÆ.

Genus CIROLANA Leach.

Cirolana borealis Lilljeborg.

Cirolana borealis Lilljeborg, Ofvers. Vet. Ak. Forh., VIII, 1851, p. 23. "Christiansund et Bergen." (Norway.)

—— H. Richardson, Amer. Nat., XXXIV, 1900, p. 216. (South Carolina to Florida.)

—— H. Richardson, Proc. U. S. Nat. Mus., XXIV, 1901, p. 513. Atlantic coast of North America in 233 fathoms.

—— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 101, figs. 83-85. Cape Florida and Atlantic coast of North America and Europe.

Off Atlantic coast of North America in 30 to 300 fathoms.

Cirolana impressa Harger.

Cirolana impressa Harger, Bull. Mus. Comp. Zoöl. Harvard, XI, 1883, No. 4, p. 93, Pl. 1, figs. 3-3d, Pl. 2, figs. 3-3c. N. Lat. $38^{\circ} 21' 50''$, W. Long. $73^{\circ} 32'$, in 197 fathoms; N. Lat. $39^{\circ}-40^{\circ}$, W. Long. $69^{\circ}-70^{\circ}$, in 100-321 fathoms.

—— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 559, Pl. 36, fig. 165 (compiled).

—— H. Richardson, Am. Nat., XXXIV, 1900, p. 216. Cape Cod to North Carolina in 115-321 fathoms.

—— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 513. N. Lat. $39^{\circ}-40^{\circ}$, W. Long. $69^{\circ}-70^{\circ}$.

—— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 97, figs. 78-79. N. Lat. $39^{\circ}-40^{\circ}$. W. Long. $69^{\circ}-70^{\circ}$, to Cape Hatteras and Chesapeake Bay.

GULF STREAM.

CHESAPEAKE BAY.

Cirolana concharum (Stimpson).

Family ANTHURIDÆ.

Genus PTILANTHURA Harger.

Ptilanthura Harger, Amer. Journ. Sci. Art., (3) XV, 1878, p. 376. Type *Ptilanthura tenuis* Harger, monotypic.

Ptilanthura tenuis Harger.

Ptilanthura tenuis Harger, Am. Journ. Sci. Art., (3) XV, 1878, p. 377. *New England coast, from Noank Harbor, Conn., to Casco Bay, Maine.*

— Harger, Proc. U. S. Nat. Mus., II, 1879, p. 62. Throughout New England coast.

— Harger, Rep. U. S. F. Com., VI, 1879 (1880), p. 406, Pl. 11-12, figs. 71-74. Long Island Sound to Bay of Fundy.

— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 67, figs. 51-53. Grand Menan to Long Island Sound.

Anthura tenuis Norman and Stebbing, Tr. Z. Soc. London, XII, 1886, pt. 4, p. 124 (remarks).

— H. Richardson, Am. Nat., XXXIV, 1900, p. 215. Atlantic Coast south to Cape Cod in 19 fathoms.

— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 508. Long Island Sound to Grand Manan.

LONG ISLAND SOUND.

Genus CYATHURA Norman and Stebbing.**Cyathura carinata** (Kröyer).*Family* GNATHIIDÆ.**Genus GNATHIA** Leach.

Gnathia Leach, Edinburgh Encyclop., VII, 1814, p. 402. Type *Gnathia termioides* Leach, monotypic.¹ (Not consulted.)

Praniza (Leach) Latreille, Encyclop. Method., pt. 24, 1818, p. 6. Type *Oniscus cocruleata* Montagu, monotypic.

Anceus Risso, Crust. Nice, 1816, p. 51. Type *Anceus forficularius* Risso, monotypic.

Gnathia cerina (Stimpson).

Praniza cerina Stimpson, Smithson. Contrib. Knowledge, VI, 1853, p. 42, Pl. 3, fig. 31. *Twenty to thirty fathoms, Hoke Bay, Grand Manan.*

Gnathia cerina Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 560 (compiled).

— H. Richardson, Amer. Nat., XXXIV, 1900, p. 214, fig. 2. (Atlantic coast south to Cape Cod.)

— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 507. Off New England.

¹ Am. Ed., VII, 1815, p. 240.

- H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 59. Gulf of St. Lawrence to south of Martha's Vineyard, in 10-487 fathoms.
GULF STREAM (off Martha's Vineyard).

Super-Family **TANAIOIDEA**.

Family **TANAIDÆ**.

Genus **NEOTANAIS** Beddard.

- Neotanais* Beddard, Proc. Zoöl. Soc. London, 1886, p. 117. Type *Neotanais americanus* Beddard, monotypic.

Neotanais americanus Beddard.

- Neotanais americanus* Beddard, Proc. Zool. Soc. London, 1886, p. 117. N. Lat. 38° 34', W. Long. 72° 10' in 1240 fathoms. (S. Lat. 35° 39', W. Long. 50° 47' in 1000 fathoms.)
 — Beddard, Rep. Voy. Challenger, XVII, 1886, p. 124, Pl. 16, figs. 4-6 (above material).
 — H. Richardson, Am. Nat., XXXIV, 1900, p. 212. Cape Cod to North Carolina in 1240 fathoms.
 — H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 504 (compiled).
 — H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 32, fig. 32 (compiled).

GULF STREAM.

Genus **LEPTOCHELIA** Dana.

Leptochelia savignyi (Kröyer).

Leptochelia rapax Harger.

- Leptochelia rapax* Harger, Proc. U. S. Nat. Mus., II, 1879, p. 163. *Annisquam, Massachusetts*.
 — Harger, Rep. U. S. F. Com., VI, 1878 (1880), p. 424, Pl. 13, figs. 89-90 (types).
 — Sars, Arch. Math. Naturvid. Christiania, VII, 1882, p. 28. Northeast America.
 — H. Richardson, Am. Nat., XXXIV, 1900, p. 212. Cape Cod to North Carolina Region.
 — H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 30. *Annisquam Massachusetts to Bermuda*.
Leptochila rapax Paulmier, 58th Rep. N. Y. State Mus., VI, 1904 (1906), p. 171, fig. 41. Bayshore, N. Y.
 Middle States coastal region.
NEW YORK (Bayshore).

Genus TANAIS Audouin and Milne-Edwards.**Tanais robustus** H. F. Moore.**Tanais cavolinii** Milne-Edwards.*Tanais cavolinii* Milne-Edwards, Hist. Nat. Crust., III, 1840, p. 141, Pl. 31, fig. 6. *Gulf of Naples*.

——— H. Richardson, Proc. U. S. Nat. Mus., XXIII, 1901, p. 501. Long Island Sound to Greenland and Europe.

——— H. Richardson, Bull. U. S. Nat. Mus., No. 54, 1905, p. 8, figs. 11-12. Long Island Sound.

——— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 34. (Connecticut.)

Tanais vittatus Harger, Proc. U. S. Nat. Mus., II, 1879, p. 162. (Connecticut.)

——— Harger, Rep. U. S. F. Com., VI, 1878 (1880), p. 418, Pl. 13, figs. 81-82. (Connecticut.)

LONG ISLAND SOUND.

Order CUMACEA.*Family* DIASTYLIDÆ.**Genus OXYUROSTYLIS** Calman.*Oxyurostylis* Calman, Proc. U. S. Nat. Mus., XLI, 1912, p. 666. Type *Oxyurostylis smithi* Calman, designated, monotypic.**Oxyurostylis smithi** Calman.*Oxyurostylis smithi* Calman, Proc. U. S. Nat. Mus., XLI, 1912, p. 667, figs. 91-99. *Casco Bay, Vineyard Sound, Wood's Holl, Florida, Louisiana.*
Atlantic Coast region of Middle States.**Genus DIASTYLIS** Say.*Diastylis* Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 313. Type *Diastylis arenarius* Say, monotypic.*Condylura* (nec Illiger 1811) Latreille, Règne An. Cuv., Ed. 2, IV, 1829, p. 153. Atypic.*Alauna* Goodsir, Edinburgh New Phil. Journ., XXXIV, 1843, p. 127. Type *Alauna rostrata* Goodsir, monotypic.

Diastylis polita S. I. Smith.

Diastylis politus S. I. Smith, Trans. Conn. Acad. Sci., V, 1879, p. 109. Vineyard Sound; Gloucester, Massachusetts; Casco Bay; Trenton, Maine; Halifax; Gulf of St. Lawrence.

Diastylis polita Calman, Proc. U. S. Nat. Mus., XLI, 1912, p. 655, figs. 79-80. Block Island Sound.

Atlantic Coast of Middle States.

Diastylis stygia G. O. Sars.

Diastylis stygia G. O. Sars, Ofvers. K. Svensk. Vet. Ak. Handl., XI, 1872, No. 6, p. 6, Pl. 2, figs. 4-7. "Arct. lat. 78° longit. occident. 2° 27' 2600 orgyrum."

—— Calman, l. c., p. 661. N. Lat. 38°-40°, W. Long. 66°-70° in 146-1813 fathoms.

GULF STREAM.

Diastylis sculpta G. O. Sars.

Diastylis sculpta G. O. Sars, Ofv. K. Vet. Ak. Förh. Stockholm, XXVIII, 1871 (1872), p. 71. Shinnecock Bay, North America.

—— G. O. Sars, K. Svensk. Ak. Handl., IX, 1870 (1871), No. 13, p. 24, figs. 1-49. Shinnecock Bay, North America.

—— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 554 (on Sars).

—— Calman, Proc. U. S. Nat. Mus., 1912, p. 657. Block Island Sound.

Diastylis sculptus S. I. Smith, Trans. Conn. Acad. Sci., V, 1880, p. 111. Off Shinnecock Bay, Long Island, to Gulf of St. Lawrence.

—— Benedict, Rep. U. S. F. Com., XI, 1883 (1885), p. 176. Off Montauk Point, Long Island.

NEW YORK (Shinnecock Bay and off Montauk Point, Long Island).

Diastylis quadrispinosa G. O. Sars.

Diastylis quadrispinosa G. O. Sars, Ofvers. K. Vet. Ak. Förh. Stockholm, XXVIII, 1871 (1872), p. 72. "Prof. 30-35 org. latitud. 39° 54' sept., longit. 73° 15' occid. Grenw."

—— G. O. Sars, K. Svensk. Ak. Handl., IX, 1870 (1871), No. 13, p. 28, fig. 50-60 (same as above locality).

—— Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 507, Pl. 3, fig. 13. On soft muddy bottoms.

—— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 554, Pl. 3, fig. 13. Off Martha's Vineyard, Buzzard's Bay. Bay of Fundy.

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 32. Off Martha's Vineyard. (New England.)

- Calman, Proc. U. S. Nat. Mus., XLI, 1912, p. 658. Off Block Island.
N. Lat. 38° , W. Long. 73° in 102 fathoms.
- Diastylis quadrispinosus* S. I. Smith, Proc. U. S. Nat. Mus., III, 1880, p. 446.
N. Lat. 39° – 40° , W. Long. 70° in 100–142 fathoms.
- S. I. Smith, Trans. Conn. Acad., V, 1879 (1880), p. 112. Off New Jersey and Long Island Sound, Block Island Sound.
- Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 558 (compiled).

LONG ISLAND SOUND.

GULF STREAM.

***Diastylis abbreviata* G. O. Sars.**

- Diastylis abbreviata* G. O. Sars, Ofvers. Vet. Ak. Förh. Stöckholm, XXVIII, 1871 (1872), p. 74. "Prof. 30–35 org. lat. $39^{\circ} 54'$, long. $73^{\circ} 15'$."
- G. O. Sars, K. Svensk. Ak. Handl., IX, 1870 (1871), No. 13, p. 30, Pl. 12, figs. 62–64 (same locality as above).
- S. I. Smith, Rep. U. S. F. Com., I, 1871–72 (1873), p. 554 (from Sars).
- S. I. Smith, Trans. Conn. Acad. Sci., V, 1879, p. 113. Off New Jersey, Cape Ann, Casco Bay.

GULF STREAM.

Family LAMPROPIDÆ.**Genus** PARALAMPROPS G. O. Sars.

- Paralamprops* G. O. Sars, Rep. Voy. Challenger, Zoöl., XIX, 1887, p. 26. Type *Paralamprops serrato-costata* G. O. Sars, monotypic.

***Paralamprops orbicularis* (Calman).**

- Platyaspis orbicularis* Calman, Fisher. Irel. Sci. Invest., 1904, No. 1, 1905, p. 43, Pl. 5, figs. 77–81. Ireland. (Not consulted.)
- Paralamprops orbicularis* Calman, Proc. U. S. Nat. Mus., XLI, 1912, p. 631, figs. 29–39. N. Lat. 39° , W. Long. 70° – 71° in 335–480 fathoms.

GULF STREAM.

Family NANNASTACIDÆ.**Genus** CAMPYLASPIS G. O. Sars.

- Campylaspis* G. O. Sars, Forh. Vid. Selsk. Christiania, 1864, p. 200. Type *Cuma rubicunda* Lilljeborg, first species.

***Campylaspis vitrea* Calman.**

- Campylaspis vitrea* Calman, Mitt. Z. Stat. Neapel, XVII, 1906, p. (412) 425, Pl. 28, figs. 28–34. Sta. 18, 26, 39 in 950–1100 meters (near Capri).

— Calman, Proc. U. S. Nat. Mus., XLI, 1912, p. 628. N. Lat. 40°, W. Long. 68° in 547 fathoms.

GULF STREAM.

Campylaspis horrida G. O. Sars.

Campylaspis horrida G. O. Sars, Forh. Vid. Selsk. Christiania, 1869 (1870), p. 162. "Loften." (Norway.)

— Calman, l. c., p. 627. N. Lat. 39° W. Long. 70° in 428 fathoms.

GULF STREAM.

Family LEUCONIDÆ.

Genus EUDORELLOPSIS G. O. Sars.

Eudorellopsis G. O. Sars, Forh. Vid. Selsk. Christiania, 1882, No. 18, pp. 12, 56. Type *Leucon deformis* Krøyer, monotypic.

Eudorellopsis deformis (Krøyer).

Leucon deformis Krøyer, Naturhist. Tidssk., (2) II, 1846, pp. 194, 209, Pl. 2, fig. 4. Southern Greenland.

Eudorella deformis G. O. Sars, Kon. Svensk. Vet. Ak. Handl., IX, 1870 (1871), No. 13, p. 50, figs. 101–118. Off Shinnecock Bay, Long Island.

— S. I. Smith, Trans. Conn. Acad. Sci., V, 1879, p. 116. Off Shinnecock Bay, Long Island, to Massachusetts, Greenland and Europe.

Eudorellopsis deformis Calman, Proc. U. S. Nat. Mus., XLI, 1912, p. 625. (Off New England and Nova Scotia.)

NEW YORK (Shinnecock Bay and off Long Island).

Genus LEUCON Krøyer.

Leucon Krøyer, Naturh. Tidssk., (2) II, 1846, pp. 181, 208. Type *Leucon emarginatus* Krøyer, first species.

Leucon longirostris G. O. Sars.

Leucon longirostris G. O. Sars, K. Svensk. Vet. Ak. Handl., IX, 1870 (1871), No. 13, p. 42, fig. 75. "550 orgyr. latit. 38° 7' sept. longit. 9° 18' occ. a Gr."

— Calman, Proc. U. S. Nat. Mus., XLI, 1912, p. 619. N. Lat. 40° W. Long. 67° in 1290 fathoms.

GULF STREAM.

Genus EUDORELLA Norman.

Eudorella Norman, Rep. Brit. Assoc. Adv. Sci., 1866, p. 197. Type *Eudora truncatula* Bate, virtually, as *Eudorella* proposed to replace *Eudora*.

Eudora (nec Peron and Le Sueur) Bate, Ann. Mag. N. Hist. London, (2) XVII, 1856, p. 457. Type *Eudora truncatula* Bate, monotypic.

Eudorella truncatula (Bate).

Eudora truncatula Bate, Ann. Mag. N. Hist. London, (2) XVII, 1856, p. 457, Pl. 14, fig. 3. *Plymouth Harbour*.

Eudorella truncatula Calman, Proc. U. S. Nat. Mus., XLI, 1912, p. 620. Off Block Island and Block Island Sound.

Eudorella pusilla G. O. Sars, Ofvers. K. Vet. Ak. Forh. Stockholm, XXVIII, 1871 (1872), p. 79. *Off Shinnecock Bay, Long Island*.

—— G. O. Sars, K. Svensk. Ak. Handl., IX, 1871, No. 13, p. 46, figs. 76-94. Off Shinnecock Bay, Long Island.

—— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 554 (on Sars).

—— S. I. Smith, Trans. Conn. Acad. Sci., V, 1879, p. 116. Off Shinnecock Bay, Long Island, to Gulf of St. Lawrence.

NEW YORK (off Shinnecock Bay, Long Island).

Eudorella hispida G. O. Sars.

Eudorella hispida G. O. Sars, Ofvers. K. Vet. Ak. Forh. Stockholm, XXVIII, 1871 (1872), p. 80. "*Prof. 30-35 orgyar. latit. 39° 54' sept., longit. 73° 15' occid.*"

—— G. O. Sars, K. Svensk. Ak. Handl., IX, 1871, No. 13, p. 49, figs. 95-97 (same locality as above).

—— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 555 (on Sars).

—— S. I. Smith, Trans. Conn. Acad. Sci., V, 1879, p. 115. N. Lat. 39° 54' W. Long. 73° 15'.

GULF STREAM.

Family BODOTRIIDÆ.**Genus** CYCLASPIS G. O. Sars.

Cyclaspis G. O. Sars, Forh. Vid. Selsk. Christiania, 1864 (1865), p. 206. Type

Cyclaspis longicaudata G. O. Sars, monotypic.

Cyclaspis longicaudata G. O. Sars.

Cyclaspis longicaudata G. O. Sars, Forh. Vid. Selsk. Christiania, 1864 (1865), p. 207. "*Loften*". (Norway.)

—— Calman, Proc. U. S. Nat. Mus., XLI, 1912, p. 609. N. Lat. 38°-39° W. Long. 70° in 1525-1825 fathoms.

GULF STREAM.

Order STOMATOPODA.

The Mantis Shrimps.

Family CHLORIDELLIDÆ.

The Mantis Shrimps.

Genus CHLORIDELLA Miers.

*The Squills.**Chloridella empusa* (Say).*Squill.*

Genus GNATHOPHAUSIA Thompson.

Gnathophausia (Willemoes-Suhm) Thompson, Nature, VIII, 1873 (September 18th), p. 400. Type *Gnathophausia gigas* Thompson, first species.
Gnathophausia, auct.

Gnathophausia gigas Thompson.

Gnathophausia gigas Thompson, Nature, VIII, 1873 (September 18th), p. 400, figs. 4-5. In 2000 fathoms 400 miles west of Azores.
Gnathophausia gigas Ortmann, Proc. U. S. Nat. Mus., XXXI, 1907, p. 36. Pl. 2, figs. 1a-1b. Between Cape Charles and Long Island.
 Off coast of Middle States.

Gnathophausia zoëa Thompson.

Gnathophausia zoëa Thompson, Nature, VIII, 1873 (September 18th), p. 401, fig. 6. About 400 miles west of the Azores.
Gnathophausia zoëa Ortmann, Proc. U. S. Nat. Mus., XXXI, 1907, p. 42, Pl. 2 figs. 2a-2b. Between Cape Charles and Nantucket in 1685 fathoms.
 Off coast of Middle States.

Genus LYSIOSQUILLA Dana.

Lysiosquilla Dana, U. S. Expl. Exped. Crust., XIII, 1852, p. 615. Type *Lysiosquilla inornata* Dana, virtually monotypic (as three other species only referred to).
Coronis (nec Hübner 1816) Latreille, Encyclop. Méth. Hist. Nat., X, 1825 p. 474. Type *Coronis scolopendra* Latreille, monotypic.

Lysiosquilla armata S. I. Smith.

Lysiosquilla armata S. I. Smith, Proc. U. S. Nat. Mus., III, 1880, p. 446 N. Lat. 39°-40° W. Long. 70° in 65-125 fathoms.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 29. Off Martha's Vineyard.

GULF STREAM.

Order SCHIZOPODA.

The Schizopods.

Sub-Order EUPHAUSIACEA.

Family EUPHAUSIIDÆ.

Genus NYCTIPHANES G. O. Sars.

Nyctiphanes G. O. Sars, Forh. Vid. Selsk. Christiania, 1883 (1884), No. 7, p. 23. Type *Nyctiphanes australis* G. O. Sars, first species described.

Nyctiphanes norvegica (M. Sars).

*Thysanopoda*¹ *norvegica* M. Sars, Forh. Skand. Naturforsk., VII, 1856, p. 169. *Floro Island in Sandfjord, and Manger* (from mouth of *Sebastes norvegicus*).

— S. I. Smith, Proc. U. S. Nat. Mus., III, 1880, p. 445. N. Lat. 39° W. Long. 70° in 225–252 fathoms.

GULF STREAM.

Sub-Order MYSIDACEA.

Family MYSIDÆ.

The Opossum Shrimps.

Genus BOREOMYSIS G. O. Sars.

Boreomysis G. O. Sars, Nyt. Mag. Naturvid., XIX, 1869, p. 330. Type *Mysis arctica* Krøyer, monotypic.

Boreomysis arctica (Krøyer).

Mysis arctica Krøyer, Naturh. Tidssk., (3) I, 1861, pp. 32, 41, Pl. I, fig. 5. *Greenland.*

¹ *Thysanopoda* (Milne-Edwards) Latreille, Cours d'Entomol., 1831, p. 386. Atypic. (Name evidently based on "*Thysanopodes*" Milne-Edwards, Ann. Sci. Nat. Zoöl., XIX., 1830, p. 452, monotype "*Thysanopodes tricuspida*," Milne-Edwards, but inadmissible as vernaculars.) Type *Thysanopoda tricuspida* Milne-Edwards, Hist. Nat. Crust., II, 1837, p. 466.

Boreomysis arctica G. O. Sars, Nyt. Mag. Naturvid., XIX, 1869, p. 330.
"Christianieusi 200 orgyrum."

— S. I. Smith, Proc. U. S. Nat. Mus., III, 1880, p. 445. N. Lat. 39° W.
Long. 71° in 500 fathoms.

GULF STREAM.

Genus PSEUDOMMA G. O. Sars.

Pseudomma G. O. Sars, Forh. Vid. Selsk. Christiania, 1869 (1870), p. 154.
Type *Pseudomma roseum* G. O. Sars, first species.

Pseudomma roseum G. O. Sars.

Pseudomma roseum G. O. Sars, Forh. Vid. Selsk. Christiania, 1869 (1870),
p. 154. "Loften 200-300" (Norway).

— S. I. Smith, Trans. Conn. Acad. Sci., V, 1879, p. 98. (Gulf of Maine,
Gulf of St. Lawrence, Cape Gaspe, Norway.)

— S. I. Smith, Proc. U. S. Nat. Mus., III, 1880, p. 445. N. Lat. 39°
W. Long. 71° in 500 fathoms.

— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 558 (compiled).

GULF STREAM.

Genus MYSIS Latreille.

Mysis americana S. I. Smith.

Genus HETEROMYSIS S. I. Smith.

Heteromysis S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 553. Type-
Heteromysis formosa S. I. Smith, monotypic.

Chiromysis G. O. Sars, Arch. Math. Naturvid. Christ., II, 1877, p. 56. Type
Chiromysis microps G. O. Sars, monotypic.

Heteromysis formosa S. I. Smith.

Heteromysis formosa S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p.
553. *Locality not given.*

— Benedict, Rep. U. S. F. Com., XI, 1883 (1885), p. 176. Off Montauk
Point, Long Island.

NEW YORK (off Montauk Point, Long Island).

Order DECAPODA.

The Stalk-eyed Crustacea.

Sub-Order MACRURA.

The Macrurans.

Tribe CARIDIDES.

Super-Family PENÆIDEA.

Family PENÆIDÆ.

The Edible Prawns.

Genus PENÆUS Fabricius.

The Edible Prawns.

Penæus brasiliensis Latreille.

Brazilian Prawn.

Penæus constrictus Stimpson.

Penæus constrictus Stimpson, Ann. Lyc. N. Hist. N. Y., X, 1874, p. 135.
Beaufort, North Carolina. Charleston, South Carolina.

—— Miers, Proc. Zoöl. Soc. London, 1878, p. 308. East coast of United States.

Penæus constrictus Kingsley, Bull. Essex Inst., X, 1878, p. 70. Carolinas.

—— Kingsley, Amer. Nat., XXXIII, 1899, p. 719. Cape Cod to North Carolina.

Parapenæus constrictus S. I. Smith, Proc. U. S. Nat. Mus., VIII, 1885, p. 174.
 Off Chesapeake Bay.

—— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1886), p. 686 (84). N. Lat. 35° W. Long. 74°-75° in 7-27 fathoms.

—— M. J. Rathbun, Bull. U. S. F. Com., XX, 1900 (1902), p. 101. Off Chesapeake Bay to West Indies.

Trachypenæus constrictus A. Milne-Edwards and Bouvier, Mem. Mus. Comp. Zoöl., XXVII, 1909, p. 232, figs. 60-63, Pl. 5, figs. 7-10, Pl. 6, figs. 1-2.
 Off Virginia in 18 "brasses" and Sombrero.

Off Chesapeake Bay.

Penæus politus S. I. Smith.

Penæus politus S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 444.
 N. Lat. 39° 55' W. Long. 70° 54' 15" in 142 fathoms.

GULF STREAM.

Penæus setiferus (Linnæus).

Southern Prawn.

Genus HALIPORUS Bate.

Haliporus Bate, Ann. Mag. Nat. Hist., VIII (5), 1881, p. 185. Type *Haliporus curvirostris* Bate, first species.

- ?*Penaeopsis* (A. Milne-Edwards) Bate, l. c., p. 182. Type *Penaeopsis serratus* (A. Milne-Edwards) Bate, first species, designated by Bouvier, Compt. Rend. Ac. Sci. Paris, CXL, 1905, p. 981.
- Hymenopenæus* S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 91. Type *Hymenopenæus debilis* S. I. Smith, monotypic.
- Hymenopenæus*, auct.
- Philonicus* (nec Loew 1848) Bate, Rep. Challenger, Macr., LII, 1888, p. 273. Type *Philonicus mülleri* Bate, first species.
- Pleoticus* Bate, l. c., p. XII (based on *Philonicus* Bate, and thus type *Philonicus mülleri* Bate).
- Faxonia* Bouvier, Compt. Rend. Ac. Paris, CXL, 1905, p. 981. Type *Penaeopsis ocularis* A. Milne-Edwards, designated, first species.
- Parartemesia* Bouvier, l. c., CXLI, 1905, p. 747. Type *Parartemesia carinata* Bouvier, first species.

Haliporus debilis (S. I. Smith).

- Hymenopenæus debilis* S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 91, Pl. 15, figs. 6-11, Pl. 16, figs. 1-3. N. Lat. 31° - 33° W. Long. 76° - 78° in 333-464 fathoms.
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 687, Pl. 16, fig. 7. N. Lat. 38° 39° W. Long. 71° 73° in 420-630 fathoms.

GULF STREAM.

Haliporus microps (S. I. Smith).

- Hymenopenæus microps* S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 413, Pl. 10, fig. 1. N. Lat. 38° - 41° W. Long. 60° - 69° in 906-1731 fathoms.
- S. I. Smith, l. c., XIII, 1885 (1887), p. 688, Pl. 16, fig. 8. N. Lat. 36° - 39° W. Long. 68° in 1555-2574 fathoms.

GULF STREAM.

Haliporus modestus (S. I. Smith).

- Hymenopenæus modestus* S. I. Smith, Proc. U. S. Nat. Mus., VIII, 1885, p. 183. N. Lat. 38° $31'$ W. Long. 73° $21'$ in 156 fathoms.

GULF STREAM.

Genus ARISTEUS Duvernoy.

- Aristeus* Duvernoy, Ann. Sci. Nat. Zoöl., (2) XV, 1841, p. 101. Type *Penæus antennatus* Risso, monotypic.
- Hemipenæus* Bate, Ann. Mag. Nat. Hist., (5) VIII, 1881, p. 186. Type *Hemipenæus spinidorsalis* Bate, first species, designated by Faxon, Mem. Mus. Comp. Zoöl., XVIII, 1895, p. 199.
- Hemipenæus*, auct.

Plesiopencaus Bate, l. c., p. 188. Atypic. (Type *Aristeus armatus* Bate, designated by Faxon, l. c.)

Plesiopencaus, auct.

Aristaeopsis Wood-Mason and Alcock, Ann. Mag. Nat. Hist., (6) VIII, 1891, p. 282. Type *Pencaus edwardsiana* Johnson, designated, monotypic.

Aristaeomorpha Wood-Mason and Alcock, l. c., p. 286. Type *Aristeus rostridenticulata* Bate, designated, monotypic.

Aristeus tridens S. I. Smith.

Aristeus tridens S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 404, Pl. 9, figs. 1-6. N. Lat. 35° - 39° W. Long. 68° - 74° in 843-2221 fathoms.

— S. I. Smith, l. c., XIII, 1885 (1886), p. 689, Pl. 19, figs. 2-2a. N. Lat. 37° - 39° W. Long. 68° - 72° in 1525-2574 fathoms.

GULF STREAM.

Genus HEPOMADUS Bate.

Hepomadus Bate, Ann. Mag. Nat. Hist., (5) VIII, 1881, p. 189. Type *Hepomadus glacialis* Bate, first species.

Hepomadus tener S. I. Smith.

Hepomadus tener S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 409, Pl. 9, figs. 7-8. N. Lat. $37^{\circ} 12' 20''$ W. Long. $69^{\circ} 30'$ in 2949 fathoms.

— S. I. Smith, l. c., XIII, 1885 (1887), p. 689, Pl. 19, figs. 3-3a. N. Lat. 37° - 38° W. Long. 69° - 72° in 1209-2949 fathoms.

GULF STREAM.

Genus BENTHONECTES S. I. Smith.

Benthonectes S. I. Smith, Proc. U. S. Nat. Mus., VII, 1884, p. 509. Type *Benthonectes filipes* S. I. Smith, monotypic.

Benthonectes filipes S. I. Smith.

Benthonectes filipes S. I. Smith, Proc. U. S. Nat. Mus., VII, 1884, p. 509. N. Lat. 39° W. Long. 71° - 72° in 693-1043 fathoms.

— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 692, Pl. 18, figs. 1-1a, Pl. 19, figs. 1, 1a, 1b. N. Lat. 39° W. Long. 71° - 72° in 693-1043 fathoms.

GULF STREAM.

Genus BENTHESICYMUS Bate.

Benthescyamus Bate, Ann. Mag. Nat. Hist., (5) VIII, 1881, p. 190. Type *Benthescyamus crenatus* Bate, first species, designated by Bate, Rep. Voy. Challenger, Macr., LII, 1888, p. 320.

Benthæcetes S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 391. Type *Benthescyamus bartletti* S. I. Smith, monotypic.

Benthesicymus moratus S. I. Smith.

Benthesicymus moratus S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 694. N. Lat. $38^{\circ} 41'$ W. Long. $65^{\circ} 72'$ in 1537-1710 fathoms.

GULF STREAM.

Benthesicymus moratus S. I. Smith.

Benthesicymus bartletti S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 82, Pl. 14, figs. 1-7. N. Lat. $39^{\circ} 45' 40''$ W. Long. $70^{\circ} 55'$ in 732 fathoms.

Benthacetes bartletti S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 391, Pl. 10, fig. 8. N. Lat. $39^{\circ} 29' 45''$ W. Long. $71^{\circ} 43'$ in 588 fathoms (N. Lat. 43° W. Long. 65° in 858 fathoms).

— S. I. Smith, Proc. U. S. Nat. Mus., VII, 1884, p. 508. Off East Coast of U. S.

— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 691, Pl. 18, figs. 2, 2a, 2b. N. Lat. 39° W. Long. 70° - 72° in 578-963 fathoms.

GULF STREAM.

Genus GENNADAS Bate.

Gennadas Bate, Ann. Mag. Nat. Hist. London, (5) VIII, 1881, p. 191. Type *Gennadas parvus* Bate, monotypic.

Amalopenæus S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 86. Type *Amalopenæus elegans* S. I. Smith, monotypic.

Gennadas valens (S. I. Smith).

Amalopenæus valens S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 402, Pl. 10, fig. 2. N. Lat. $37^{\circ} 16' 30''$ W. Long. $74^{\circ} 20' 36''$ in 640 fathoms.

GULF STREAM.

Gennadas elegans (S. I. Smith).

Amalopenæus elegans S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 87, Pl. 14, figs. 8-14, Pl. 15, figs. 1-15. N. Lat. 31° - 39° W. Long. 66° - 76° in 372-1632 fathoms.

— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 691. N. Lat. 39° W. Long. 70° - 72° in 538-1180 fathoms.

GULF STREAM.

Family SERGESTIDÆ.**Genus SERGESTES** Milne-Edwards.

Sergestes Milne-Edwards, Ann. Sci. Nat. Zoöl., (2) XIX, 1830, p. 348. Type *Sergestes atlanticus* Milne-Edwards, monotypic.

Sergestes arcticus Kröyer.

Sergestes arcticus Kröyer, Overs. Dansk. Vid. Sels. Forh. Kjöbenh., 1855, pp. 25, 27. *Greenland*.

— S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 445. N. Lat. 39° W. Long. 70° in 252-500 fathoms.

— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 693, Pl. 20, figs. 1-2. N. Lat. 39° W. Long. 69°-72° in 235-2516 fathoms; N. Lat. 35° W. Long. 74° in 296 fathoms.

GULF STREAM.

Sergestes mollis S. I. Smith.

Sergestes mollis S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 419. N. Lat. 35°-40° W. Long. 67°-72° in 373-2949 fathoms.

— S. I. Smith, l. c., XIII, 1885 (1887), p. 697, Pl. 20, figs. 3-3a, 4-5. N. Lat. 37°-39° W. Long. 69°-73° in 578-1423 fathoms.

GULF STREAM.

Genus SERGIA Stimpson.

Sergia Stimpson, Proc. Acad. Nat. Sci. Phila., 1860, p. 46. Type *Sergia remipes* Stimpson, monotypic.

Sergia meyeri (Metzger).

Sergestes meyeri Metzger, Jahresb. Com. Wiss. Unters. Deutsch. Meer. Kiel, II, III, 1875, p. 302, Pl. 6, fig. 7. *Kors Fjord, Norway*.

Sergestes arcticus (nec Kröyer) S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 96, Pl. 16, fig. 4. N. Lat. 33°-41° W. Long. 65°-76° in 139-740 fathoms.

— S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 415, Pl. 8, fig. 2. N. Lat. 27°-41° W. Long. 66°-74° in 221-1025 fathoms.

GULF STREAM.

Sergia robusta (S. I. Smith).

Sergestes robustus S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 97, Pl. 16, figs. 5-8b. N. Lat. 34° W. Long. 75° in 1632 fathoms; off *Martha's Vineyard* in 372-952 fathoms.

— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 697, Pl. 20, fig. 6. N. Lat. 38°-39° W. Long. 68°-72° in 515-2574 fathoms.

GULF STREAM.

Super-Family CARIDEA.

Alliance PASIPHÆOIDA.

Family PASIPHÆIDÆ.**Genus PASIPHÆA** Savigny.

Pasiphæa Savigny, Mem. An. San. Vert., January 1816, p. 50. Type *Alpheus sivado* Risso, monotypic.

Pasiphæa, auct.

Phye Wood-Mason and Alcock, Ann. Mag. Nat. Hist., (6) XI, 1893, p. 164.
Type *Parapasiphæa alcocki* Wood-Mason, monotypic.

Pasiphæa princeps S. I. Smith.

Pasiphæa princeps S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 381, Pl. 5, fig. 2. N. Lat. $39^{\circ} 29'$ W. Long. $70^{\circ} 58' 40''$ in 1342 fathoms.

—— S. I. Smith, l. c., XIII, 1885 (1887), p. 682. N. Lat. 37° – 39° W. Long. 71° – 73° in 444–693 fathoms.

GULF STREAM.

Genus PARAPASIPHÆA S. I. Smith.

Parapasiphæa S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 383. Type *Parapasiphæa sulcatifrons* S. I. Smith, first species.

Parapasiphæa sulcatifrons S. I. Smith.

Parapasiphæa sulcatifrons S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 384, Pl. 5, fig. 4, Pl. 6, figs. 1–7. N. Lat. 35° – 41° W. Long. 65° – 74° in 517–2949 fathoms.

—— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 689. N. Lat. 37° – 39° W. Long. 69° – 73° in 515–2516 fathoms.

GULF STREAM.

Parapasiphæa compta S. I. Smith.

Parapasiphæa compta S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 389. N. Lat. $38^{\circ} 19' 26''$, W. Long. $68^{\circ} 20' 20''$ in 2369 fathoms.

—— S. I. Smith, l. c., XIII, 1885 (1887), p. 683. N. Lat. 39° , W. Long. 70° in 1537 fathoms.

GULF STREAM.

Genus ORPHANIA Bate.

Orphanía Bate, Rep. Voy. Challenger, Macr., LII, 1888, p. 872. Type *Orphanía tenuimana* Bate, monotypic.

Orphanía tenuimana Bate.

Orphanía tenuimana Bate, Rep. Voy. Challenger, Macr., LII, 1888, p. 872, Pl. 141, fig. 4. N. Lat. $38^{\circ} 34'$, W. Long. $72^{\circ} 10'$ in 1240 fathoms.

GULF STREAM.

Alliance OPLOPHORIDA.

Family OPLOPHORIDÆ.

Genus MIERSIA Kingsley.

Miersia Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 416. Type *Pandalus pelagicus* Risso, designated, first species.

Ephyra (nec Péron and Le Sueur 1809) Roux, Mem. Class. Crust. Silicoques. 1831, p. 24. Type *Pandalus pelagicus* Risso, first species.

Acantheephyra A. Milne-Edwards, Ann. Sci. Nat. Zoöl., (6) XI, 1881, p. 12. Type *Acantheephyra armata* A. Milne-Edwards, first species.

Systellaspis Bate, Rep. Voy. Challenger, Macr., LII, 1888, p. 757. Type *Systellaspis lanceocudata* Bate, first species.

Miersia eximea (S. I. Smith).

Acantheephyra eximea S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 376. N. Lat. $35^{\circ} 9' 50''$ W. Long. $74^{\circ} 57' 40''$ in 938 fathoms.

—— S. I. Smith, l. c., XIII, 1885 (1887), p. 667, Pl. 14, fig. 1 (type).

GULF STREAM.

Miersia purpurea (A. Milne-Edwards).

Acantheephyra purpurea A. Milne-Edwards, Compt. Rend. Ac. Sci. Paris, XCIII, 1881, p. 933. Eastern Atlantic in 2590 meters.

Miersia agassizii S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 67, Pl. 11, figs. 5-7, Pl. 12, figs. 1-4. N. Lat. $31^{\circ}-41^{\circ}$ W. Long. $65^{\circ}-76^{\circ}$ in 457-1047 in 1047 fathoms.

—— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 667, Pl. 15, figs. 1, 6-6a, 7, Pl. 16, fig. 2. N. Lat. $36^{\circ}-39^{\circ}$ W. Long. $68^{\circ}-73^{\circ}$ in 578-2574 fathoms.

Acantheephyra agassizii M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 25. Georges Bank 105-810 fathoms.

GULF STREAM.

Miersia microphthalma (S. I. Smith).

Acanthephyra microphthalma S. I. Smith, Proc. U. S. Nat. Mus., VII, 1884, p. 502. N. Lat. $36^{\circ} 16' 30''$, W. Long. $68^{\circ} 21'$ in 2574 fathoms.

— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 668, Pl. 13, fig. 3. N. Lat. 36° - 37° , W. Long. 63° - 68° in 2574-2620 fathoms.

GULF STREAM.

Miersia brevirostris (S. I. Smith).

Acanthephyra brevirostris S. I. Smith, Proc. U. S. Nat. Mus., VII, 1884, p. 504. N. Lat. 37° - 39° W. Long. 68° - 73° in 1395-2949 fathoms.

— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 670, Pl. 14, fig. 2, Pl. 15, figs. 2, 8, Pl. 16, figs. 1, 6. N. Lat. 37° - 39° W. Long. 68° - 73° in 1395-2949 fathoms.

GULF STREAM.

Subsequent to the original account by S. I. Smith, Bate has described a species from off Sierra Leone, West Africa, under the same name,¹ which if distinct will of course require a new name.

Miersia gracilis S. I. Smith.

Miersia gracilis S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 70, Pl. 11, figs. 4-4d, Pl. 12, fig. 10. N. Lat. $34^{\circ} 28' 25''$ W. Long. $75^{\circ} 22' 50''$ in 1632 fathoms.

Acanthephyra gracilis S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 672. N. Lat. 36° W. Long. 69° in 2512 fathoms.

GULF STREAM.

Genus EPHYRINA S. I. Smith.

Ephyrina S. I. Smith, Proc. U. S. Nat. Mus., VII, 1884, p. 506. Type *Ephyrina benedicti* S. I. Smith, monotypic.

Ephyrina benedicti S. I. Smith.

Ephyrina benedicti S. I. Smith, Proc. U. S. Nat. Mus., VII, 1884, p. 506. N. Lat. $40^{\circ} 26' 40''$, W. Long. $67^{\circ} 5' 15''$, in 959 fathoms.

— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 674, Pl. 14, fig. 3, Pl. 16, fig. 4. N. Lat. 40° , W. Long. 67° in 959 fathoms.

GULF STREAM.

¹ Rep. Voy. Challenger, Macr., LII, 1888, p. 751, Pl. 126, figs. 5-6.

Genus NOTOSTOMUS A. Milne-Edwards.

Notostomus A. Milne-Edwards, Ann. Sci. Nat. Zoöl., (6) XI, 1881, p. 7.
Type *Notostomus gibbosus* A. Milne-Edwards, first species.

Notostomus robustus S. I. Smith.

Notostomus robustus S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 347,
Pl. 7, fig. 2. N. Lat. 39° - 41° , W. Long. 65° - 68° , in 1309-1555 fathoms.
— S. I. Smith, l. c., XIII, 1885 (1887), p. 678, Pl. 12, fig. 5. N. Lat. 37° ,
W. Long. 73° , in 1582 fathoms.
GULF STREAM.

Notostomus vescus S. I. Smith.

Notostomus vescus S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 676.
N. Lat. $37^{\circ} 12' 20''$, W. Long. $69^{\circ} 39'$, in 29.19 fathoms.
GULF STREAM.

Genus HYMENODORA G. O. Sars.

Hymenodora G. O. Sars, Arch. Math. Naturv. Christ., II, 1877, p. 340. Type
Pasiphae glacialis Buchholz, first species, designated by Bate, Rep. Voy.
Challenger, Macr., LII, 1888, p. 838.
Meningodora S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 73. Type
Meningodora mollis S. I. Smith, monotypic.

Hymenodora glacialis (Buchholz).

Pasiphae glacialis Buchholz, Zweit. Deutsch. Nordpolf., II, 1874, p. 279, Pl. 1,
fig. 1. Eastern Greenland 74° N. Lat.
Hymenodora glacialis S. I. Smith, Proc. U. S. Nat. Mus., VII, 1884, p. 501.
N. Lat. 35° - 40° , W. Long. 67° - 74° , in 861-2949 fathoms.
— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 678, Pl. 15, figs.
3, 10, Pl. 16, fig. 5. N. Lat. 37° - 38° , W. Long. 68° - 69° , in 2369-2949
fathoms.
GULF STREAM.

Hymenodora gracilis S. I. Smith.

Hymenodora gracilis S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887),
p. 680, Pl. 12, fig. 6. N. Lat. 37° - 40° , W. Long. 67° - 74° , in 861-2949
fathoms.
GULF STREAM.

Alliance PANDALOIDA.

Family NEMATOCARCINIDÆ.

Genus NEMATOCARCINUS A. Milne-Edwards.

Nematocarcinus A. Milne-Edwards, Ann. Sci. Nat. Zoöl., (6) XI, 1881, p. 14.

Type *Nematocarcinus cursor* A. Milne-Edwards, monotypic.

Eumiersia S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 77. Type *Eumiersia ensifera* S. I. Smith, monotypic.

Stochasmus Bate, Rep. Voy. Challenger, Macr., LII, p. 1888, 822. Type *Stochasmus exilis* Bate, monotypic.

Nematocarcinus ensiferus (S. I. Smith).

Eumiersia ensifera S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 77, Pl. 13, figs. 1-9. N. Lat. 38°-41°, W. Long. 65°-73°, in 810-1594 fathoms.

Nematocarcinus ensiferus S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 368, Pl. 7, fig. 1. N. Lat. 35°-41°, W. Long. 65°-74°, in 588-2033 fathoms.

— S. I. Smith, l. c., XIII, 1885 (1887), p. 664, Pl. 17, fig. 2. N. Lat. 37°-39°, W. Long. 69°-73°, in 707-2021 fathoms

GULF STREAM.

Nematocarcinus cursor A. Milne-Edwards.

Nematocarcinus cursor A. Milne-Edwards, Ann. Sci. Nat. Zoöl., (6) IX, No. 4, 1881, p. 14. Antilles.

— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 665, Pl. 17, figs. 1-1a. N. Lat. 37°-39°, W. Long. 70°-73°, in 384-693 fathoms.

GULF STREAM.

Family PANDALIDÆ.

Genus PANDALUS Leach.

Pandalus Leach, Edinburgh. Encyclop.,¹ VII, 1814, p. 432. Type *Pandalus montagui* Leach, monotypic. (Not consulted.)

Plesionika Bate, Rep. Voy. Challenger, Macr., LII, 1888, p. 640. Type *Pandalus uniproducta* Bate, first species, designated by Alcock, Cat. Crust. Ind. Mus., 1901, p. 93.

Nothocaris Bate, l. c., p. 650. Type *Nothocaris rostricrescentis* Bate, first species.

Pandalopsis (A. Milne-Edwards) Bate, l. c., p. 671. Type *Pandalopsis amplius* Bate, monotypic.

Dickelopandalus Caullery, Ann. Univ. Lyon (Res. Caudan in G. Gascogne),

¹ In Am. Ed., VII, 1815, p. 271.

XXVI, 1893, p. 379. Type *Dichelopandalus bonnierii* Caullery, monotypic.

Parapandalus Borradaile, Zoöl. Res. New Brit., New Guinea, etc. Willey, IV, 1900, p. 411. Type *Pandalus serratifrons* Borradaile, first species.

***Pandalus borealis* Kröyer.**

Pandalus borealis Kröyer, Naturh. Tidsskr., II, 1838, p. 254. *Greenland*.

——— Kingsley, Bull. Essex Inst., X, 1878, p. 63. (Greenland, Alaska, Massachusetts Bay.)

——— R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 814. On Atlantic Coast of U. S. far south as Virginia.

Coast of Middle Atlantic States.

***Pandalus montagui* Leach.**

Pandalus montagui Leach, Edinburgh Encyclop.,¹ VII, 1813-14, p. 432. *Zetland*. (Not consulted.)

——— R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 819. Atlantic coast of U. S. south to Virginia.

——— Kingsley, Amer. Nat., XXXIII, 1899, p. 718. Atlantic coast south to Cape Cod and North Carolina.

Coast of Middle Atlantic States.

***Pandalus leptocerus* S. I. Smith.**

Pandalus leptocerus S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 437. *Off Cape Cod, Cape Ann, Block Island, Casco Bay, Halifax and George's Banks in 42-430 fathoms*.

——— S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 58. N. Lat. 39°-41°, W. Long. 65°-71°, in 44-306 fathoms.

——— R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 819. South on Atlantic coast of U. S. to Virginia.

——— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 663. N. Lat. 39°-40°, W. Long. 69°-70°, in 32-148 fathoms; N. Lat. 37°-39°, W. Long. 72°-74°, in 70-302 fathoms.

Pandalus leptoceros Kingsley, Amer. Nat., XXXIII, 1899, p. 718. Atlantic coast south to Cape Cod and North Carolina.

GULF STREAM.

***Pandalus propinquus* G. O. Sars.**

Pandalus propinquus G. O. Sars, Forh. Vid. Selsk. Christ., 1869, p. 149. *Lofoten, in 200-300 orgyarum*. (Norway.)

——— S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 437. N. Lat. 39°, W. Long. 70°, in 142-365 fathoms.

¹ Am. Ed., VII, 1815, p. 271.

- S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 58. N. Lat. 40°-41°, W. Long. 65°-68°, in 304-524 fathoms; N. Lat. 38°, W. Long. 73°, in 312 fathoms.
- R. Rathbun, Rep. Fisher. Ind. U. S., I, 1884, p. 819. Atlantic coast of U. S. south to Virginia.
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 662, Pl. 13, fig. 1. N. Lat. 39°, W. Long. 69°-78°, in 229-538 fathoms.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 25. Off Martha's Vineyard and Nantucket, 158-640 fathoms. George's Bank, 122-304 fathoms.

GULF STREAM.

Pandalus tenuipes S. I. Smith.

- Pandalus tenuipes* S. I. Smith, Proc. U. S. Nat. Mus., III, 1860 (1861), p. 441. N. Lat. 39°-40°, W. Long. 70°, in 100-252 fathoms.
- S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 59, Pl. 13, fig. 12. N. Lat. 32°, W. Long. 78°, in 142 fathoms.

GULF STREAM.

Alliance CRANGONIDA.

Family CRANGONIDÆ.

Genus CRAGO Lamarek.

The Sand Shrimps.

Crago septemspinus (Say).

Sand Shrimp.

[Genus HIPPOLYSMATA Stimpson.

- Hippolysmata* Stimpson, Proc. Acad. Nat. Sci. Phila., 1860, p. 26. Type *Hippolysmata vittata* Stimpson, monotypic.

Hippolysmata wurdemanni (Gibbes).

- Hippolyte wurdemanni* Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1851, p. 197. Key West and Charleston.
- Hippolysmata wurdemanni* Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 413. (Beaufort, North Carolina and Florida).
- Kingsley, Amer. Nat., XXXIII, 1899, p. 715. Cape Cod to North Carolina and Florida.
- Southern, north to Beaufort, North Carolina.]

[Genus *TOZEUMA* Stimpson.

Tozeuma Stimpson, Proc. Acad. Nat. Sci. Phila., 1860, p. 26. Type *Tozeuma lanccolatatum* Stimpson, monotypic.

Angasia (White) Bate, Proc. Z. Soc. London, 1863, p. 498. Type *Angasia pavonina* Bate, monotypic.

Tozeuma carolinensis Kingsley.

Tozeuma carolinensis Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 90. Fort Macon, North Carolina.

——— Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 413, Pl. 14, fig. 8. Beaufort, North Carolina, and Florida.

——— Kingsley, Amer. Nat., XXXIII, 1899, p. 715. Cape Cod to North Carolina, and Florida.

Southern, north to Beaufort, North Carolina.]

[Genus *CONCORDIA* Kingsley.

Concordia Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 413. Type *Concordia gibberosus* Kingsley, monotypic.

Concordia gibberosus Kingsley.

Concordia gibberosus Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 414, Pl. 16, fig. 5. Fort Macon, North Carolina.

——— Kingsley, Amer. Nat., XXXIII, 1899, p. 716, fig. 17. Cape Cod to North Carolina.

Southern, north to Fort Macon, North Carolina.]

Genus *PONTOPHILUS* Leach.

Pontophilus Leach, Malac. Podoph. Brit., 1815, Pl. 37-a. Type *Pontophilus spinosus* Leach, monotypic.

Egeon Risso, Hist. Nat. Eur. Mérid., V, 1826, p. 58. Type *Egeon lorincatus* Risso, monotypic.

Cheraphilus Kinahan, Proc. Roy. Irish Acad., Dublin, VIII, 1862, p. 68. Type *Pontophilus bispinosus* Westwood, first species.

Aegeon Kinahan, l. c., 69. Type *Crangon fasciatus* Risso, first species.

Pontophilus norwegicus (M. Sars).

Crangon norwegicus M. Sars, Nyt. Mag. Naturv., XI, 1861, p. 248. Christiana, Norway.

Pontophilus norwegicus S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 435. N. Lat. 39°-40°, W. Long. 70°, in 155-372 fathoms.

——— S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 34. N. Lat. 40°-41°, W. Long. 65°-68°, in 304-524 fathoms.

- S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 362. N. Lat. 39° - 42° , W. Long. 68° - 71° , in 105-239 fathoms.
- S. I. Smith, l. c., XIII, 1885 (1887), p. 652. Pl. 11, figs. 6-6a, 7. N. Lat. 39° , W. Long. 72° , in 229 fathoms; N. Lat. 38° - 39° , W. Long. 69° - 73° , in 122-428 fathoms.
- Ortmann, Proc. Acad. Nat. Sci. Phila., 1895, pp. 182, 184 (compiled).
- Kingsley, Amer. Nat., XXXIII, 1899, p. 715. Atlantic coast, south to Cape Cod and North Carolina.

GULF STREAM.

Pontophilus brevirostris S. I. Smith.

- Pontophilus brevirostris* S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 435. N. Lat. 39° - 40° , W. Long. 70° , in 65-155 fathoms.
- S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 35, Pl. 7, figs. 1-1b. N. Lat. 32° - 40° , W. Long. 70° - 78° , in 65-233 fathoms.
- S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 362. N. Lat. 37° - 40° , W. Long. 70° - 74° , in 65-98 fathoms.
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 653. N. Lat. 39° - 40° , W. Long. 69° - 70° , in 63-195 fathoms; N. Lat. 39° , W. Long. 72° , in 87 fathoms; N. Lat. 37° , W. Long. 74° , in 70 fathoms.
- Ortmann, Proc. Acad. Nat. Sci. Phila., 1895, pp. 182, 185 (compiled).
- Kingsley, Amer. Nat., XXXIII, 1899, p. 715. Cape Cod to North Carolina.
- Howe, Bull. U. S. F. Com., XIX, 1899 (1901), p. 239. N. Lat. 39° - 40° , W. Long. 70 trawled.

GULF STREAM.

Pontophilus abyssi S. I. Smith.

- Pontophilus abyssi* S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 363. N. Lat. 37° , W. Long. 70° , in 1917-2221 fathoms.
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 653, Pl. 11, figs. 3-3a, 4-5. N. Lat. 37° , W. Long. 71° , in 2021 fathoms.
- Ortmann, Proc. Acad. Nat. Sci. Phila., 1895, pp. 183, 185 (compiled).

GULF STREAM.

Pontophilus gracilis S. I. Smith.

- Pontophilus gracilis* S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 36, Pl. 7, figs. 2-2a, 2b, 2c, figs. 3-3a. N. Lat. $32^{\circ} 18' 20''$, W. Long. $78^{\circ} 43'$, in 225 fathoms; off Martha's Vineyard.
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 654, Pl. 11, figs. 1-1a, 2. N. Lat. 39° , W. Long. 69° - 71° , in 368-458 fathoms.
- Ortmann, Proc. Acad. Nat. Sci. Phila., 1895, pp. 183, 186 (compiled).

GULF STREAM.

Genus **SABINEA** Owen.

Sabinca Owen, Append. Ross's Narr. Sec. Voyage, 1835, p. 82. Type *Crangon septemcarinata* Sabine, monotypic.

Sabinea princeps S. I. Smith.

Sabinea princeps S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 38, Pl. 8, figs. 1-1b. N. Lat. 33° - 39° , W. Long. 73° - 76° , in 464-740 fathoms.

—— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 654, Pl. 10, figs. 1-1a, 1b, 2. N. Lat. 37° - 39° , W. Long. 70° - 73° , in 353-630 fathoms.

Sabinea hystrix (part) Ortmann, Proc. Acad. Nat. Sci. Phila., 1895, p. 188 (compiled).

GULF STREAM.

Sabinea sarsii S. I. Smith.

Sabinea sarsii S. I. Smith, Trans. Conn. Acad., V, 1879, p. 59, Pl. 11, figs. 6-8. *George's Bank, Gulf of Maine, Le Have Bank and Norway.*

—— S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 364. N. Lat. 42° , W. Long. 65° - 66° , in 122-150 fathoms.

—— S. I. Smith, l. c., XIII, 1885 (1887), p. 654, Pl. 10, figs. 3-3a, 4 (on above).

—— Ortmann, Proc. Acad. Nat. Sci. Phila., 1895, p. 188 (compiled).

GULF STREAM.

Family **GLYPHOCRANGONIDÆ**.Genus **GLYPHOCRANGON** A. Milne-Edwards.

Glyphocrangon A. Milne-Edwards, Ann. Sci. Nat. Zoöl., (6) XI, 1881, p. 3. Type *Glyphocrangon spinicauda* A. Milne-Edwards, first species.

Rhachocaris S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 41. Type *Rhachocaris agassizii* S. I. Smith, first species.

Sclerocrangon G. O. Sars, Norsk. Nordh. Ex. Crust., I, 1885, p. 14. Type *Cancer boreas* Phipps, designated, first species mentioned.

Plastocrangon Alcock, Cat. Crust. Ind. Mus., 1901, p. 133. Type *Glyphocrangon cæcescens* Wood-Mason, first species.

Glyphocrangon agassizii (S. I. Smith).

Ceraphilus agassizii S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 32, Pl. 7, figs. 4-5a. N. Lat. 31° 39° , W. Long. 71° - 78° , in 263-603 fathoms.

—— S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 362. N. Lat. 37° - 41° , W. Long. 65° - 74° , in 499-959 fathoms.

—— Howe, Bull. U. S. F. Com., XIX, 1899 (1901), p. 239. N. Lat. 39° - 40° , W. Long. 70° , trawled.

Sclerocrangon agassizii S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 652. N. Lat. 37° - 39° , W. Long. 71° - 73° , in 444-568 fathoms.

Crangon (*Sclerocrangon*) *agassizii* Ortmann, Proc. Acad. Nat. Sci. Phila., 1895, pp. 176, 179 (compiled).

GULF STREAM.

***Glyphocrangon sculptus* (S. I. Smith).**

Rhachocaris sculpta S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 49, Pl. 5, fig. 3, Pl. 6, figs. 3-3d. N. Lat. $38^{\circ} 16' 45''$, W. Long. $73^{\circ} 10' 30''$, in 1186 fathoms.

Glyphocrangon sculptus S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 365. N. Lat. 66° - 73° , W. Long. 37° - 49° , in 1098-1395 fathoms.

Glyphocrangon insculptus S. I. Smith, l. c., XIII, 1885 (1887), p. 655, Pl. 8, fig. 3, Pl. 9, figs. 1-2. N. Lat. 39° , W. Long. 69° , in 1230 fathoms.

GULF STREAM.

***Glyphocrangon longirostris* (S. I. Smith).**

Rhachocaris longirostris S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 51, Pl. 5, fig. 1, Pl. 6, fig. 1. N. Lat. $31^{\circ} 41'$, W. Long. $74^{\circ} 35'$, in 1047 fathoms; N. Lat. 32° , W. Long. 78° , in 252 fathoms.

Glyphocrangon longirostris S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 365 (name only).

— S. I. Smith, l. c., XIII, 1855 (1887), p. 655, Pl. 8, figs. 1-2, Pl. 9, figs. 3-5. N. Lat. 39° , W. Long. 71° , in 1043-1073 fathoms.

GULF STREAM.

Alliance PSALIDOPODIA.

No representative has been found in our region.

Alliance PALÆMONOIDA.

Family PALÆMONIDÆ.

Genus PALÆMONETES Heller.

Palæmonetes vulgaris (Say).

Prævn.

Palæmonetes carolinus Stimpson.

Genus PALÆMON Fabricius.

Palæmon Fabricius, Suppl. Entomol. Syst., 1798, p. 402. Type *Cancer squilla* Linnæus, designated by Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 425.

- Leander* Desmarest, Ann. Soc. Entomol. France, (2) VII, 1849, p. 87. Type *Leander erraticus* Desmarest, monotypic.
- Bithynis* Philippi, Arch. Naturges., XXVI, 1860, pt. 1, p. 161. Type *Bithynis longimana* Philippi, monotypic.
- Macrobrachium* Bate, Proc. Zoöl. Soc. London, 1868, p. 363. Type *Macrobrachium americanum* Bate, first species.
- Brachycarpus* Bate, Rep. Voy. Challenger, Macr., LII, 1888, pp. 781, 795. Type *Brachycarpus savignyi* Bate, designated, first species.

[*Palæmon ohionis* S. I. Smith.]

- Palæmon ohionis* S. I. Smith, Rep. U. S. F. Com., II, 1872-73 (1874), p. 640. *Ohio River at Cannelton, Indiana.*
- Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 374. Indiana, Illinois, Mississippi, Mississippi River.
- Kingsley, Amer. Nat., XXXIII, 1899, p. 718. Ohio and Mississippi Rivers.
- OHIO RIVER BASIN.]

Palæmon tenuicornis Say.

- Palæmon tenuicornis* Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 249. *The Banks of Newfoundland.*
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 30. Northern coast.
- Kingsley, Amer. Nat., XXXIII, 1899, p. 718. Gulf weed, Atlantic.
- Leander tenuicornis* (S. I. Smith) Kingsley, Bull. Essex Inst., X, 1878, p. 66. In Gulf weed of the Atlantic.
- S. I. Smith, Trans. Conn. Acad., V, 1879, p. 122. Gulf Stream to Newfoundland Banks.
- Kingsley, Bull. Essex Inst., X, 1878, p. 66. Gulf weed, Atlantic.
- Leander natator* Stimpson, Proc. Acad. Nat. Sci. Phila., 1860, p. 40. In Oceano Atlantico, lat. bor. 30°-35°, etc.
- GULF STREAM (pelagic).

Genus *ALPHEUS* Fabricius.

- Alpheus* Fabricius, Suppl. Entomol. Syst., 1798, p. 404. Type *Alpheus rapax* Fabricius, second species, designated by Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 416.
- Betæus* Dana, U. S. Expl. Exped. Crust., 1852, p. 558. Type *Betæus truncatus* Dana, first species.

[*Alpheus minus* Say.]

- Alpheus minus* Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 245. *Coasts of the Southern States and of East Florida.*
- Kingsley, Bull. Essex Inst., X, 1878, p. 57. North Carolina to West Indies and Panama.

- Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 416. Beaufort, North Carolina, to Florida.
- Kingsley, Amer. Nat., XXXIII, 1899, p. 716. Cape Cod to Florida. Southern, north to Beaufort, North Carolina.]

Alpheus heterochælis Say.

- Alpheus heterochælis* Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 243. *Coasts of Southern States* (South Carolina and Florida).
- Alpheus heterochælis* Kingsley, Bull. Essex Inst., X, 1878, p. 58. North Carolina to Brazil.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 417. Northampton County, Virginia, to Florida.
- Kingsley, Amer. Nat., XXXIII, 1899, p. 717. Cape Cod to Florida. Southern, north to Virginia.

[**Genus UROCARIS** Stimpson.

- Urocaris* Stimpson, Proc. Acad. Nat. Sci. Phila., 1860, p. 39. Type *Urocaris longicaudata* Stimpson, designated, first species.

Urocaris longicaudata Stimpson.

- Urocaris longicaudata* Stimpson, Proc. Acad. Nat. Sci. Phila., 1860, p. 39. *Littoribus Carolinensibus habitans*.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 424. Beaufort, North Carolina, to Florida.
- Kingsley, Amer. Nat., XXXIII, 1899, p. 718. Cape Cod to North Carolina, and Florida. Southern, north to Beaufort, North Carolina.]

Family HIPPOLYTIIDÆ.

Genus HIPPOLYTE Leach.

- Hippolyte* Leach, Edinburgh Encyclop.,¹ VII, 1814, p. 432. Type *Hippolyte varians* Leach, monotypic. (Not consulted.)
- Periclemenes* Costa, Annal. Accad. Aspiraz. Natur di Napoli, II, 1844, p. 285. Type *Periclemenes insignis* Costa. (Not consulted.)
- Bellidia* Gosse, Ann. Mag. N. Hist. London, (4) XX, 1877, p. 313. Type *Bellidia huntii* Gosse, monotypic.

¹ Am. Ed., VII, 1815, p. 271.

Hippolyte pusiola Kröyer.

- Hippolyte pusiola* Kröyer, Vid. Selsk. Afhandl. Kjöbenhavn, IX, 1842, p. 319, Pl. 2, figs. 69-73. (*Europe.*) (Not consulted.)
- Kingsley, Bull. Essex Inst., X, 1878, p. 59. Vineyard Sound to Greenland and Europe.
- Kingsley, Amer. Nat., XXXIII, 1899, p. 717, fig. 22 (rostrum). Atlantic coast, south to Cape Cod and North Carolina.
- Region of Middle Atlantic States.

Hippolyte lilljeborgi Danielssen.

- Hippolyte lilljeborgi* Danielssen, Nyt. Mag. Naturv. Christ., XI, 1861, p. 5. *Slotholmen, Leerbund.*
- Hippolyte lilljeborgii* S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 54. N. Lat. 40°-41°, W. Long. 65°-68°, in 304-524 fathoms; N. Lat. 38°, W. Long. 73°, in 312 fathoms.
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 658. N. Lat. 39°, W. Long. 69°, in 250 fathoms; N. Lat. 39°, W. Long. 72°, in 229-452 fathoms; N. Lat. 38°, W. Long. 73°, in 243 fathoms; N. Lat. 37°, W. Long. 74°, in 70-167 fathoms.
- Hippolyte securifrons* S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 437. N. Lat. 39°, W. Long. 70°, in 252 fathoms; N. Lat. 37°, W. Long. 74°, in 225 fathoms.
- GULF STREAM.

Genus OGYRIS Stimpson.

- Ogyris* Stimpson, Proc. Acad. Nat. Sci. Phila., 1860, p. 36. Type *Ogyris orientalis* Stimpson, monotypic.

Ogyris alphærostris Kingsley.

- Ogyris alphærostris* Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 420, Pl. 14, fig. 7. *Atlantic side of eastern shore of Northampton County, Virginia.*
- Kingsley, Amer. Nat., XXXIII, 1899, p. 717, fig. 35 (carapace). Cape Cod to North Carolina.
- VIRGINIA (Atlantic shore of Northampton County).

Genus BYTHOCARIS G. O. Sars.

- Bythocaris* G. O. Sars, Forh. Vid. Selsk. Christiania, 1869, p. 149. Type *Bythocaris simplicirostris* G. O. Sars, monotypic.

Bythocaris gracilis S. I. Smith.

Bythocaris gracilis S. I. Smith, Proc. U. S. Nat. Mus., VII, 1884, p. 497. N.

Lat. 35° - 39° , W. Long. 71° - 74° , in 888-1043 fathoms.

— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 658, Pl. 12, figs.

3-4. N. Lat. 39° , W. Long. 71° , in 1043 fathoms.

GULF STREAM.

Bythocaris nana S. I. Smith.

Bythocaris nana S. I. Smith, Proc. U. S. Nat. Mus., VII, 1884, p. 499. N. Lat.

39° - 40° , W. Long. 70° , in 65-142 fathoms.

— S. I. Smith, Rep. U. S. F. Com., XI, 1885 (1887), p. 660, Pl. 12, fig. 2.

N. Lat. 39° - 40° , W. Long. 70° , in 65-142 fathoms; N. Lat. 37° , W. Long. 74° , in 70 fathoms.

GULF STREAM.

Genus LATREUTES Stimpson.

Latreutes Stimpson, Proc. Acad. Nat. Sci. Phila., XII, 1860, p. 27 (96). Type

Hippolyte ensiferus Milne-Edwards, first species, designated by Kingsley,

Proc. Acad. Nat. Sci. Phila., 1879, p. 413.

Latreutes ensiferus (Milne-Edwards).

Hippolyte ensiferus Milne-Edwards, Hist. Nat. Crust., II, 1837, p. 374.

Azores.

Latreutes ensiferus Stimpson, Proc. Acad. Nat. Sci. Phila., 1860, p. 27 (96).

(In Oceano Atlantico lat. bor. 30° - 35° .)

— S. I. Smith and O. Harger, Trans. Conn. Acad., III, 1874, p. 26. N.

Lat. $41^{\circ} 25'$, W. Long. $65^{\circ} 5'$ to $30'$.

— Kingsley, Bull. Essex Inst., X, 1878, p. 56. Gulf weed, Atlantic.

— S. I. Smith, Trans. Conn. Acad., V, 1879, p. 121. Gulf Stream.

— Kingsley, Amer. Nat., XXXIII, 1899, p. 716. Gulf weed.

— Howe, Bull. U. S. F. Com., XIX, 1899 (1901), p. 240. N. Lat. 39° - 40° , W. Long. 70° , at surface.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 21.

Gulf Stream.

GULF STREAM (pelagic).

Genus CARIDION Goës.

Caridion Goës, Ofvers. K. Vet. Forh., 1863, p. 170. Type *Hippolyte gordonii* Bate, monotypic.

Doryphorus (nec Cuvier 1829) Norman, Ann. Mag. Nat. Hist. London, (3) VIII, 1861, p. 276. Type *Hippolyte gordonii* Bate, monotypic.

Caridion gordonii (Bate).

Hippolyte gordonii Bate, Nat. Hist. Review, V, 1858, p. (5) IV of index, 4 figs. *Moray Frith*.

Caridion gordonii S. I. Smith, Trans. Conn. Acad., V, 1879, p. 61. Off New England and northward.

—S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 55. N. Lat. 39°, W. Long. 70°, in 143 fathoms.

GULF STREAM.

Genus VIRBIUS Stimpson.

Virbius pleuracanthus Stimpson.

Virbius acuminatus (Dana).

Hippolyte acuminata Dana, U. S. Expl. Ex. Crust., 1851, p. 562, Pl. 30, fig. 1.
N. Lat. 36° 7', W. Long. 71° 36'; N. Lat. 38° 12', W. Long. 44° 41';
N. Lat. 4° 7', W. Long. 20° 43'.

Virbius acuminatus Stimpson, Proc. Acad. Nat. Sci. Phila., 1860, p. 36. Atlantic Ocean.

—Kingsley, Bull. Essex Inst., X, 1878, p. 63. Gulf weed, Atlantic.

—Kingsley, Amer. Nat., XXXIII, 1899, p. 717. Gulf weed.

GULF WEED (pelagic).

Tribe ASTACIDES.

Super-Family ASTACIDEA.

The Crayfishes.

Family ASTACIDÆ.

The Crayfishes.

Sub-Family ASTACINÆ.

Genus HOMARUS Weber.

The Lobsters.

Homarus americanus Milne-Edwards.

Lobster.

Genus **CAMBARUS** Erichson.

The Crawfishes.

Cambarus bartoni (Fabricius).

Brook Crawfish.

Common Crawfish. Barton's Crawfish.

Cambarus bartoni robustus (Girard).

Western Crawfish.

Cambarus robustus Girard, Proc. Acad. Nat. Sci. Phila., 1852, p. 90. *Humber River, near Toronto, Canada.*

— Hagen, Mem. Mus. Comp. Zoöl., III, 1870, p. 80, Pl. 3, fig. 167. Toronto, Canada; Rochester and Lake Regis, New York; Fredericksburg, Virginia.

— S. I. Smith, Rep. U. S. F. Com., II, 1872-73 (1874), p. 639. Western New York (on Hagen).

— Faxon, Proc. Amer. Acad. Sci., XX, 1884, p. 143. New York, Maryland, Virginia (Illinois, Ontario).

Cambarus bartoni var. *robustus* Faxon, Mem. Mus. Comp. Zoöl., X, 1885, p. 61. Forestville, Rochester, Sodus, near Tupper's Shore, Canton, Fulton Lakes, Natural Bridge, New York; Montgomery County, Maryland; Virginia (to Canada, Illinois and Tennessee).

Cambarus bartonii var. *robusta* Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 367. New York, Maryland, Virginia (Illinois, Ontario).

Cambarus bartonii var. *robustus* Faxon, Proc. U. S. Nat. Mus., XII, 1889 (1890), p. 622. Virginia.

— Faxon, l. c., 1898, p. 649. Petersboro, New York; Montgomery County, Maryland.

— Williamson, Ann. Carnegie Mus., I, 1901, p. 11. Squaw Run, Allegheny County, Pennsylvania.

Cambarus bartonii robustus W. P. Hay, Amer. Nat., XXXIII, 1899, p. 959. Canada to Illinois.

— Ortmann, Proc. Amer. Philos. Soc. Phila., XLIV, 1905, p. 135. Kentucky and Ohio.

Cambarus bartoni robustus Ortmann, Ann. Carnegie Mus., III, 1905, p. 391. Pine Creek, Carnegie, Larabee, Union City, Lake Erie basin, Conneautville, Albion, Girard, Swanville, Port Allegany, Pennsylvania.

— Ortmann, Mem. Carnegie Mus., II, No. 10, 1906, p. 388, Pl. B, fig. 2, Pl. 39, figs. 2-2b, Pl. 40, fig. 3. Near Aspinwall, Sandy Creek, Hulton, Tarentum, Puketta Creek, Garland, Spartansburg, Northeast (besides preceding localities), Pennsylvania.

NEW YORK (Rochester, Lake Regis, Sodus, Tupper's Shore, Canton, Fulton Lakes, Natural Bridge, Petersboro).

PENNSYLVANIA (Pine Creek, Carnegie, Larabee, Union City, Lake Erie basin, Conneautville, Albion, Girard, Swanville, Port Allegany, near Aspinwall, Sandy Creek, Hulton, Tarentum, Puketta Creek, Garland, Spartansburg, Northeast).

MARYLAND (Montgomery County).

VIRGINIA (Fredericksburg).

Cambarus diogenes Girard.

Chimney Crawfish.

Mud Crawfish.

Cambarus limosus (Rafinesque).

River Crawfish.

Cambarus obscurus Hagen.

Western River Crawfish.

Cambarus obscurus Hagen, Mem. Mus. Comp. Zoöl., III, 1870, p. 69, Pl. 1, figs. 72-75, Pl. 3, fig. 154. *Genesee River, Rochester, New York.*

—— S. I. Smith, Rep. U. S. F. Com., II, 1872-73 (1874), p. 639 (on Hagen).

—— Faxon, Proc. Amer. Acad. Sci., XX, 1884 (1885), p. 148. Rochester, New York.

—— Faxon, Proc. U. S. Nat. Mus., XX, 1898, p. 652. Westmoreland County, Penna.

—— Ortman, Ann. Carnegie Mus., III, 1905, p. 402. Green, Fayette, Washington, Westmoreland, Beaver, Allegheny, Butler, Clarion, Venango, Erie, Crawford, Warren, McKean and Bedford Counties, Penna.; Cattaraugus County, New York.

Cambarus propinquus var. *obscura* Faxon, Mem. Mus. Comp. Zoöl., X, No. 4, 1885, p. 92. Rochester, New York (remarks).

—— Faxon, Proc. U. S. Nat. Mus., 1885, p. 360 (type). "California" ?

—— Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 372. New York.

Cambarus propinquus obscurus W. P. Hay, Am. Nat., XXXIII, 1899, pp. 960, 964. New York, Pennsylvania.

Cambarus (Faxonius) obscurus Ortmann, Proc. Amer. Philos. Soc. Phila., XLIV, 1905, p. 112 (diagnosis in key).

——— Ortmann, Mem. Carnegie Mus., II, No. 10, 1906, p. 369, Pl. A, figs. 1-2, Pl. 39, figs. 7a-7e, Pl. 40, fig. 1. Deep Valley, Waynesburg, Deer Lick, Rice's Landing, Cheat Haven, Connelsville, Taylorstown, Dinsmore, Burgettstown, Monongahela City, Hanlon, Beaver, Raccoon Creek, New Galilee, Fallston, Baden, Ambridge, Wampum, Newcastle, Mercer, Jamestown, Hadley, Linesville, Shermansville, Conneaut Outlet, Spartansburg, Albion, Miles Grove, Union City, Branchton, Renfrew, West Winfield, Neville Island, Belleview, Shonstown, Flaugherty Run, Carnegie, Bridgeville, Pitcairn, Boston, Pittsburgh, Millvale, Thornhill, Bakerstown Station, Six Mile Island, Aspinwall, Sandy Creek, Verona, Twelve Mile Island, Harmarville, Russelton, Puchetta Creek, Tarentum, Butler Junction, Montrose, Livermore, Blairsville Intersection, Derry, Dundale, New Alexandria, Ligonier, Crisp, Jane's Mill, Homer, Creekside, Goodville, Indiana, Avonmore Station, Kittanning, Mosgrove, Templeton, Red Bank, Punxsutawney, Du Bois, Franklin, Oil City, Tionesta, Garland, Larabee, Hyndman, Ulysses, Pa.; West Virginia.

Cambarus propinquus Williamson, Ann. Carnegie Mus., I, 1901, p. 13. Allegheny County, Pennsylvania.

Cambarus rusticus Williamson, l. c. Allegheny County, Pennsylvania.

NEW YORK (Rochester and Cattaraugus Counties).

PENNSYLVANIA (Green, Fayette, Washington, Westmoreland, Beaver, Allegheny, Butler, Clarion, Venango, Erie, Crawford, Warren, McKean, Bedford Counties).

Cambarus propinquus Girard.

Lake Erie Crawfish.

Cambarus propinquus Girard, Proc. Acad. Nat. Sci. Phila., 1852, p. 88. *Lake Ontario, opposite Oswego; in Lota maculosa; Garrison Creek, Sackett's Harbor, Four Mile Creek, Oswego, New York.*

——— Hagen, Mem. Mus. Comp. Zoöl., III, 1870, p. 67, Pl. I, figs. 34-38, Pl. 3, fig. 153. Lake Oneida, Niagara, Rochester, Grass River, New York (Lake Superior, Illinois, Indiana).

——— S. I. Smith, Rep. U. S. F. Com., II, 1872-73 (1874), p. 638. Cayuga Lake (Montreal, Wisconsin, Michigan).

——— Faxon, Proc. U. S. Nat. Mus., 1885, p. 360. Canton, Ogdensburg, Forrestville, New York. (Illinois, Michigan.)

——— Faxon, Mem. Mus. Comp. Zoöl., X, 1885, p. 91. Grass River, Canton, Black Lake, Ogdensburg, Lake Ontario, Sackett's Harbor, Oswego,

Oneida Lake, Cayuga Lake, Rochester, Niagara, Forestville, New York (Canada, Indiana, Illinois, Michigan, Wisconsin, Lake Superior.)

——— Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 371. New York (Ontario, Quebec, Indiana, Illinois, Michigan, Lake Superior, Wisconsin, Iowa).

——— W. P. Hay, Amer. Nat., XXXIII, 1899, pp. 960, 962. Canada to Minnesota.

——— Ortmann, Ann. Carnegie Mus., III, 1905, p. 400. Presque Isle, Miles Grove, Albion, Conneautville, Elk Creek, Swanville, Squaw Run, Braeburn, Hill, Monaca, Monongahela City, Taylorstown, Smithfield, Cheat Haven, Pennsylvania.

Cambarus (Faxonius) propinquus Ortmann, Proc. Amer. Philos. Soc. Phila., XLIV, 1905, p. 112 (diagnosis in key), p. 132 (Ohio, Michigan).

——— Ortmann, Mem. Carnegie Mus., II, No. 10, 1906, p. 358, Pl. 39, figs. 6a-6b. (Above localities in Pennsylvania; Ohio, Michigan.)

NEW YORK (Lake Ontario, Garrison Creek, Sackett's Harbor, Four-mile Creek, Oswego, Lake Oneida, Niagara, Rochester, Grass Creek, Cayuga Lake, Canton, Black Lake, Ogdensburg, Niagara, Forestville).

PENNSYLVANIA (Presque Isle, Miles Grove, Albion, Conneautville, Elk Creek, Swanville, Squaw Run, Braeburn, Hill, Monaca, Monongahela City, Taylorstown, Smithfield, Cheat Haven).

Cambarus immunis Hagen.

Cambarus immunis Hagen, Mem. Mus. Comp. Zoöl., No. III, 1870, p. 71, Pl. 1, figs. 101, 102, Pl. 3, fig. 160, Pl. 8, fig. b (male and female). *Lawn Bridge and Belleville, Illinois; Huntsville, Alabama; Beaufort, North Carolina.*

——— S. I. Smith, Rep. U. S. F. Com., II, 1872-73 (1874), p. 639 (on Hagen).

——— Faxon, Proc. Amer. Acad. Sci., XX, 1884, p. 146. New York (Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Wyoming, Alabama, Mexico).

——— Faxon, Mem. Mus. Comp. Zoöl., X, 1885, p. 99, Pl. 10, figs. 6a, 6a' New York to Wyoming.

——— Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 369. New York (to Wyoming and Mexico).

——— W. P. Hay, Amer. Nat., XXXIII, 1899, p. 960. New York (to Wyoming and Texas).

NEW YORK.

Cambarus blandingii (Harlan).*Blanding's Crawfish.***Cambarus carolinus** (Erichson).*Red Crawfish.*

- Astacus* (*Cambarus*) *carolinus* Erichson, Arch. Naturg., XII, 1846, p. 96. *Carolina*. (Greenville, South Carolina.)
- Cambarus carolinus* Faxon, Proc. Amer. Acad. Sci., XX, 1884, p. 140. (South Carolina.)
- Faxon, Mem. Mus. Comp. Zoöl., X, 1885, p. 54. (South Carolina, Georgia, Alabama.)
- W. P. Hay, Amer. Nat., XXXIII, 1899, p. 959. (South Carolina to Texas.)
- W. P. Hay, Proc. Biol. Soc. Wash., XV, 1902, p. 38 (type). South-west Virginia and adjacent portions of Virginia.
- Ortmann, Ann. Carnegie Mus., III, 1905, p. 393. Rockwood, Meyersdale, Fayette County, Dunbar, Indian Creek, Ohio Pyle and Jane's Mills, Pennsylvania; Selbyport, Maryland.
- Cambarus* (*Bartonius*) *carolinus* Ortmann, Proc. Amer. Philos. Soc. Phila., XLIV, 1905, p. 120 (diagnosis in key), p. 135 (remarks).
- Ortmann, Mem. Carnegie Mus., II, No. 10, 1906, p. 394, Pl. A, fig. 4, Pl. 39, figs. 3a, 3b, 9, Pl. 40, fig. 4. Flanigan, Humbertston, Great Meadow Run, Millrun, Windber, Listie, Confluence, Ursina, Salisbury, Pennsylvania (besides above localities, also West Virginia and North Carolina).
- Cambarus advena* (nec Le Conte) Hagen, Mem. Mus. Comp. Zoöl., III, 1870, p. 86, Pl. 1, figs. 90-92 (part). (South Carolina, Georgia, Alabama.)
- Cambarus dubius* Faxon, Proc. Amer. Acad. Sci., XX, 1884, p. 114. *West Virginia, Virginia, Tennessee.*
- Faxon, Mem. Mus. Comp. Zoöl., X, No. 4, 1885, p. 70, Pl. 4, fig. 3, Pl. 8, figs. 7-7'. West Virginia; Cranberry Summit, Virginia; Tennessee.
- Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 368. Virginia, West Virginia, Tennessee.
- W. P. Hay, Amer. Nat., XXXIII, 1899, pp. 959, 965. West Virginia to Tennessee.

PENNSYLVANIA (Redwood, Meyersdale, Fayette County, Dunbar, Indian Creek, Ohio Pyle, Jane's Mills, Flanigan, Humbertston, Great Meadow Run, Millrun, Windber, Listie, Confluence, Ursina, Salisbury).

MARYLAND (Selbyport).

Cambarus monongalensis Ortmann.*Blue Crawfish.*

- Cambarus monongalensis* Ortmann, Ann. Carnegie Mus., III, 1905, p. 395. *Gordon's Valley, Allegheny Valley, Pennsylvania.*

Cambarus (Bartoniuss) monongalensis Ortmann, Proc. Amer. Philos. Soc. Phila., XLIV, 1905, p. 120 (diagnosis in key).

—— Ortmann, Mem. Carnegie Mus., II, No. 10, 1906, p. 398, Pl. B, fig. 4, Pl. 39, figs. 4a, 4b, 10, Pl. 40, fig. 5. Opposite Leachburg, Braeburn, Dundale, Jeanette, Logan's Ferry, Hulton, Wilkinsburg, Edgewood Park, Nine Mile Run, Fern Hollow, Schenley Park, Aspinwall, opposite Stewart, Jack's Run, Long Run, Boston, Kennywood, Carnegie, Moon Township, Lashell's Hollow, Sandy Creek, Monaca, Burgettstown, Taylorstown, Monongahela City, West Brownsville, Smithfield, Cheat Haven, Deer Lick, Pennsylvania.

Cambarus dubius (nec Faxon) Williamson, Ann. Carnegie Mus., I, 1901, p. 11. Schenley Park, Moon Township, Fayette, Washington, Allegheny, Beaver and Westmoreland Counties, Pennsylvania.

PENNSYLVANIA. (See above.)

Cambarus uhleri Faxon.

Maryland Crawfish.

Cambarus uhleri Faxon, Proc. Amer. Acad. Sci., XX, 1884 (1885), p. 116. *Caroline, Dorchester, Talbot, St. Mary's, Wicomico, Somerset and Worcester Counties, Maryland.*

—— Faxon, Mem. Mus. Comp. Zoöl., X, 1885, p. 77, Pl. 8, figs. 8, 8', 8a, 8a' (above localities).

—— Underwood, Bull. Ill. Lab. N. Hist., II, 1886, p. 373. Maryland.

—— W. P. Hay, Amer. Nat., XXXIII, 1899, p. 959. "Eastern shore."

Cambarus (Bartoniuss) uhleri Ortmann, Proc. Amer. Philos. Soc. Phila., XLIV, 1905, p. 120 (diagnosis in key).

MARYLAND (*Caroline, Dorchester, Talbot, St. Mary's, Wicomico, Somerset and Worcester Counties*).

Family NEPHROPSIDÆ.

Genus NEPHROPSIS Wood-Mason.

Nephropsis Wood-Mason, Journ. As. Soc. Bengal, XLII, pt. 2, 1873, p. 39. Type *Nephropsis stewarti* Wood-Mason, monotypic.

***Nephropsis aculeatus* S. I. Smith.**

Nephropsis aculeatus S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 431. *N. Lat. 39°-40°, W. Long. 70°, in 100-126 fathoms.*

—— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 558 (from Smith).

—— Kingsley, Amer. Nat., XXXIII, 1899, p. 822. Cape Cod to North Carolina.

GULF STREAM.

Nephropsis agassizii Milne-Edwards.

Nephropsis agassizii Milne-Edwards, Ann. Sci. Nat. Zoöl., (6) IX, No. 2, 1880, p. (124). *Florida Straits in 1500 meters.*

— Faxon, Bull. Mus. Harvard, XXX, 1896, p. 156 (Stations 195, 200, 227, in 472-501½ fs.).

— Howe, Bull. U. S. F. Com., XIX, 1899 (1901), p. 210. N. Lat. 40° 4', W. Long. 70° 20', in 95 faths.

GULF STREAM.

Family ERYONIDÆ.**Genus** PENTACHELES Bate.

Pentacheles Bate, Ann. Mag. N. Hist. London, (5) II, 1878, p. 276. Type *Pentacheles laevis* Bate, first species.

Pentacheles roseus (Bate).

Nephropsis rosea (Willemoes-Suhm) Bate, Rep. Voy. Challenger, Macr., LXX, 1888, p. 178, fig. 39, Pl. 23, figs. 1-2, Pl. 24, fig. 1. N. Lat. 32° 11' 7'', W. Long. 65° 3' 20'', in 690 fathoms.

Nephropsis aculeata Faxon, Bull. Mus. Harvard, XXX, 1896, p. 156. Stations 185, 188, 222, 226, 230, in 333-464 fathoms, all in Caribbean Sea.

Nephropsis agassizii (nec A. Milne-Edwards) S. I. Smith, Bull. Mus. Harvard, XV, 1888, p. 43, fig. 240. West Indies.

GULF STREAM.

Pentacheles sculptus (S. I. Smith).

Polycheles sculptus S. I. Smith, Proc. U. S. Nat. Mus., II, 1879 (1880), p. 346, Pl. 7. N. Lat. 43° 10', W. Long. 61° 20', in 250 fathoms.

Pentacheles sculptus S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 23, Pls. 3-4. N. Lat. 33°-37°, W. Long. 74°-76°, in 300-647 fathoms.

— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 554 (compiled).

— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 650. N. Lat. 38°-39°, W. Long. 70°-73°, in 384-707 fathoms.

— Bate, Rep. Voy. Challenger, Macr., LXX, 1888, p. 141 (remarks).

Pentacheles spinosus A. Milne-Edwards, Bull. Mus. Comp. Zoöl., VIII, December, 1880, p. 66. N. Lat. 24° 36', W. Long. 84° 5', *Guadeloupe, Dominica.*

GULF STREAM.

Pentacheles nanus S. I. Smith.

Pentacheles nanus S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 359. N. Lat. 35°-41°, W. Long. 66°-74°, in 843-1917 fathoms.

—— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 554 (compiled).

—— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 651, Pl. 7, figs.

1-1a. N. Lat. 38° - 39° , W. Long. 69° - 73° , in 705-1168 fathoms.

GULF STREAM.

Pentacheles debelis S. I. Smith.

Pentacheles debilis S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 360.

N. Lat. 41° $43'$, W. Long. 65° $21'$ $50''$, in 1309 fathoms; N. Lat. 40° $16'$ $50''$, W. Long. 67° $5'$ $15''$, in 1290 fathoms.

—— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 554 (compiled).

—— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 651, Pl. 7, fig. 2 (on above).

GULF STREAM.

Super-Family SCYLLARIDEA.

Family SCYLLARIDÆ.

Genus ARCTUS Dana.

Arctus Dana, Proc. Acad. Nat. Sci. Phila., 1852, p. 14. Type *Arctus ursus* Dana, monotypic.

Arctus depressus S. I. Smith.

Arctus depressus S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 429.

N. Lat. 40° $5'$ $30''$, W. Long. 70° $23'$ $52''$, in 86 fathoms.

—— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 558 (on Smith).

—— Kingsley, Amer. Nat., XXXIII, 1899, p. 823. Cape Cod to North Carolina.

GULF STREAM.

Super-Family THALASSINIDEA.

Family UPOGEBIDÆ.

Genus CALLIANASSA Leach.

Callianassa Leach, Edinburgh Encyclop.,¹ VII, 1814, p. 400. Type *Callianassa subterranea* Leach, monotypic. (Not consulted.)

Callianassa stimpsoni S. I. Smith.

Callianassa stimpsoni (S. I. Smith) Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 369, Pl. 2, fig. 8 (habits; no description).

¹ Amer. Ed., VII, 1815, p. 239.

Callinassa stimpsoni S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 549, Pl. 2, fig. 8. *From the coast of the Southern States north to Long Island Sound.*

— Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 327. Long Island Sound and southward.

— Kingsley, Amer. Nat., XXXIII, 1899, p. 824. Cape Cod to North Carolina.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 17. Vineyard Sound to Long Island Sound.

Long Island Sound southward.

Genus UPOGEBIA Leach.

Upogebia affinis (Say).

Mud Lobster.

Genus CALLICHIRUS Stimpson.

Callichirus Stimpson, Proc. Chicago Acad. Sci., I, 1866, p. 47. Type *Callinassa major* Say, designated.

Callichirus major (Say).

Callinassa? major Say, Journ. Acad. Nat. Sci. Phila., I, 1818, p. 238. *River St. John, East Florida.*

Callichirus major Kingsley, Amer. Nat., XXXIII, 1899, p. 824. Cape Cod to North Carolina and Florida.

Coast of Middle State region?

Family AXIIDÆ.

Genus AXIUS Leach.

Axius Leach, Trans. Linn. Soc. London, XI, 1815, pp. 335, 343. Type *Axius stirynechus* Leach, monotypic.

Axius serratus S. I. Smith.

Axius serratus S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 433. *N. Lat. 39°-40° W. Long. 70° in 100-142 fathoms.*

— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 558 (compiled).

— Kingsley, Amer. Nat., XXXIII, 1899, p. 824. Cape Cod to North Carolina region.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 17 (New England; Georges Bank).

GULF STREAM.

[Genus **NAUSHONIA** Kingsley.*Naushonia* Kingsley, Bull. Essex Inst., XXVII, 1893, p. 95. Type *Naushonia crangonoides* Kingsley, monotypic.**Naushonia crangonoides** Kingsley.*Naushonia crangonoides* Kingsley, Bull. Essex Inst., XXVII, 1893, p. 95.
Off Naushon, Elizabeth Islands, Massachusetts.

—— Kingsley, Amer. Nat., XXXIII, 1899, p. 824. Cape Cod to North Carolina region.

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 18 (Massachusetts).

Off Elizabeth Islands, Massachusetts.]

Sub-Order ANOMURA.

Super-Family HIPPIDEA.

Family RANINIDÆ.

Genus **LYREIDUS** Haan.*Lyreidus* Haan, Faun. Japon. Crust., 1850, p. 138. Type *Lyreidus tridentatus* Haan, monotypic.**Lyreidus bairdii** S. I. Smith.*Lyreidus bairdii* S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 420
N. Lat. 40° 2' W. Long. 70° 57' in 100 fathoms.

—— S. I. Smith, l. c., VI, 1883, p. 24 (on above).

GULF STREAM.

Family HIPPIDÆ.

The Sand Bugs.

Genus **EMERITA** Gronow.

The Sand Bugs.

Emerita talpoida (Say).

Sand Bug.

Super-Family GALATHEIDEA.

Family GALATHEIDÆ.

Genus MUNIDA Leach.

Munida Leach, Dict. Sci. Nat., XVIII, 1820, p. 52. Type *Galathea rugosa* Fabricius, monotypic, first species.

Munida iris A. Milne-Edwards.

Munida iris A. Milne-Edwards, Bull. Mus. Comp. Zoöl., VIII, 1880, p. 49. Barbadoes.

— A. Milne-Edwards and E. L. Bouvier, Mem. Mus. Comp. Zoöl., XIX, 1897, p. 21, Pl. 2, figs. 2-7. N. Lat. 42° 10' W. Long. 78° 44' to Cape de Verde in 275 "brasses."

— Benedict, Proc. U. S. Nat. Mus., XXVI, 1903, p. 310 (compiled).

?*Munida caribæa* Stimpson, Ann. Lyc. N. Hist. N. Y., VII, 1860, p. 244. *The [North] American shores.* (Absolutely indeterminable and types now destroyed.)

— S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 428. N. Lat. 39°-40° W. Long. 70° in 65-142 fathoms.

— S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 22, Pl. 10, fig. 1. N. Lat. 32°-40° W. Long. 70°-78° in 65-225 fathoms.

— S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 40, Pl. 3, fig. 11. N. Lat. 39°-40° W. Long. 69°-72° in 65-264 fathoms; N. Lat. 38° W. Long. 73° in 89-197 fathoms; N. Lat. 37° W. Long. 74° in 56-57 fathoms; N. Lat. 32°-35° W. Long. 74°-78° in 65-225 fathoms.

— S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 355. N. Lat. 36°-40° W. Long. 70°-74° in 66-131 fathoms.

— S. I. Smith, l. c., XIII, 1885 (1887), p. 643. N. Lat. 39°-40° W. Long. 69°-70° in 58-84 fathoms; N. Lat. 39° W. Long. 72° in 87 fathoms; N. Lat. 37° W. Long. 74° in 70-167 fathoms; off Cape Hatteras in 43-80 fathoms.

— Howe, Bull. U. S. F. Com., XIX, 1899 (1901), p. 240. N. Lat. 39°-40° W. Long. 70° trawled.

— Benedict, Proc. U. S. Nat. Mus., XXVI, 1903, p. 306 (note on synonymy).

GULF STREAM.

Munida irrasa A. Milne-Edwards.

Munida irrasa A. Milne-Edwards, Bull. Mus. Comp. Zoöl., VIII, 1880, p. 49. N. Lat. 23°-26° W. Long. 85°-89°, *Frederichstadt, Dominica, St. Vincent, Grenadines, Grenada, Barbadoes.*

— Benedict, Proc. U. S. Nat. Mus., XXVI, 1903, p. 310 (compiled).

Munida caribæa (nec Stimpson) A. Milne-Edwards, l. c. (N. Lat. 23° 13' W. Long. 89° 16'.)

Munida carbæa A. Milne-Edwards and E. L. Bouvier, Mem. Mus. Harvard, XIX, 1897, p. 25, Pl. 1, figs. 16-20, Pl. 2, fig. 1 (on preceding).

GULF STREAM.

***Munida valida* S. I. Smith.**

Munida valida S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 42, Pl. 1. N. Lat. 39° - 40° W. Long. 68° - 70° in 245-640 fathoms.

—— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 558 (compiled).

—— Benedict, Proc. U. S. Nat. Mus., XXVI, 1903, p. 314 (compiled, and note on validity).

GULF STREAM.

Genus MUNIDOPSIS Whiteaves.

Munidopsis Whiteaves, Amer. Journ. Sci. Art., (3) VII, 1874, p. 212. Type *Munidopsis curvirostra* Whiteaves, monotypic.

Galathodes A. Milne-Edwards, Bull. Mus. Comp. Zoöl., VIII, 1880, p. 53. Type *Galathodes erinaceus* A. Milne-Edwards, first species.

Orophorhynchus A. Milne-Edwards, l. c., p. 58. Type *Orophorhynchus aries* A. Milne-Edwards, first species.

Elasmonotus A. Milne-Edwards, l. c., p. 60. Type *Elasmonotus longimanus* A. Milne-Edwards, first species.

Anoplnotus S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 50. Type *Anoplnotus politus* S. I. Smith, monotypic.

Bathyankyristes Alcock and Anderson, Journ. As. Soc. Bengal, LXIII, 1894, p. 173. Type *Bathyankyristes spinosus* Alcock and Anderson, first species.

***Munidopsis bairdii* (S. I. Smith).**

Galacantha bairdii S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 356. N. Lat. 37° $41'$ $20''$ W. Long. 73° $3'$ $20''$ in 1497 fathoms.

Munidopsis bairdii Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 554 (compiled).

—— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 649, Pl. 5, fig. 2. (Type.) N. Lat. 40° W. Long. 66° in 1742 fathoms.

—— Benedict, Proc. U. S. Nat. Mus., XXVI, 1903, p. 317, fig. 47 (compiled).

GULF STREAM.

***Munidopsis crassa* S. I. Smith.**

Munidopsis crassa S. I. Smith, Proc. U. S. Nat. Mus., VII, 1885, p. 494. N. Lat. 36° $16'$ $30''$ W. Long. 68° $21'$ in 2574 fathoms.

—— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 645, Pl. 4. N. Lat. 36° - 40° W. Long. 63° - 68° in 1742-2620 fathoms.

—— Benedict, Proc. U. S. Nat. Mus., XXVI, 1903, p. 318 (compiled).

GULF STREAM.

Munidopsis curvirostra Whiteaves.

Munidopsis curvirostra Whiteaves, Amer. Journ. Sci. Art., (3) VII, 1874, p. 212. *Gulf of St. Lawrence*.

—— S. I. Smith, Trans. Conn. Acad. Sci., V, 1879, p. 54 (on Whiteaves' material).

—— S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 21, Pl. 8, figs. 2-3a. (N. Lat. 33° W. Long. 76° in 647 fathoms.)

—— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 554 (compiled).

—— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 645. N. Lat. 39° W. Long. 69°-73° in 384-1230 fathoms.

—— Benedict, Proc. U. S. Nat. Mus., XXVI, 1903, p. 319 (compiled).

GULF STREAM.

Munidopsis similis S. I. Smith.

Munidopsis similis S. I. Smith, Proc. U. S. Nat. Mus., VII, 1884, p. 496. N. Lat. 39° 46' 30" W. Long. 70° 14' 45" in 1060 fathoms.

—— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 647. Pl. 5, figs. 1-1e, Pl. 6, figs. 2-2a. N. Lat. 39°, W. Long. 70° in 1060 fathoms.

—— Benedict, Proc. U. S. Nat. Mus., XXVI, 1903, p. 326 (compiled).

GULF STREAM.

Munidopsis polita (S. I. Smith).

Anoplnotus politus S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 50, Pl. 2, fig. 1, Pl. 3, figs. 1-5a. N. Lat. 39°-40° W. Long. 69°-70° in 79-134 fathoms.

—— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 558 (compiled).

Munidopsis polita Benedict, Proc. U. S. Nat. Mus., XXVI, 1903, p. 324 (compiled).

GULF STREAM.

Genus GALACANTHA A. Milne-Edwards.

Galacantha A. Milne-Edwards, Bull. Mus. Comp. Zoöl., VIII, 1880, p. 52. Type *Galacantha rostrata* A. Milne-Edwards, first species.

Galacantha rostrata A. Milne-Edwards.

Galacantha rostrata A. Milne-Edwards, Bull. Mus. Comp. Zoöl., VIII, 1880, p. 52. *Bequia*.

—— S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 21, Pl. 9, figs. 2-2a. N. Lat. 39° W. Long. 70° in 1241-1394 fathoms.

—— S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 355. N. Lat. 39°-40° W. Long. 67°-70° in 1098-1342 fathoms.

- A. Milne-Edwards and E. L. Bouvier, Mem. Mus. Comp. Zoöl., XIX, 1897, p. 60, Pl. 4, figs. 21-24. Antilles to N. Lat. 40° and Florida Straits, in 1098-1356 "brasses."
- Benedict, Proc. U. S. Nat. Mus., XXVI, 1903, p. 304 (compiled).
- Munidopsis rostrata* S. I. Smith, Proc. U. S. Nat. Mus., VII, 1885, p. 493 (name only).
- Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 554 (compiled).
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 649, Pl. 6, figs. 1-1a. N. Lat. 38°-39° W. Long. 71°-73° in 1168-1178 fathoms.
- GULF STREAM.

Genus EUMUNIDA S. I. Smith.

- Eumunida* S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 44. Type
Eumunida picta S. I. Smith, monotypic.

***Eumunida picta* S. I. Smith.**

- Eumunida picta* S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 44, Pl. 2, fig. 2, Pl. 3, figs. 6-10, Pl. 4, figs. 1-3. N. Lat. 39° W. Long. 69°-70° in 115-158 fathoms; N. Lat. 38° W. Long. 73° in 130 fathoms.
- Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 558 (compiled).
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 650. N. Lat. 37° W. Long. 74° in 167 fathoms.
- GULF STREAM.

Super-Family PORCELLANIDEA.

Family PORCELLANIDÆ.

Genus PETROLISTHES Stimpson.

- Petrolisthes* Stimpson, Proc. Acad. Nat. Sci. Phila., 1858, p. 227. Type
Porcellana violacea Guérin-Méneville, designated, first species.

***Petrolisthes armatus* (Gibbes).**

- Porcellana armata* Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850, p. 190. Florida.
- Petrolisthes armatus* Stimpson, Proc. Acad. Nat. Sci. Phila., 1858, p. 227. Florida (reference).
- Young, Stalk E. Crust. W. Indies, 1900, p. 393. (Florida, St. Thomas, Aspinwall, Bermuda.)
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 13. Stony Creek, Connecticut.
- New England in Connecticut, to Florida and south.

Genus **POLYONYX** Stimpson.

Polyonyx Stimpson, Proc. Acad. Nat. Sci. Phila., 1858, p. 229. Type *Porcellana macrocheles* Gibbes, designated, first species.

Polyonyx macrocheles (Gibbes).

Porcellana macrocheles Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850, p. 191. South Carolina coast.

Polyonyx macrocheles Stimpson, Proc. Acad. Nat. Sci. Phila., 1860, p. 229. Carolina (reference).

—— Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 408. Florida, North Carolina and Rhode Island.

—— Benedict, Bull. U. S. F. Com., XX, 1900 (1902), p. 138 (hypothetical in West Indies).

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 14. (Newport, Rhode Island.)

Porcellana (Polyonyx) macrocheles Faxon, Mem. Mus. Comp. Zoöl., V, 1879, p. 256, Pl. 3, fig. 11. (Carolina and Newport, Rhode Island, larva.) Rhode Island to Carolina.

Genus **PORCELLANA** Latreille.

Porcellana (Lamarck) Latreille, Hist. Nat. Crust., III, 1802, p. 25. Type *Cancer platycheles* Oliver, first species, designated by Stimpson, Proc. Acad. Nat. Sci. Phila., 1858, p. 228.

Pisidia Leach, Dict. Sci. Nat., XVIII, 1820, p. 53. Type *Pisidia viridis* Leach, first species.

Porcellana sigsbeiana A. Milne-Edwards.

Porcellana sigsbeiana A. Milne-Edwards, Bull. Mus. Comp Zoöl., VIII, 1880, p. 35. N. Lat. 23°–28° W. Long. 89°, and Flannegan Passage.

—— S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 25. N. Lat. 39° 54' W. Long. 69° 51' 30" in 134 fathoms.

—— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 557 (compiled).

GULF STREAM.

Super-Family **LITHODIDEA**.Family **LITHODIDÆ**.Genus **LITHODES** Latreille.

Lithodes Latreille, Gen. Crust. Ins., I, 1803, p. 40. Type *Cancer maja* Linnæus, virtually monotypic.

Lithodes maja (Linnæus).

Cancer maja Linnæus, Syst. Nat., Ed. 10, 1758, p. 629. *European Ocean*.

Lithodes maja S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 25. N. Lat. 40° 3' W. Long. 68° 56' in 291 fathoms.

— S. I. Smith, Trans. Conn. Acad., V, 1879, p. 45. (Off Massachusetts to Nova Scotia and Europe.)

— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 553 (compiled).

Lithodes maja M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 14. (New England.) Off Nantucket in 291 fathoms.

GULF STREAM.

Lithodes agassizii S. I. Smith.

Lithodes agassizii S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 8, Pl. 1. N. Lat. 33°-41° W. Long. 65°-76° in 468-810 fathoms.

— S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 25. N. Lat. 39° 57' W. Long. 69° 17' in 410 fathoms; N. Lat. 39° 57' 6" W. Long. 69° 16' in 458 fathoms; N. Lat. 41° 33' 15" W. Long. 65° 51' 25" in 810 fathoms; off Carolina.

— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 553 (compiled).

— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 638, Pl. 3, figs. 1-2. N. Lat. 39° W. Long. 69°-71° in 705-1230 fathoms; N. Lat. 35° W. Long. 74° in 843 fathoms.

GULF STREAM.

Super-Family PAGURIDEA.*The Hermit Crabs.**Family PAGURIDÆ.**The Hermit Crabs.***Genus PAGURUS** Fabricius.*The Hermit Crabs.***Pagurus pollicaris** Say.*Big Hermit Crab.***Pagurus longicarpus** Say.*Long-wristed Hermit Crab.*

Pagurus pubescens Kröyer.*Hairy Hermit Crab.***Pagurus acadianus** Benedict.

Pagurus acadianus Benedict, Proc. U. S. Nat. Mus., XXIII, 1901, p. 454, fig. From the Grand Bank of Newfoundland to the mouth of Chesapeake Bay.

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 15. Eastport, Maine to eastern portion of Long Island Sound.

LONG ISLAND SOUND.

Pagurus politus (S. I. Smith).

Eupagurus politus S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 12, Pl. 2, fig. 5. N. Lat. 38° - 40° W. Long. 68° - 73° in 197-304 fathoms.

— S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 27. N. Lat. 39° - 40° W. Long. 68° - 72° in 34-640 fathoms; N. Lat. 38° W. Long. 73° in 104-435 fathoms; N. Lat. 37° W. Long. 74° in 56-300 fathoms; N. Lat. 34° W. Long. 76° in 178 fathoms.

— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 553 (compiled).

— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 639. N. Lat. 39° - 40° W. Long. 69° - 72° in 38-428 fathoms; N. Lat. 39° W. Long. 72° in 87-302 fathoms; N. Lat. 37° W. Long. 73° - 74° in 70-167 fathoms; off Cape Hatteras in 296 fathoms.

— Howe, Bull. U. S. F. Com., XIV, 1899 (1901), p. 240. N. Lat. 39° - 40° W. Long. 70° trawled.

Pagurus politus M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 16. Off Georges Bank and Martha's Vineyard.

GULF STREAM.

Pagurus annulipes (Stimpson).

Eupagurus annulipes Stimpson, Ann. Lyc. N. Hist. N. Y., VII, 1859, p. 243. Beaufort Harbor, North Carolina.

— Stimpson, Amer. Journ. Sci. Art., (2) XXIX, 1860, p. 444. (Beaufort).

— Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 326 (on Stimpson).

— Turner, South Carolina, 1883, p. 293 (South Carolina).

— Ives, Proc. Acad. Nat. Sci. Phila., 1891, p. 193 (Anclote Bay, Florida).

Pagurus annulipes M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 16 (Massachusetts).

Massachusetts to Florida.

Pagurus kröyeri (Stimpson).

Eupagurus kroyeri Stimpson, Ann. Lyc. N. Hist. N. Y., VII, 1859, p. 89.

Grand Manan, Massachusetts Bay, Puget Sound.

- S. I. Smith, Trans. Conn. Acad. Sci., II, 1874, p. 28 (not seen south of Cape Cod).
- S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 428. N. Lat. 39° – 40° W. Long. 70° in 126–192 fathoms.
- S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 12. N. Lat. 39° – 41° W. Long. 65° – 70° in 143–524 fathoms.
- S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 27. N. Lat. 39° – 40° W. Long. 69° – 71° in 63–640 fathoms.
- Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 553 (compiled).
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 641. N. Lat. 39° – 40° W. Long. 69° – 70° in 47–250 fathoms; N. Lat. 39° W. Long. 72° in 87 fathoms; N. Lat. 37° W. Long. 74° in 70 fathoms.
- Howe, Bull. U. S. F. Com., XIX, 1899 (1901), p. 240. N. Lat. 39° – 40° W. Long. 70° trawled.
- Pagurus kroyeri* M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 16. (New England Coast).

GULF STREAM.

Pagurus bernhardus (Linnæus).

- Cancer bernhardus* Linnæus, Syst. Nat., Ed. 10, 1758, p. 631. *European Ocean*.
- Eupagurus bernhardus* S. I. Smith, Trans. Conn. Acad. Sci., V, 1879, p. 46. East Long Island Sound, Block Island Sound, to Nova Scotia and Europe.
- S. I. Smith, Proc. U. S. N. Mus., III, 1880 (1881), p. 428. N. Lat. 40° W. Long. 70° in 65 fathoms.
- Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 553 (compiled).
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 639. N. Lat. 40° W. Long. 69° in 18 to 36 fathoms.

LONG ISLAND SOUND.

GULF STREAM.

Genus CATAPAGURUS A. Milne-Edwards.

- Catapagurus* A. Milne-Edwards, Bull. Mus. Comp. Zoöl., VIII, (December 29th) 1880, p. 46. Type *Catapagurus sharreri* A. Milne-Edwards, first species.
- Hemipagurus* S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 422. Type *Hemipagurus socialis* S. I. Smith, first species.

Catapagurus sharreri A. Milne-Edwards.

- Catapagurus sharreri* A. Milne-Edwards, Bull. Mus. Comp. Zoöl., VIII, 1880, p. 46. *Barbadoes*.
- S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 31. N. Lat. 39° – 40° W. Long. 68° – 71° in 53–264 fathoms; N. Lat. 38° W. Long. 73° in 130–156 fathoms; N. Lat. 37° W. Long. 74° in 57 fathoms; N. Lat. 32° – 34° W. Long. 76° – 78° in 75–229 fathoms.

- Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 554 (compiled).
 — S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 642. N. Lat. 40° W. Long. 69°-70° in 78-98 fathoms; N. Lat. 37° W. Long. 74° in 70-167 fathoms.
 — Howe, Bull. U. S. F. Com., XIX, 1899 (1901), p. 240. N. Lat. 39°-40° W. Long. 70° trawled.
Hemipagurus socialis S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 423. N. Lat. 39°-40° W. Long. 40° in 65-252 fathoms.
Catapagurus socialis S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 16. N. Lat. 32°-40° W. Long. 70°-78° in 71-229 fathoms.
 GULF STREAM.

Catapagurus gracilis (S. I. Smith).

- Hemipagurus gracilis* S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 426. N. Lat. 39° 40' W. Long. 70° in 65-155 fathoms.
Catapagurus gracilis S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 19. N. Lat. 40° W. Long. 70°-71° in 71-129 fathoms.
 — S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 33. N. Lat. 39°-40° W. Long. 69°-71° in 53-155 fathoms; N. Lat. 37° W. Long. 74° in 56-57 fathoms.
 — Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 556 (compiled).
 — S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 642. N. Lat. 40° W. Long. 70° in 98 fathoms; N. Lat. 37° W. Long. 74° in 70 fathoms.
 GULF STREAM.

Genus PARAPAGURUS S. I. Smith.

- Parapagurus* S. I. Smith, Trans. Conn. Acad. Sci., V, 1879, p. 50. Type *Parapagurus pilosimanus* S. I. Smith, monotypic.

Parapagurus pilosimanus S. I. Smith.

- Parapagurus pilosimanus* S. I. Smith, Trans. Conn. Acad. Sci., V, 1879, p. 51. N. Lat. 42° 41' W. Long. 63° 6' in 250 fathoms.
 — S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 428. N. Lat. 39° W. Long. 70° in 252-372 fathoms (and off Nova Scotia).
 — S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 20, Pl. 2, figs. 4-4a. N. Lat. 33°-41° W. Long. 65°-76° in 304-524 fathoms.
 — S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 33, Pl. 5, figs. 2-2a (nec 3-3a). N. Lat. 39°-40° W. Long. 65°-71° in 252-640 fathoms; N. Lat. 37° W. Long. 74° in 300 fathoms; N. Lat. 33° W. Long. 76° in 362 fathoms; N. Lat. 42° W. Long. 63° in 250 fathoms.
 — Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 554 (compiled).
 — S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 643. N. Lat. 37°-39° W. Long. 69°-72° in 250-2021 fathoms.
 GULF STREAM.

Genus SYMPAGURUS S. I. Smith.

Sympagurus S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 37. Type
Sympagurus pictus S. I. Smith, monotypic.

Sympagurus pictus S. I. Smith.

Sympagurus pictus S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 37, Pl. 5, figs. 2-2a, Pl. 6, figs. 5-8. N. Lat. 39° W. Long. 69°-70° in 164-264 fathoms.

— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 554 (compiled).

GULF STREAM.

Sub-Order BRACHYURA.

Tribe DROMIDÆ.

Super-Family HOMOLIDEA.

Family HOMOLIDÆ.

Genus HOMOLA Leach.

Homola Leach, Trans. Linn. Soc. London, XI, 1815, p. 324. Type *Homola spinifrons* Leach, monotypic.

Homolar Alcock, Cat. Decapod Crust. Ind. Mus., I, 1901, p. 61. Type *Homola megalops* Alcock, designated.

Paromola Wood-Mason, Ann. Mag. N. Hist. London, (6) VII, 1891, p. 267. Type *Homola cuvieri* Risso, designated, monotypic.

Homola barbata (Fabricius).

Cancer barbatus Fabricius, Entomol. Syst., II, 1793, p. 460. *Oceano Neapolitano*.

Homola barbata S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 420. N. Lat. 40° W. Long. 70° in 86 fathoms.

— S. I. Smith, l. c., VI, 1883, p. 24. N. Lat. 39°-40° W. Long. 69°-70° in 86-134 fathoms; N. Lat. 38° W. Long. 73° in 104-130 fathoms; N. Lat. 37° W. Long. 74° in 56-57 fathoms.

— S. I. Smith, Rep. U. S. F. Com., XI, 1882 (1884), p. 351. N. Lat. 36°-39° W. Long. 70°-74° in 143-373 fathoms.

— S. I. Smith, l. c., XIII, 1885 (1887), p. 637, Pl. 2, fig. 1. N. Lat. 39° W. Long. 69° in 84 fathoms; N. Lat. 37° W. Long. 74° in 70 fathoms.

GULF STREAM.

Family LATREILLIDÆ.

Genus LATREILLIA Roux.

Latreillia Roux, Crust. Medit., 1828, text, Pl. 22. Type *Latreillia elegans* Roux, monotypic.

Latreillia elegans Roux.

Latreillia elegans Roux, Crust. Medit., 1828, descr., Pl. 22. *Sicily*.

—— S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 418. N. Lat. 40° W. Long. 70° in 85–86 fathoms.

—— S. I. Smith, l. c., VI, 1883, p. 23. N. Lat. 39°–40° W. Long. 69°–70° in 85–134 fathoms; N. Lat. 38° 39' W. Long. 73° 11' in 130 fathoms.

—— S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 373, Pl. 2, figs. 2–2a, Pl. 3, fig. 1. N. Lat. 40° 5' W. Long. 70° 34' 45" in 70 fathoms.

—— S. I. Smith, l. c., XIII, 1885 (1887), p. 637. N. Lat. 39° W. Long. 69° in 78 fathoms.

GULF STREAM.

Tribe OXYRHYNCHA.

The Spider Crabs.

Family MAIIDÆ.

The Spider Crabs.

Genus HYAS Leach.

The Toad Crabs.

Hyas coarctatus Leach.

Toad Crab.

Genus LIBINIA Leach.

The Spider Crabs.

Libinia dubia Milne-Edwards.

Libinia emarginata Leach.

Genus ANAMATHIA S. I. Smith.

Anamathia S. I. Smith, Proc. U. S. Nat. Mus., VII, 1884, p. 493. Type *Amathia rissoana* Roux, virtually, as name proposed to replace *Amathia*.

Amathia (nec Lamouroux 1812) Roux, Crust. Medit., 1828, descr., Pl. 3.
Type *Amathia rissoana* Roux, monotypic.

Anamathia crassa (A. Milne-Edwards).

Amathia crassa A. Milne-Edwards, Miss. Sci. Mex. Crust., 1878, p. 203, Pl. 28, fig. 2. N. Lat. $24^{\circ} 15'$ W. Long. $80^{\circ} 13'$ in 229 fathoms.

Amathia agassizii S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 1, Pl. 2, figs. 2-3. N. Lat. $32^{\circ} 25'$ W. Long. $77^{\circ} 42' 30''$ in 262 fathoms and off Middle States.

—— S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 3. N. Lat. 39° W. Long. 69° - 70° in 192-264 fathoms.

—— S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 346. N. Lat. 35° - 39° W. Long. 71° - 74° in 142-197 fathoms.

Anamathia agassizii S. I. Smith, Proc. U. S. Nat. Mus., VII, 1884, p. 493. Off East coast of U. S.

—— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 624, Pl. 1, figs. 2-3, 3a. N. Lat. 39° W. Long. 69° - 70° in 149-195 fathoms.

GULF STREAM.

Anamathia tanneri (S. I. Smith).

Amathia tanneri S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 4. N. Lat. $39^{\circ} 59'$ W. Long. $70^{\circ} 6'$ in 146 fathoms; N. Lat. $38^{\circ} 39'$ W. Long. $73^{\circ} 11'$ in 130 fathoms.

Anamathia tanneri S. I. Smith, l. c., VII, 1884, p. 493 (evidently on above).

—— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 626, Pl. 1, fig. 4 (type).

GULF STREAM.

Genus COLLODES Stimpson.

Collodes Stimpson, Ann. Lyc. N. Hist. N. Y., VII, 1862, p. 193. Type *Collodes granosus* Stimpson, monotypic.

Collodes robustus S. I. Smith.

Collodes robustus S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 5. Off Middle States in 65-146 fathoms; N. Lat. 38° W. Long. 73° in 104-156 fathoms; N. Lat. 37° W. Long. 74° in 56-57 fathoms.

—— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 621. N. Lat. 37° W. Long. 74° in 70 fathoms.

—— M. J. Rathbun, Proc. U. S. Nat. Mus., XVII, 1894, p. 52. N. Lat. 37° W. Long. 74° in 64-104 fathoms.

—— M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 508. Cape Cod to North Carolina.

Collodes depressus (nec A. Milne-Edwards) S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 414. N. Lat. 39° - 40° W. Long. 70° in 65-142 fathoms.

GULF STREAM.

Collodes depressus A. Milne-Edwards.

Collodes depressus A. Milne-Edwards, Miss. Sci. Mex. Crust., 1878, p. 176, Pl. 32, fig. 4. Near Sombrero and West Florida in 20 fathoms.

—— S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 414. N. Lat. 39° - 40° W. Long. 70° in 65-142 fathoms.

—— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 621. N. Lat. 35° $35'$ $20''$ W. Long. 74° $58'$ $45''$ in 27 fathoms.

—— M. J. Rathbun, Proc. U. S. Nat. Mus., XVII, 1891, p. 52. N. Lat. 26° - 35° W. Long. 75° - 85° in 24-79 fathoms.

GULF STREAM.

Genus EUPROGNATHA Stimpson.

Euprognatha Stimpson, Bull. Mus. Comp. Zoöl., II, 1870, p. 122. Type *Euprognatha rastellifera* Stimpson, monotypic.

Euprognatha rastellifera Stimpson.

Euprognatha rastellifera Stimpson, Bull. Mus. Comp. Zoöl., II, 1870, p. 123. Off Florida Keys.

—— A. Milne-Edwards, Bull. Mus. Comp. Zoöl., VIII, 1880, p. 7. (West Indies.)

—— S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 415. N. Lat. 39° - 40° W. Long. 70° in 65-192 fathoms.

—— S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 4. N. Lat. 38° - 40° W. Long. 71° - 73° in 44-89 fathoms.

—— S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 9. N. Lat. 39° - 40° W. Long. 69° - 71° in 44-229 fathoms; N. Lat. 38° W. Long. 73° in 130-156 fathoms; N. Lat. 37° W. Long. 74° in 56-57 fathoms.

—— S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 347, Pl. 1, figs. 3-3a. N. Lat. 36° - 37° W. Long. 74° in 66-98 fathoms.

—— S. I. Smith, l. c., XIII, 1885 (1887), p. 621. N. Lat. 37° W. Long. 74° in 70-167 fathoms.

—— M. J. Rathbun, Proc. U. S. Nat. Mus., XVII, 1891, p. 55. N. Lat. 37° W. Long. 74° in 64-217 fathoms.

—— M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 509. In the Virginia province.

GULF STREAM.

Genus PELIA Bell.

Pelia Bell, Trans. Zoöl. Soc. London, II, 1842, p. 44. Type *Pelia pulchella* Bell, monotypic.

Pelia mutica (Gibbes).

- Pisa mutica* Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850, p. 171. *Off White Point Battery, Charleston, South Carolina.*
- Pelia mutica* Stimpson, Ann. Lyc. N. Hist. N. Y., VII, 1860, p. 177 (Holmes's Holl, Beaufort Harbor, Charleston Harbor).
- Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 415 (bottoms of bays and sounds).
- S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 548. Vineyard Sound to Florida.
- Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 316. Massachusetts to Florida.
- Kingsley, l. c., 1879, p. 385. Northampton Co., Va.
- M. J. Rathbun, Proc. U. S. Nat. Mus., XVI, 1893, p. 89. Vineyard Sound, Virginia and south.
- M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 510. Cape Cod to Florida.
- M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 11. Vineyard Sound and westward. Massachusetts to Florida.

Genus DORYNCHUS Thomson.

- Dorynchus* (Norman) Thomson, The Depths of the Sea, 1872, p. 174. Type *Dorynchus thomsoni* (Norman) Thomson, monotypic.
- Lispognathus* A. Milne-Edwards, Miss. Sci. Mex. Crust., 1878, p. 349. Type *Lispognathus fucillatus* A. Milne-Edwards, monotypic.

Dorynchus thomsoni Thomson.

- Dorynchus thomsoni* (Norman) Thomson, The Depths of the Sea, 1873, p. 174, fig. 34. "*Very widely diffused.*"
- Lispognathus thomsoni* S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 12. N. Lat. 39° 57' W. Long. 70° 31' 30" in 225 fathoms; N. Lat. 39° 53' W. Long. 69° 47' in 317 fathoms.
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 622, Pl. 1, fig. 1-1a. N. Lat. 39° W. Long. 69°-70° in 225-317 fathoms.
- M. J. Rathbun, Proc. U. S. Nat. Mus., XVII, 1891, p. 64. Off Georgia and Middle States.

GULF STREAM.

Family PARTHENOPIDÆ.

The Pentagon Crabs.

Genus PARTHENOPE Weber.

The Pentagon Crabs.

Parthenope Weber, Nomenclat. Entomol., 1795, p. 92. Type *Cancer longimana* Linnæus, third species, designated by M. J. Rathbun, Proc. Biol. Soc. Wash., XVII, 1904, p. 170.¹

Lambrus Leach, Trans. Linn. Soc. London, XI, 1815, p. 308. Type *Maia longimana* Bosc, monotypic.

Parthenope pourtalesii (Stimpson).

Lambrus pourtalesii Stimpson, Bull. Mus. Comp. Zoöl., II, 1870, p. 129. *Off Couch Reef, French Reef, American Shoal, Florida Keys.*

— M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 514, fig. 11. Virginian province.

Virginian province.

Parthenope verrillii (S. I. Smith).

Lambrus verrillii S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 415. N. Lat. 40° W. Long. 70° in 65–86 fathoms.

— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 628, Pl. 2, fig. 2. N. Lat. 40° W. Long. 70° in 67 fathoms.

Lambrus verrillii S. I. Smith, l. c., VI, 1883 (1885), p. 14. N. Lat. 39°–40° W. Long. 69°–70° in 65–134 fathoms.

GULF STREAM.

Genus HETEROCRYPTA Stimpson.

Heterocrypta Stimpson, Ann. Lyc. N. Hist. N. Y., X, 1871, p. 102. Type *Cryptopodia granulata* Gibbs, designated, first species.

¹ Possibly *Parthenope fornicata* Weber = *Cancer parthenope* Linnæus, is eligible and thus type by virtual tautonomy.

Heterocrypta granulata (Gibbes).*Pentagon Crab.*

Cryptopodia granulata Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850 (1851), p. 173. *Kiawah Island, Sullivan's Island, White Point Shoal, Charleston Harbor, South Carolina.*

Heterocrypta granulata Stimpson, Ann. Lyc. N. Hist. N. Y., X, 1871, p. 103. (Sea of Southern States and West Indies.)

—— Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 415. (Off Falmouth and near Suconesset light-ship, Mass.)

—— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 548. Vineyard Sound to West Indies.

—— Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 317. (North Carolina to West Indies).

—— Kingsley, l. c., 1879, p. 391. Northampton Co., Va.

—— M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 515. Cape Cod to Gulf of Mexico.

—— Moriera, Arch. Mus. Nac. Rio Janeiro, XI, 1901, pp. 61, 129. Virginia to Bahia.

—— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 12. (Vineyard Sound and Wood's Holl, Mass.).

Massachusetts to Gulf of Mexico.

Tribe LEUCOSIDEA.*Family* CALAPPIDÆ.*The Box Crabs.***Genus** CALAPPA Fabricius.*The Box Crabs.***Calappa flammea** (Herbst).*Box Crab.***Genus** ACANTHOCARPUS Stimpson.

Acanthocarpus Stimpson, Bull. Mus. Comp. Zoöl., II, 1870, p. 152. Type *Acanthocarpus alexandri* Stimpson, monotypic.

Acanthocarpus alexandri Stimpson.

Acanthocarpus alexandri Stimpson, Bull. Mus. Comp. Zoöl., II, 1870, p. 153.
Florida Straits in 74 fathoms.

—— S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 418. N. Lat. 39°-40° W. Long. 70° in 85-155 fathoms.

—— S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 7. N. Lat. 40° W. Long. 71° in 71 fathoms.

—— S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 19. Off Middle States in 50-200 fathoms.

—— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 557 (compiled).

—— M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 516. Cape Cod to North Carolina and Gulf of Mexico.

GULF STREAM.

Genus MYROPSIS Stimpson.

Myropsis Stimpson, Bull. Mus. Comp. Zoöl., II, 1870, p. 156. Type *Myropsis quinquespinosa* Stimpson, monotypic.

Myropsis quinquespinosa Stimpson.

Myropsis quinquespinosa Stimpson, Bull. Mus. Comp. Zoöl., II, 1870, p. 157.
Florida Straits in 21-82 fathoms.

—— A. Milne-Edwards, Bull. Mus. Comp. Zoöl., VIII, 1880, p. 21 (N. Lat. 23°-25° W. Long. 84°-89°, Martinique and Grenada).

—— S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 19. N. Lat. 40° W. Long. 69° 59'.

—— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 557 (compiled).

—— Faxon, Bull. Mus. Comp. Zoöl., XXX, 1896, p. 154 (off Port Royal, Jamaica, in 100 fathoms).

GULF STREAM.

Genus CYMOPOLIA Roux.

Cymopolia Roux, Crust. Medit., 1828, descr., Pl. 21. Type *Cymopolia caronii* Roux, monotypic.

Cymopolia gracilis S. I. Smith.

Cymopolia gracilis S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 20.
N. Lat. 39° 55' W. Long. 70° 54' 12" in 142 fathoms.

—— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 557 (from above)

GULF STREAM.

Family MATUTIDÆ.

Genus HEPATULUS new name.

Type *Hepatus fasciatus* Latreille.

Hepatus (nec Gronow 1763 in fishes) Latreille, Hist. Nat. Crust., II, 1802, p. 22. Type *Hepatus fasciatus* Latreille, monotypic.

Hepatulus epheliticus (Linnæus).

Dolly Varden.

Cancer epheliticus Linnæus, Amœn. Acad., VI, 1763, p. 414. *Carolina.*

Hepatus epheliticus M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 517. Cape Cod to North Carolina, Florida and Gulf of Mexico.

Virginian province.

Family DORIPPIDÆ.

Genus ETHUSA Roux.

Ethusa Roux, Crust. Medit., 1828, no descr. (not paged) Pl. 18. Type *Ethusa mascarone* Roux, monotypic.

Æthusa, auct.

Ethusa microphthalma S. I. Smith.

Ethusa microphthalma S. I. Smith, Proc. U. S. Nat. Mus., III, 1881, p. 418. N. Lat. 39° 55' W. Long. 70° 54' 15" in 142 fathoms.

— S. I. Smith, l. c., VI, 1883, p. 22. N. Lat. 40° 7' 48" W. Long. 70° 43' 54" in 67 fathoms; N. Lat. 38° 31' W. Long. 73° 21' in 156 fathoms; and type.

— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 557 (compiled).

— M. J. Rathbun, Am. Nat., XXXIV, 1900, p. 519. Virginia province.

GULF STREAM.

Genus Ethusina S. I. Smith.

Ethusina S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 349. Type *Ethusina abyssicola* S. I. Smith, monotypic.

Ethusina abyssicola S. I. Smith.

Ethusina abyssicola S. I. Smith, Rep. U. S. F. Com., X, 1882 (1884), p. 349, Pl. 2, figs. 1-1a. N. Lat. 37°-38° W. Long. 69°-73° in 1731-1497 fathoms.

— Verrill, Rep. U. S. F. Com., XI, 1883 (1884), p. 553 (compiled).

— S. I. Smith, l. c., XIII, 1885 (1887), p. 635. N. Lat. 37° W. Long. 71°-73° in 1582-2221 fathoms.

GULF STREAM.

Tribe CATOMETOPA.

Family PILUMNIDÆ.

The Mud Crabs.

Genus EURYPANOPEUS A. Milne-Edwards.

Eurypanopeus depressus (S. I. Smith).

Mud Crab.

Genus RHITHROPANOPEUS M. J. Rathbun.

Rhithropanopeus harrisii (Gould).

Harris's Crab.

Genus NEOPANOPE A. Milne-Edwards.

Neopanope texana sayi (S. I. Smith).

Say's Crab.

Genus HEXAPANOPEUS M. J. Rathbun.

Hexapanopeus M. J. Rathbun, Bull. Lab. N. Hist. State Univ. Iowa, IV, 1898, p. 273. Type *Panopeus angustifrons* J. M. Benedict and M. J. Rathbun, designated.

Hexapanopeus angustifrons (J. M. Benedict and M. J. Rathbun).

Panopeus angustifrons J. M. Benedict and M. J. Rathbun, Proc. U. S. Nat. Mus., XIV, 1891, p. 373, Pl. 22, fig. 3, Pl. 24, fig. 18. *Vineyard Sound, Mass.; Buzzard's Bay; Narragansett Bay; Long Island Sound; Virginia; North Carolina; South Carolina; Florida; Brazil.*

Hexapanopeus angustifrons M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 138. Virginia province.

— M. J. Rathbun, Occas. Papers Boston Soc. Nat. Hist., VII, 1905, p. 7. Massachusetts, Rhode Island, Connecticut.

LONG ISLAND SOUND.

VIRGINIA.

Genus EUPANOPEUS M. J. Rathbun.

Eupanopeus herbstii (Milne-Edwards).

Herbst's Crab.

Genus **EURYTIUM** Stimpson.

Eurytium limosum (Say).

The Swimming Crabs.

Family **PORTUNIDÆ.**

Genus **CARCINIDES** M. J. Rathbun.

The Green Crabs.

Carcinides mænas (Linnæus).

Green Crab.

Genus **ARENÆUS** Dana.

Arenæus cribrarius (Lamarck).

Genus **CALLINECTES** Stimpson.

The Blue Crabs.

Callinectes sapidus M. J. Rathbun.

Blue Crab.

Genus **PORTUNUS** Fabricius.

Portunus Fabricius, Entom. Syst. Suppl., 1798, p. 325. Type *Cancer depurator* Linnæus, ninth species and designated as "example" by Latreille, Hist. Nat. Crust., III, 1802, p. 23.

Lupa Leach, Edin. Encyclop., VII, 1814, p. 390.¹ Type *Cancer pelagicus* Linnæus, monotypic virtually. (Not consulted.)

Lupania Rafinesque, Amer. Month. Mag. Crit. Rev., III, August 1818, p. 272. Type *Cancer pelagicus* Linnæus, virtually, as name proposed to replace *Lupa* Leach.

Neptunus Haan, Faun. Japon. Crust., 1833, pp. 3, 7. Type *Cancer pelagicus* Linnæus, first species, designated by Miers, Rep. Voy. Challenger, Brach., XVII, 1886, p. 172.

Achelous Haan, l. c., pp. 3, 8. Type *Portunus spinimanus* Latreille, monotypic.

Portunus sayi (Gibbes).

Lupa sayi Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850, p. 178. *South Carolina coast.*

¹ Amer. Ed., VII, 1815, p. 228.

- Neptunus sayi* Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 319. New York to Florida.
- A. Milne-Edwards, Miss. Sci. Mex. Crust., X, 1878, p. 211. Eastern coast of North America.
- S. I. Smith, Trans. Conn. Acad., V, 1879, p. 121. Gulf Stream; N. Lat. $41^{\circ} 30'$.
- Howe, Bull. U. S. F. Com., XIX, 1899 (1901), p. 240. N. Lat. 39° – 40° W. Long. 70° at surface.
- Neptunus (Neptunus) sayi* Miers, Rep. Voy. Challenger, Brach., XVII, 1886, p. 173. Western North Atlantic; South of Nova Scotia.
- Portunus sayi* M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 140. Virginia province.
- M. J. Rathbun, Occas. Papers Boston Soc. Nat. Hist., VII, 1905, p. 8. Vineyard Sound.
- Mayer, Sea Shore Life, 1906, p. 101, fig. 70. Sometimes drifted upon our coast.
- Lupa pelagica* (nec Linnæus) Say, Journ. Acad. Nat. Sci. Phila., I, pt. 1, 1818, p. 97. Gulf Stream.
- De Kay, N. Y. Fauna, Crust., VI, 1844, p. 11, Pl. 6, fig. 8. Southern coast.

NEW YORK.

GULF STREAM.

***Portunus gibbesii* (Stimpson).**

- Lupa gibbesii* Stimpson, Ann. Lyc. N. Hist. N. Y., VII, 1860, p. 57. South Carolina and St. Augustine, Florida.
- Portunus gibbesii* M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 140. Cape Cod to North Carolina, Florida and Gulf of Mexico. Virginian province.

***Portunus spinimanus* Latreille.**

- Portunus spinimanus* Latreille, Dict. Sci. Nat., Ed. 2, XXVIII, 1819, p. 47. America, Brazil.
- M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 141. Cape Cod to North Carolina, Florida and Gulf of Mexico. Virginian province.

Genus BATHYNECTES Stimpson.

- Bathynectes* Stimpson, Bull. Mus. Comp. Zoöl., II, 1870, p. 145. Type *Bathynectes longispina* Stimpson, first species.
- Thranites Bovallius*, Oefv. K. Vet. Ak. Förh., XXXIII, 1876, No. 9, p. 59. Type *Thranites velox* Bovallius, monotypic.

Bathynectes superba (Costa).

Portunus superbus Costa, Faun. Naples, 1853, p. 19, Pl. 7. *Naples*.

Bathynectes superba Rathbun, Amer. Nat., XXXIV, 1900, p. 142. Cape Cod to North Carolina, Florida and Gulf of Mexico.

Bathynectes longispina S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 418. N. Lat. 39°-40° W. Long. 70° in 85-225 fathoms.

— S. I. Smith, l. c., VI, 1883, p. 17. Off Middle States in 85-225 fathoms; N. Lat. 38° 39' W. Long. 73° in 11-130 fathoms.

— S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 633. N. Lat. 39° W. Long. 69° in 78 fathoms; N. Lat. 37° W. Long. 74° in 70-167 fathoms.

— Verrill, Rep. U. S. F. Com., XI, 1883 (1885), p. 557 (compiled).

GULF STREAM.

Genus OVALIPES M. J. Rathbun.*The Lady Crabs.***Ovalipes ocellatus** (Herbst).*Lady Crab.*

Family CANCRIDÆ.

*The Edible Crabs.***Genus CANCER** Linnæus.*The Edible Crabs.***Cancer borealis** Stimpson.*Jonah Crab.***Cancer irroratus** Say.*Rock Crab.*

Tribe GRAPSOIDEA.

The Grapsoid Crabs.

Family PINNOTHERIDÆ

The Oyster Crabs.

Genus **ZAOPS** M. J. Rathbun.

Zaops depressa (Say).

Genus **ECHINOPHILUS** M. J. Rathbun.

Echinophilus M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 590. Type
Echinophilus mellitæ M. J. Rathbun, monotypic.

Echinophilus mellitæ M. J. Rathbun.

Echinophilus mellitæ M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 590.
Pensacola, Florida (Virginia province, or region between Cape Cod and
North Carolina, to Gulf of Mexico).
Virginian province.

Genus **PINNOTHERES** Latreille.

The Oyster Crabs.

Pinnotheres maculatus Say.

Mussel Crab.

Pinnotheres ostreum Say.

Oyster Crab.

Genus **PINNIXA** White.

Pinnixa White, Ann. Mag. N. Hist. London, (1) XVIII, 1846, p. 177. Type
Pinnixa cylindrica Say, monotypic.
Tubicola (nec Latreille 1825) Lockington, Proc. Cal. Acad. Sci., VII, 1876, p.
55. Type *Tubicola longipes* Latreille, monotypic.

Pinnixa chætopterana Stimpson.

Pinnixa chætopterana Stimpson, Ann. Lyc. N. Hist. N. Y., VII, 1860, p. 235.
Charleston Harbor, South Carolina.
— Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 402. Eastern Shore
of Virginia.

— M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 589. Virginia province.
VIRGINIA (Eastern Shore).

[*Pinnixa cristata* M. J. Rathbun.

Pinnixa cristata M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 589. *Beaufort, North Carolina.*

NORTH CAROLINA.]

Pinnixa sayana Stimpson.

Pinnixa sayana Stimpson, Ann. Lyc. N. Hist. N. Y., VII, 1860, p. 236. *Off mouth of Beaufort Harbor, North Carolina.*

— Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 323 (on Stimpson).

— M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 589. *Virginian province, in region from Cape Cod to N. C.*

— M. J. Rathbun, Occas. Papers Boston Soc. N. Hist., VII, 1905, p. 6. *Massachusetts and Connecticut, south.*

Pinnotheres cylindricum (nec Say) De Kay, N. Y. Fauna, Crust., VI, 1844, p. 13. *Georgia (part).*

Pinnixa cylindrica Stimpson, Ann. Lyc. N. Hist. N. Y., VII, 1860, p. 68 (*South Carolina*).

— Verrill, Rep. U. S. F. Com., I, 1871-72 (1873), p. 367, Pl. 1, fig. 1 (*muddy shores, in annelids, in Arenicola, in stomach of ocellated flounder*).

— S. I. Smith, Rep. U. S. F. Com., I, 1871-72 (1873), p. 546, Pl. 1, fig. 1. *Vineyard Sound to South Carolina.*

— Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 324. *Long Island Sound to South Carolina.*

— M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 589. *South Carolina to Gulf of Mexico.*

LONG ISLAND SOUND.

Massachusetts to Carolina.

Family GRAPSIDÆ.

[*Genus* PACHYGRAPSUS Randall.

Pachygrapsus Randall, Journ. Acad. Nat. Sci. Phila., VIII, 1839, p. 126. Type *Pachygrapsus crassipes* Randall, first species.

Pachygrapsus transversus (Gibbes).

Grapsus transversus Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 1850 (1851), p. 181. *Key West, Florida.*

Pachygrapsus transversus M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 589. *Occasional to North Carolina, Gulf of Mexico, California.*

North to North Carolina.]

Genus **SESARMA** Say.**Sesarma reticulatum** (Say)**Sesarma cinereum** (Bosc)*Wood Crab.**Grapsus cinereus* Bosc, Hist. Nat. Crust.,¹ I, 1802, p. 204, Pl. 5, fig. 1.
(Not consulted.)*Sesarma cinerea* S. I. Smith, Trans. Conn. Acad., II, 1870, p. 157. Virginia.—— Kingsley, Proc. Acad. Nat. Sci. Phila., 1879, p. 401. Northampton
County, Va.—— Young, Stalk E. Crust. W. Ind., 1900, p. 291. Virginia to West
Indies.*Sesarma cinereus* Kingsley, l. c., 1880, p. 214. Virginia to Florida and West
Indies.*Sesarma cinereum* M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 587. Vir-
ginian province to Gulf of Mexico.

VIRGINIA (Northampton County).

Genus **PLANES** Bowdich.*The Gulf-weed Crabs.***Planes minutus** (Linnæus).*Gulf-weed Crab.*

Family OCYPODIDÆ.

*The Ghost Crabs.*Genus **GERYON** Kröyer.*Geryon* Kröyer, Nat. Tidssk. Kjöbenh., I, 1837, p. 9. Type *Geryon tridens*
Kröyer, monotypic.*Chalæpus* Gerstaecker, Arch. Naturg. Berlin, pt. I, 1856, p. 118. Type *Cancer*
trispinosus Herbst, monotypic.**Geryon quinquedens** S. I. Smith.*Geryon quinquedens* S. I. Smith, Trans. Conn. Acad., V, 1879, p. 35, Pl. 9, figs.
1-2. *Casco Bay* (from fish stomachs, fish taken in deep water); *Gulf*
of Maine; *fourteen miles southeast of Cape Ann.*¹ Desmarest, Ed. 2, I, 1828, p. 258. "*Le bord et dans les eaux saunatres de*
la Caroline."

- S. I. Smith, Proc. U. S. Nat. Mus., III, 1880 (1881), p. 417. N. Lat. 39° W. Long. 70° in 252-373 fathoms.
- S. I. Smith, Bull. Mus. Comp. Zoöl., X, 1882, p. 6. N. Lat. 33°-40° W. Long. 68°-76° in 263-740 fathoms.
- S. I. Smith, Proc. U. S. Nat. Mus., VI, 1883, p. 15. N. Lat. 39°-40° W. Long. 68°-72° in 207-640 fathoms; N. Lat. 38° W. Long. 73° in 435 fathoms.
- S. I. Smith, Rep. U. S. F. Com., XIII, 1885 (1887), p. 631. N. Lat. 39° W. Long. 70°-72° in 353-1043 fathoms; N. Lat. 39° W. Long. 71° in 510-811 fathoms.
- M. J. Rathbun, Amer. Nat., XXXIV, 1900, p. 586, fig. 5 (carapace).
Virginian province.

GULF STREAM.

Genus **UCA** Leach.*The Fiddler Crabs.***Uca pugilator** (Bosc).*Fiddler Crab.***Uca minax** (Le Conte).*Red-jointed Fiddler Crab.***Uca pugnax** (S. I. Smith).*Marsh Fiddler Crab.*Genus **OCYPODE** Fabricius.*The Ghost Crabs.***Ocypode albicans** (Bosc)*Ghost Crab.*

Glossary.

Abdomen. Hind division of body.

Abdominal feet. Appendages of the abdomen; many as six pairs may be developed.

Abyssal. Of the depths, said of deep-sea forms.

Accessory gill. Additional or extra gill.

Acicle. Stout bristle; said of scale of second antenna when not laminar.

Adductor muscle. Muscle closing shell and passing transversely from valve to valve, as in many entomostraca.

Adhesion pads. Holding disks, as those of many parasitic forms.

Aerial. Living in the air.

Æsthetask. Sense-clubs, as those on the antennæ of certain copepods, like Cyclops and Diaptomus.

Afferent. Conveying inward.

Alæ. Wings.

Alecithal. Said of eggs when the yolk material is evenly distributed and of small quantity.

Ambulatory. Walking; as of the legs, which may be many as five pairs.

Anal segment. Usually last segment of body.

Anchylosed. Grown solidly together.

Andricum. Male organ on first pair of abdominal appendages, as in some prawns.

Annulus ventralis. Plate containing female genital-opening, as in crawfishes.

Antenna. Feeler; usually known as the second pair of appendages of the head—thus antennæ, second, outer, or under antennæ.

Antennule. A little antenna; usually known as the first pair of appendages of the head—thus antennules or first antennæ. Their divisions often comprise the peduncle, flagellum and secondary appendage.

Antrorse. Turned forward.

Anus. Posterior aperture of the alimentary canal.

Apodeme. Plates of chitin passing inward from integuments of crustaceans, dividing as well as supporting their internal organs.

Arcuate. Curved.

Areola. Small space between line defining upper extent of gills, as seen on upper surface of thorax in crawfishes.

Article. Segment.

Asexual. Without sex.

Asymmetrical. Not symmetrical, or one side or portion developed more than the other.

Attenuate. Long and slenderly pointed.

Basipodite. Base-foot, or second basal joint of a limb; basis.

Biarticulate. Two-jointed.

Bidentate. Two-toothed.

Biflagellate. With two flagella.

Bilateral symmetry. Said of animals in which each side of body is equally formed.

Binocular. Two-eyed.

Bipartite. In two parts.

Biramous. Two-branched; also biramous.

Bivalve. In two halves or valves, like an oyster shell.

Boss. Knob or swelling.

Bract. Thin plate.

Branchia. Gills or respiratory organs.

Branchial lamella. Plate gills; as the appendages to legs in amphipods, etc.

Branchiform. Shaped like gills.

Branchiostegal spine. Spine on carapace in region of gills, as in shrimps, prawns, etc.

Bristle. Stiff hair.

Brood-pouch. Capsule formed on back or on certain appendages, and containing ova, as in many entomostraca.

Buccal area. Region of the mouth.

Buccal cavern. Said of the mouth region when deep or cavernous, as in crabs.

Buccal mass. The mouth, with its various appendages, as the lips, mandibles, maxillæ, maxillipeds, etc.

Bulbous. Bulb-like or swollen.

Cæcum. Blind sac.

Calcareous. Partaking of lime.

Cancellated. Cross-barred, like network.

Capitulum. Top of a column, as the upper part of a stalked barnacle.

Carapace. Shell or hard covering of back.

Carina. Keel; especially median dorsal calcareous plate of the carapace in certain barnacles.

Carinate. Keeled.

Carpopodite. Appendage to carpus, as that in certain macrurans.

Carpus. Wrist.

Caudal fan. Tail fan, as flattened lobes formed by telson and uropoda in the macrurans.

Caudal styles. Pillars of the tail, as the long processes of anal segment seen in phyllopod and copepods.

Caudal swimmerets. Leaf-like lateral lobes of caudal fan or telson.

Centrolecithal. Said of eggs which have an accumulation of yolk in the center surrounded by a superficial layer of protoplasm.

Cephalon. Head, or anterior portion of front division of body.

Cephalosome. Head as a segment.

Cephalothorax. So called when thoracic segments may be fused in greater or lesser number to form an anterior division of body.

Cervical groove. Line dividing front division of body into a cephalothorax and thorax, as in crawfishes.

- Chalimus*. Final state of development in young, as in copepods.
- Chela*. Claw.
- Chelate*. Claw or pincher-like.
- Cheliform*. Shaped like claws or pinchers.
- Cheliped*. Claw or pincher foot, like the large first pair of feet in macrurans and crabs.
- Chitin*. Substance forming carapace.
- Ciliate*. Provided with cilia.
- Cilium*. Hair, or hair-like filament.
- Cirrus*. A fringe-like prehensile or locomotive organ, so called usually from its curled or tufted form.
- Clasping organs*. Modified second antennæ of certain male phyllopods.
- Clavate*. Club-shaped.
- Claw*. Chela, or nail-like point, or end, to an organ.
- Clypeus*. Shield, or carapace.
- Coalescent*. Joined or united.
- Calome*. The body-cavity as distinguished from the intestinal cavity.
- Commensal*. Mess-mates; usually said of such forms as are not strictly parasitic, or do not feed on the juices or tissues of their host, though they may live within its body.
- Commissure*. Seam or suture.
- Compound eye*. Said of that found in many entomostraca when certain elements composing it are in a condition of optical isolation from their fellows.
- Concentric*. With a common center.
- Connective*. Tending to connect.
- Contour*. Outline.
- Contractile*. Narrow or shrunken.
- Convolute*. Rolled together.
- Copulatory*. Joined, with reference to the sexual embrace.
- Corium*. Innermost layer of the skin.
- Cornea*. Transparent cuticle covering the eye.
- Cosmopolitan*. Said of species or groups whose range is world-wide. Mundane.
- Costate*. Ribbed.
- Coxa*. Basal joint of the leg; coxopodite.
- Coxal lobe*. Lobe formed on coxa.
- Coxal plate*. Coxal lobe.
- Coxopodite*. Basal joint of a developed limb by which its limb articulates with its somite or segment of the body; coxa.
- Crenulate*. With little notches.
- Cuticle*. A thin skin.
- Dactyl*. Finger.
- Dactylopodite*. Finger-foot; finger.
- Dendrobranchia*. Root-like gills, as in prawns.
- Denticulate*. Toothed.
- Dentiform*. Shaped like a tooth.
- Depressor muscles*. Said of those which press downward.

Diacresis. Division made by line.

Didactyle. Two-fingered.

Digitate. Branched out like fingers.

Dimorphism. Of two forms.

Discoid. Like a disc or round plate.

Distal. End, terminal.

Diverticle. A turning aside.

Dorsal anus. Vent in dorsal surface of last abdominal segment, as in Cyclops.

Ductus. Tube or canal.

Ecarinate. Without keel.

Ectoparasitic. Parasites living on the outside of the body of the host.

Efferent channels. Channels conveying outward.

Ellipsoid. Formed as an ellipse.

Elytraform. Sheath-shaped.

Embryo. First stage of development in the young.

Endite. Inner offshoot of an appendage or limb.

Endopod. Inner foot.

Endopodite. Inner terminal branch of protopodite; endopod.

Endostome. Part placed behind and supporting labrum; endostoma.

Ensiform. Shaped like a razor.

Enteric canal. The main digestive canal of the body.

Ephippium. Saddle-like organ, as in water-fleas.

Epidermis. Outer portion of the skin.

Epignath. Outer jaw.

Epimera. Side-piece in segments of the body.

Epipod. Outer foot.

Epipodite. Folded plate or terminal segment of an exopodite; epipod.

Epistome. Preoral part or parts above and before mouth on the antennary somite; placed between labrum and bases of antennæ; epistoma.

Epithelial. With reference to the lining membrane of the mucous surface.

Ethology. A discourse on customs or habits.

Excretory organs. Organs ejecting waste matter from the body.

Exite. Outer offshoot of an appendage or limb.

Exopod. Outer foot.

Exopodite. Outer terminal branch of protopodite; exopod.

Exoskeleton. Outer skeleton or hard parts of body externally.

Eye-stalk. Ophthalmopod, or the appendage containing the eye in higher crustacea.

Facets. Small surfaces.

Falcate. Scythe or sickle-shaped.

Falciform. Scythe-formed.

Fascicle. Bundle, as a cluster of bristles, etc.

Filagree. Formed as little threads or grains.

Filiform. Shaped like a thread.

Finger. Digit.

First antennæ. Antennules, or first pair of appendages to head.

First maxilla. First jaws, or fourth pair of appendages to head.

- Fixed.* Said of stationary forms, like barnacles.
- Flabelliform.* Shaped like a fan or flap.
- Flabellum.* Fan.
- Flagellum.* Whip.
- Fleck.* Spot or stain.
- Flexuous.* Bent, as the abdomen of many macrurans.
- Foliaceous.* Leaf-like.
- Foramen.* A perforation or small hole.
- Fornices.* Rounded sides of shield, which protect insertion of antennæ in certain water-fleas.
- Fossa.* Pit or socket.
- Furca.* Fork.
- Ganglion.* Small or minor nerve-center.
- Gastric-mill.* Masticatory stomach, as in the lobster.
- Gastric region.* Stomach tract.
- Gibbous.* Humped or protuberant.
- Gill.* Respiratory organ.
- Geniculation.* Jointing or knotting.
- Globosc.* Spherical.
- Gnathobase.* Jaw-base.
- Gnathopod.* Jaw-foot; in amphipods first and second pairs of legs.
- Green gland.* Renal or excretory organs at base of each antennæ, thus sometimes called antennary glands, as in certain crawfishes.
- Head.* Cephalon, or anterior portion of front division of body.
- Hepatic lobe.* Small lateral division of carapace, bounded behind by cervical groove, and internally by protogastric lobe.
- Hepatic spine.* Spine on hepatic lobe.
- Hiatus.* Breach or aperture.
- Homogeneous.* With sameness of nature throughout.
- Incubatory lamella.* Appendages to legs containing ova, as in amphipods, etc.
- Intercalated.* Oddly inserted, or placed between.
- Interspinal.* Between spines.
- Ischium.* Basal joint of legs.
- Joint.* Segment or article; with reference to the legs usually as coxal, basal, ischial, meral, carpal, propodal, and terminal or dactylus; as appendages to legs usually as branchial lamella and incubatory lamella.
- Labium.* Lower lip; sometimes anterior and posterior developed, with buccal plate and epistome, and latter with lobes and lateral corners.
- Labrum.* Upper lip.
- Lamellate.* Plate-like.
- Lamina.* Plate.
- Lense.* Crystalline humor of eye.
- Linguiform.* Shaped like a tongue.
- Littoral.* Belonging in or to the shore.
- Lobulate.* Divided into little lobes.

Lyrate. Shaped like a lyre or harp.

Lyriiform. Harp-shaped.

Mandibles. Crushing-jaws; usually fourth pair of appendages to head, and formed of body, masticatory part, cutting-edge, molar expansion and palp.

Marsupial pouch. Pouch in which female carries young.

Marsupium. Pouch.

Masticatory. Chewing.

Mastigobranchia. Epipodal plates.

Maxilla. Jaws; usually of two pairs as fifth and sixth pairs of appendages to head; first pair with basal part, basal lobe, masticatory lobe and palp; second pair with basal part, inner and outer lobes.

Maxillipeds. Foot-jaws; usually of several pairs, or as many as three, often formed with basal part, basal lobes, masticatory lobes and palp.

Median eye. A single eye, as in many entomostraca.

Megalops. Big-eyed, with reference to stage in development arising after the zoea stages in higher decapods.

Merus. One of joints of foot-jaws or appendages.

Mesenteron. Intestinal cavity at an early stage.

Mesosome. Hind portion of anterior division of body.

Metamere. One of a lengthwise series or part which are serially homologous with one another.

Metameric. Pertaining to a metamere.

Metamorphosis. Transformation.

Metanauplius. Second or segmented stage of the nauplius.

Metasome. Front portion of posterior division of body.

Microscopic. Very minute, with reference to the microscope.

Mobile. Free or easily moved.

Monodactyl. A single finger.

Motile. With motion.

Moult. Complete change of shell with growth.

Mouth. Aperture of head in which food is received.

Mucronate. Narrowed to a point.

Multiarticulate. With many joints.

Mysis. Stage of development in higher crustacea following the zoea stage.

Natatory. Swimming.

Nauplius. Stage of embryo before hatching, or as free-swimming.

Nephridia. Renal organs, corresponding to the kidneys of the higher animals.

Nodose. Knotty or knobby.

Obovate. Ovate, with distal end wider than the other.

Obpyriiform. Pear-shaped, with distal end wider than the other.

Occludent. Closed up.

Ocellus. Like a little eye.

Ecology. The science of animal and vegetable economy; often written ecology.

Olfactory. Pertaining to the sense of smell.

- Oosperm.* Fertilized egg.
- Oostegopod.* Brood-foot, or modified appendage to hold ova, as in some phyllopods.
- Ophthalmic.* Relating to the eye.
- Ophthalmopod.* Eye-stalk.
- Oral.* With reference to the mouth.
- Orbiculate.* Round or circular.
- Ostia.* Entrance or opening.
- Ovisac.* Egg-pouch.
- Palm.* Inner part of the hand.
- Palp.* Appendage (feeler); usually to the mouth-organs.
- Papilliform.* Formed like a nipple.
- Paragnatha.* Pair of small processes between maxillæ and mandibles, as in some phyllopods.
- Parasitic.* An animal living or deriving its existence at the expense of another.
- Paries.* Free middle part of shell as distinguished from the lateral wings in barnacles; plural parietes.
- Parthenogenetic.* Said of certain forms in which only females occur, reproduction taking place without the aid of the male.
- Pauciarticulate.* With few joints.
- Pectinate.* Comb-like.
- Pedicel.* Foot-stalk.
- Pedigerous.* Bearing feet.
- Pedipalp.* Foot appendage or feeler.
- Peduncle.* Basal joint or joints of antenna; stalk of certain barnacles.
- Pedunculate.* Stalked.
- Pelagic.* Oceanic.
- Pencil.* Brush.
- Pendant.* Streamer.
- Penniform.* Shaped like a feather.
- Pentagonal.* Like a figure with five angles.
- Pereon.* The thorax as distinguished from the head and abdomen. Sometimes written pereion.
- Peraopods.* Third to seventh pairs of legs or appendages of mesosome, in amphipods and macrurans; also called first to fifth pairs of peræopods. Sometimes called pereopods.
- Pericardial.* Relating to the membrane enclosing the heart.
- Petasma.* Or andricum, the male organ on first pair of abdominal appendages of some prawns.
- Phyllobranchiæ.* Leaf-like gills.
- Phylum.* A primary division, as a sub-kingdom of the animal kingdom.
- Piliferous.* Bearing or tipped with hairs.
- Pinnate.* Shaped like a feather.
- Plastic.* Capable of being moulded.
- Plastron.* The lower shell, as opposed to the carapace.
- Pleocleis.* Tubercle or wart-like protuberance on first somite of pleon, preventing elevation of carapace behind.

Pleon. Abdomen.

Pleopod. Swimming-foot; as first to third pairs of appendages to metasome.

Pleura. Downwardly directed lateral processes of abdominal segments, as in crawfishes.

Plica. Fold.

Plicated. Folded or plated.

Plumose. Feathery.

Podobranchial plume. Appendage attached to legs of trunk, as in crawfishes.

Podomere. Limb segment.

Pollex. Thumb.

Polygonal. A figure with many angles.

Porose. With small pores.

Post-abdomen. Last portion of abdomen.

Post-anal plate. Plate behind vent.

Post-cephalic. Behind head.

Predaceous. Living by prey.

Prehensile. Adapted to seize.

Prehension. Taking hold.

Preocular. Before the eyes.

Primordial. First in order.

Proboscis. Trunk of usually protruding feeding-organ.

Proctodæum. Hind section of alimentary canal, or so much of whole intestine as formed at aboral end by ingrowth of ectoderm.

Propodus. Fore-foot.

Prosoma. In barnacles that part of body situated immediately behind point of attachment of body to shell on rostral side.

Prostomium. Region before mouth in the embryo.

Protopodite. First and second joints of an appendage.

Protuberant. Swelling.

Proximal. Nearest, basal.

Pterygostomial. Flaring anterior edges of carapace when these turn forward in front of bases of limbs, parallel with each other and with axis of body.

Pubescent. Downy.

Pyriform. Pear-shaped.

Radii. Streaks or lines.

Raptorial. Rapacious.

Rectangular. Having right angles.

Renal. Pertaining to the reins or kidneys.

Reniform. Kidney-shaped.

Reticulate. Like net-work.

Retractile. That which may be drawn in.

Rhipidura. Hind pair of pleopods, together with telson, as in macrurans.

Rhomboidal. An oblique-angled parallelogram.

Rostrum. Large median spine produced forward on head.

Scaphognathite. An appendage of second maxillæ.

Sclerite. Any separate skeletal element or definite hard part of the arthropod integument.

- Scuta*. Two lateral basal calcareous plates of carapace in certain barnacles.
- Second maxilla*. Usually sixth pair of appendages to head.
- Second maxillipeds*. Eighth pair of appendages to head.
- Securiform*. Shaped like an axe or hatchet.
- Segment*. A division, as if cut off.
- Sense-club*. Feeling-organ.
- Sensory*. Relating to the sense of feeling.
- Septum*. Membrane, usually when forming a separation.
- Serrate*. Notched like a saw.
- Sessile*. Fixed, or without stalk.
- Seta*. Bristle.
- Setaceous*. Bristle-like.
- Setiferous*. Bearing bristles.
- Setose*. Setous or bristly.
- Sexual*. Pertaining to the sex.
- Shell*. Carapace when covering whole of body, as in many entomostraca.
- Shell-glands*. Renal organ, also sometimes including a urinary tube and a small bladder.
- Sigmoid*. Formed like the letter S.
- Sinuous*. Bending in and out.
- Sinus*. Fold or bend.
- Siphonal*. Bent tube.
- Solitary*. Living alone.
- Somite*. Any one morphological segment of an articulated body.
- Spaces*. Blood-sinuses.
- Spatulate*. Shaped like a spade or spoon.
- Sperm*. Male or seminal elements.
- Spermatophore*. Special case or capsule containing spermatozoa.
- Spiniform*. Shaped like a spine.
- Spinning-glands*. As those on feet of certain amphipods.
- Spinulated*. Furnished with little spines.
- Spinule*. Little spine.
- Spinulose*. With spines or thorns.
- Squame*. Exopodite of antenna.
- Sternum*. Ventral region of an abdominal segment, as in the crawfish.
- Stria*. Little channels, flutings or lines.
- Style*. Pillar.
- Stylet*. A little pillar or stalk.
- Styliform*. Shaped like a pillar.
- Stylocrite*. Spine or scale on basal joint of antennular peduncle.
- Subchelate*. Partly claw-like.
- Subcheliform*. Partly formed like a claw.
- Subglobular*. Partly spherical.
- Subpediform*. Partly shaped like a foot.
- Suctorial*. Sucking-like.
- Sulcus*. Groove.
- Superior antenna*. Antennule or first antenna.
- Swimming-feet*. Said of limbs used in swimming, usually in distinction to anterior limbs, which may be foot-jaws or ambulatory; pleopods.
- Syn-cerebrum*. Compound brain.

Tactile. Pertaining to touch.

Teleolecithal. Eggs in which the protoplasm and yolk accumulates at the opposite end of the developing embryo.

Telson. Last or seventh segment of abdomen, as that of macrurans.

Tentacular. Pertaining to a tentacle, as when adapted as a tactile organ.

Terga. Two lateral distal calcareous plates of carapace in certain barnacles.

Tergally. With reference to the tergum.

Tergum. Hood, as dorsal region of abdominal segments in the crawfish.

Thorax. Median body segments, or those between head and abdomen, or hind division of cephalothorax in macrurans.

Tortuous. Twisted or winding.

Trapezoidal. Like a four-sided figure with only two sides parallel.

Triarticulate. Three-jointed.

Trichobranchiæ. Hair-like gills.

Trigonus. Like a triangle.

Trilobate. With three lobes.

Tristose. With three bristles.

Truncate. Cut off abruptly.

Tubuli. Little tubes.

Tumid. Puffed up or swelled.

Umbo. Boss, knob or protuberance.

Uncinate. Hooked or crooked.

Unguiform. Formed like a claw.

Ungula. Hoof or claw.

Unioocular. With one eye.

Uniramose. With one branch.

Uromere. Caudal or posterior segment of body.

Uropod. Tail feet, or last pair of appendages.

Urosome. Hind portion of posterior division of body.

Valve. Half of a shell, especially when more or less divided in two, as in many entomostraca.

Valvular. With reference to a valve.

Vascular. Relating to or full of vessels.

Vas deferens. Sperm-duct.

Ventral. Belonging to the belly.

Ventricose. Swelled, or distended.

Verge. Bend or downward turn.

Vesicular. Hollow or full of small interstices.

Vestigial. Rudimentary.

Villose. Hairy.

Visual. Pertaining to sight.

Vomer. Plough-share.

Whorl. Arrangement around a common center on the same plane.

Zoca. Second stage of development of higher crustacea, and following first or megalops stage.

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Names in italics represent synonyms or references.

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Explanation of Plates.

All the figures given as original are drawn to scale, the accompanying line expressing a fraction of, or one or more, millimeters. Figures taken from other works are always mentioned with reference to their source.

PLATE 1.

Eubbranchipus vernalis (Verrill).

Male, original, upper figure ventral view, lower figure lateral view. Paradise, Lancaster County, Pa. March, 1891. Witmer Stone.

PLATE 2.

Eubbranchipus vernalis (Verrill).

Female, original, data otherwise as preceding.

PLATE 3.

Ino holmanii (Ryder).

Male, original, upper figure ventral view, lower figure lateral view. Chincoteague, Va. May, 1912. T. D. Keim and H. W. Fowler.

PLATE 4.

Streptocephalus sealii Ryder.

Male, original, upper figure ventral view, lower figure lateral view. Woodbury, N. J. W. P. Seal. (Type.)

PLATE 5.

Streptocephalus sealii Ryder.

Female, original, same data as preceding.

PLATE 6.

Eurycercus lamellatus (Müller).

Example without eggs to left, and female with eggs, originals. South Dennisville, N. J. April, 1912. H. W. Fowler.

PLATE 7.

Chydorus sphæricus (Müller).

Original. Tributary of Delaware River near Florence, N. J. May, 1912. H. W. Fowler.

PLATE 8.

Chydorus bicornutus Doolittle.

Modified and copied from Doolittle (Proc. U. S. Nat. Mus., XLI, 1911, Pls. 17 and 18).

PLATE 9.

Daphne pulex (Linnæus).

Original. Near Camden, N. J. May, 1912. H. W. Fowler.

PLATE 10.

Scapholeberis mucronata (Müller).

Original. Tributary of Crosswicks Creek near Trenton, N. J. June, 1912. H. W. Fowler.

PLATE 11.

Scapholeberis armata Herrick.

Original. Tributary of Crosswicks Creek near Trenton, N. J. June, 1912. H. W. Fowler.

PLATE 12.

Sida crystallina (Müller).

Original. Tributary of Crosswicks Creek near Trenton, N. J. June, 1912. H. W. Fowler.

PLATE 13.

Paracandona euplectella (Brady and Norman).

Copied Wilson (Proc. U. S. Nat. Mus., XXXV, 1909, Pl. 52). Upper figure lateral view, lower figure dorsal view.

PLATE 14.

Cypridopsis vidua (Müller).

Original. Upper figure lateral view, lower figure dorsal view. Tributary of Crosswicks Creek near Trenton, N. J. June, 1912. H. W. Fowler.

PLATE 15.

Spirocypris passaica Sharpe.

Copied from Sharpe (Proc. U. S. Nat. Mus., XXVI, 1903, Pl. 66, figs. 1 and 2), upper figure lateral view, lower figure dorsal view.

PLATE 16.

Cypris reticulata Zaddach.

Copied from Brady and Norman (Trans. Royal Dublin Soc., (2) IV, 1889, Pl. 8, figs. 1-2), upper figure lateral view, lower figure dorsal view.

PLATE 17.

Cyclocypris lævis (Müller).

Original. Upper figure lateral view, lower figure dorsal view. Length of specimen about 0.45 mm. From tributary of Crosswicks Creek near Trenton, N. J. June, 1912. H. W. Fowler.

PLATE 18.

Cypria dentifera Sharpe.

Original. Upper figure lateral view and lower figure dorsal view of another example, possibly identical. June, 1912. Tributary of Crosswicks Creek near Trenton, N. J. Length of both specimens figured about 0.60 mm.

PLATE 19.

Naobranchia pomolobi Fowler.

Original. Dorsal, lateral and ventral views of type, reading from left to right. From gills of *Pomolobus astivalis* taken in the Delaware River at Tullytown, Bucks County, Pa., May 28th, 1912. H. W. Fowler.

PLATE 20.

Lernean parasites on Fishes.

Original. Upper left figure *Fundulus heteroclitus macrolepidotus*, *Mcnidia mcnidia notata* upper right figure, and lower figure *Brevortia tyrannus*. All from Chincoteague, Va., May, 1912. T. D. Keim and H. W. Fowler.

PLATE 21.

Lerneænicus radiatus (Le Sueur).

Original. Females, left figure dorsal view, right figure lateral view, and middle figure ventral view. From *Brevortia tyrannus* secured at Chincoteague, Va., May, 1912. T. D. Keim and H. W. Fowler.

PLATE 22.

Pennella filosa (Linnæus).

Original. Female, found parasitic on *Mola mola* and brought to Port Richmond in Philadelphia, Pa. Capt. John L. Howard. Left figure ventral view, showing parasitic barnacle (*Conchoderma virgata*) attached to its abdomen, median figure lateral view, and right figure dorsal view

PLATE 23.

Pennella sagitta (Linnæus).

Copied from Nordmann (Mikr. Beitr., 1832, Pl. 10, fig. 6). Female.

PLATE 24.

Lerneoceropsis septemramosus Fowler.

Original. Females, left figure dorsal view, middle figure ventral view and right figure lateral view. Type, from *Pomolobus pseudoharcngus* taken in the Delaware River at Tullytown, Bucks County, Pa., May 28th, 1912. H. W. Fowler.

PLATE 25.

Philorthagoriscus serratus (Kröyer).

Copied Wilson (Proc. U. S. Nat. Mus., XXXIII, 1908, Pls. 42 and 43).
Left figure dorsal view of female, right figure dorsal view of male.

PLATE 26.

Orthagoriscicola muricata (Kröyer).

Copied Wilson (Proc. U. S. Nat. Mus., XXXIII, 1908, Pls. 40 and 41).
Left figure female, right figure above male and lower right figure chalimus,
all in dorsal view.

PLATE 27.

Cecrops latreillii Leach.

Copied Wilson (Proc. U. S. Nat. Mus., XXXIII, 1908, Pls. 38 and 39).
Left figure male and right figure female, both in dorsal view.

PLATE 28.

Pandarus sinuatus Say.

Original. Female, left figure dorsal view, right figure ventral view.
From large shark taken at Point Pleasant, N. J. Witmer Stone.

PLATE 29.

Pandarus sinuatus Say.

Copied Wilson (Proc. U. S. Nat. Mus., XXXIII, 1908, Pls. 32 and 33, and
figure on p. 333). Upper left figure young female, upper right figure male,
and lower figure newly-hatched nauplius, though two posterior filaments
accidentally omitted. All shown in dorsal view.

PLATE 30.

Perissopus communis R. Rathbun.

Original. Female, right figure dorsal view, left figure ventral view. From
Eulamia milberti taken at Corson's Inlet, N. J. Summer of 1910. Dr. R. J.
Phillips.

PLATE 31.

Perissopus communis R. Rathbun.

Copied from Wilson (Proc. U. S. Nat. Mus., XXXIII, 1908, Pl. 18, and
figures on pp. 340, 342 and 343). Upper left figure male, upper right figure
chalimus, lower left figure a little larger chalimus than preceding, and lower
right figure fully developed chalimus. All shown in dorsal view.

PLATE 32.

Lepeophtheirus edwardsi C. B. Wilson.

Copied Wilson (Proc. U. S. Nat. Mus., XXVIII, 1905, Pls. 21 and 22).
Figure to left female, upper figure to right male, middle figure chalimus and
lower figure to right nauplius. All shown in dorsal view.

PLATE 33.

Ergasilus labracis Kröyer.

Copied Kröyer (Naturh. Tidssk., II, 1863, Pl. 11, fig. 2 a-c). Right figure female in lateral view and middle figure same sex in dorsal view. Left figure lower view of abdomen of male.

PLATE 34.

Cyclops serrulatus Fischer.

Original. Left figure lateral view, median figure ventral view and right figure dorsal view. Tributary of Crosswicks Creek near Trenton, N. J. August, 1912. H. W. Fowler.

PLATE 35.

Calanus finmarchicus (Gunner).

Original. Left figure dorsal view, right figure lateral view. Great Bay, N. J. July 3d, 1912. W. B. Davis and H. W. Fowler.

PLATE 36.

Argulus alosæ Gould.

Copied Wilson (Proc. U. S. Nat. Mus., XXV, 1903, Pl. 12). Left figure dorsal view of female, middle figure ventral view of female, and right figure ventral view of abdominal region of male.

PLATE 37.

Argulus trilineatus C. B. Wilson.

Original. Left figure dorsal view, right figure ventral view. From *Carassius auritus* in aquaria in Philadelphia, Pa. W. T. Innes, Jr.

PLATE 38.

Argulus versicolor C. B. Wilson.

Original. Left figure dorsal view, right figure ventral view. From *Abramis crysoleucas* taken in the Pocomoke River at Willards, Md. May, 1912. T. D. Keim and H. W. Fowler.

PLATE 39.

Lepas anserifera Linnæus.

Photograph. Four upper figures, of which upper from Smith's Island, Virginia, and the three lower detached ones from Asbury Park, N. J. All the figures on this plate reduced. Specimens alcoholic.

Conchoderma virgata (Spengler).

Photograph. Three lower figures. Of these middle parasitic on *Pennella filosa* (from a *Mola mola*) without data, others from Wood's Holl, Mass. U. S. F. Com. Specimens alcoholic.

PLATE 40.

Lepas fascicularis Ellis and Solander.

Examples from Holly Beach, N. J. Photograph. About natural size. Specimens alcoholic.

PLATE 41.

Lepas anatifera Linnæus.

Examples without data. Photograph. Slightly reduced. Specimens alcoholic.

PLATE 42.

Lepas anatifera Linnæus.

Examples from Stone Harbor, N. J. D. McCadden. Photograph. About natural size. Specimens alcoholic.

PLATE 43.

Lepas pectinata Spengler.

Three uppermost figures from Albatross Station 2314 (off east coast of United States), lower left figure from Albatross Station 2379 (Gulf of Mexico) and lower right figure from Albatross Station 4372. All about natural size. Specimens alcoholic.

PLATE 44.

Lepas anserifera Linnæus.

Fig. 1. Cherrystone, Virginia.

Fig. 3. Longitude 90° east on the equator.

Lepas fascicularis Ellis and Solander.

Fig. 2. Albatross Station 2425 (off eastern United States).

Lepas pectinata Spengler.

Fig. 4. Spinose variety from Albatross Station 2379 (Gulf of Mexico).

Figs. 5 and 6. Inflated variety, carinal and lateral views, Bering Island.

Fig. 8. Vineyard Sound.

Lepas anatifera Linnæus.

Fig. 7. Typical form, Vineyard Sound, Massachusetts.

Fig. 9. Boca Chica Key, Florida.

Fig. 10. Diagram of base of capitulum, showing umbonal tooth (t) of right scutum.

All figures on this plate copied from Pilsbry (Bull. U. S. Nat. Mus., No. 60, 1907, Pls. 8 and 9).

PLATE 45.

Balanus balanoides (Linnæus).

Photograph. Large figure from Ocean City, N. J. Two small figures from Vineyard Haven, Mass. About natural size. Specimens dried.

PLATE 46.

Balanus crenatus Bruguière.

All from Cape May, N. J. C. Le Roy Wheeler. Upper right and lower right figures show specimens growing on *Fulgur canaliculatum*, two small upper figures to left specimens on brachiopods known as *Crepidula*, large median left figure specimen of *Maetra solidissima* neatly covered, and lower left figure an example of *Polyneses duplicata* partly covered. All are considerably reduced. Specimens dried.

PLATE 47.

Balanus eburneus Gould.

Two upper figures from five miles below Port Republic, N. J. Specimens growing on oyster shells. Dr. H. A. Pilsbry.

Lower figure an old hat nearly covered with examples, and found at Sea Isle City, N. J. Clarence Test.

These figures well reduced. Specimens dried.

PLATE 48.

Chelonobia testudinaria (Linnæus).

Two lower and left figure second from top, all from Point Pleasant, N. J. Witmer Stone.

Left figure, second from bottom, without locality, received from R. Swift.

Uppermost left figure, from example obtained at Progreso, Yucatan, 1980. Academy Expedition.

Remaining upper figures, eight in number, to right, from the Pacific Ocean, North America, received from Dr. T. B. Wilson.

All these figures reduced. Specimens dried.

PLATE 49.

Coronula diadema (Linnæus).

Two lower figures, ventral views. Spitzbergen. M. Somerville.

Three upper figures, left and right show lateral views and middle dorsal view. Without locality. R. Swift.

Lower of two middle right figures, dorsal view. Pacific Ocean. J. Pierce.

Remaining three figures from examples without data, of which upper two dorsal views and lower to left ventral view.

All figures on this plate reduced. Specimens dried.

PLATE 50.

Caprella acutifrons Latreille.

Middle figure, dorsal view, copied from Paulmier (Bull. N. Y. State Mus., No. 91, June, 1905, fig. 38 on p. 168).

Figure to right, lateral view, copied from Bate (Cat. Amphipod Crust. Brit. Mus., 1862, Pl. 56, fig. 8, female).

Left figure, lateral view, copied from Bate (L. c., Pl. 56, fig. 8, male).

PLATE 51.

Cerapus tubularis Say.

Upper figure lateral view, lower figure dorsal view of an example in its tube. Copied from Say (Journ. Acad. Nat. Sci. Phila., I, 1817, Pl. 4, figs. 7-11).

PLATE 52.

Corophium cylindricum (Say).

Copied from Paulmier (Bull. N. Y. State Mus., No. 91, June, 1905, fig. 37 on p. 167).

PLATE 53.

Unciola irrorata Say.

Lower left figure dorsal view, copied from S. I. Smith (Rep. U. S. F. Com., I, 1871-2, Pl. 4, fig. 19).

Haustorius arenarius (Slabber).

Upper figure lateral view, and lower right figure dorsal view, both of female, copied from G. O. Sars (Account of Crust. Norway, I, 1895, Pl. 46).

PLATE 54.

Melita nitida S. I. Smith.

Modified from Paulmier (Bull. N. Y. State Mus., No. 91, June, 1905, fig. 31 on p. 162).

PLATE 55.

Carinogammarus mucronatus (Say).

Original. Male. Corson's Inlet, N. J. March 1st, 1909. Dr. R. J. Phillips and H. W. Fowler.

PLATE 56.

Gammarus locusta (Linnæus).

Original. Male. Parmores Island, Va. May 13th, 1911. H. W. Fowler.

PLATE 57.

Gammarus fasciatus Say.

Original. Male. Pennypack Creek at Holmesburg, Philadelphia County, Pa. Spring 1912. H. W. Fowler.

PLATE 58.

Elasmopus levis (S. I. Smith).

Modified from Paulmier (Bull. N. Y. State Mus., No. 91, June, 1905, fig. 32 on p. 163).

PLATE 59.

Ampithoe longimana (S. I. Smith).

Modified from Holmes (Bull. U. S. Bur. Fisher, XXIV, 1904, Pl. 13, fig. 2).

PLATE 60.

Ampithoe rubricata (Montagu).

Original. Male. Point Pleasant, N. J. 1888. Witmer Stone.

PLATE 61.

Orchestia agilis S. I. Smith.

Original. Male. Highland Beach, Cape May County, N. J. April 7th, 1912. H. W. Hand and H. W. Fowler.

PLATE 62.

Orchestia palustris S. I. Smith.

Original. Male. Point Pleasant, N. J. 1888. Witmer Stone.

PLATE 63.

Talitrus longicornis Say.

Original. Male. Spray Beach, Ocean County, N. J. July 4th, 1912. Bayard Long.

PLATE 64.

Talitrus megalophthalmus (Bate).

Original. Male. Seaside Park, Ocean County, N. J. July 28th, 1909. H. W. Fowler.

PLATE 65.

Talitrus megalophthalmus (Bate).

Original. Female. Highland Beach, Cape May County, N. J. April 7th, 1912. H. W. Hand and H. W. Fowler.

PLATE 66.

Scyphacella arenicola S. I. Smith.

Copied Harger (Rep. U. S. F. Com., VI, 1878, Pl. 1, fig. 2). Left figure, dorsal view.

Philoscia vittata Say.

Copied Harger (L. c., Pl. 1, fig. 1). Right figure, dorsal view.

PLATE 67.

Armadillidium vulgare (Latreille).

Original. Left figure dorsal view, right figure ventral view. Cedar Island in Choptank River near Denton, Md. April 29th, 1912. H. W. Fowler.

PLATE 68.

Armadillidium vulgare (Latreille).

Original. Upper figure lateral view, lower figure view of animal rolled into a ball. Holmesburg, Philadelphia County, Pa. Winter 1912. H. W. Fowler.

PLATE 69.

Porcellio scaber Latreille.

Original. Left figure dorsal view, middle figure lateral view and right figure ventral view. Highland Beach, Cape May County, N. J. April 7th, 1912. H. W. Hand and H. W. Fowler.

PLATE 70.

Porcellio lævis Latreille.

Original. Left figure dorsal view, middle figure lateral view, and right figure ventral view. South Somerville, N. J. September 6th, 1912. A. R. Burton and H. W. Fowler.

PLATE 71.

Oniscus asellus Linnæus.

Original. Left figure dorsal view, middle figure lateral view, and right figure ventral view. Bristol, Bucks County, Pa. September 6th, 1908. H. W. Fowler.

PLATE 72.

Asellus communis Say.

Original. Left figure dorsal view, right figure ventral view. Pennypack Creek at Holmesburg, Philadelphia County, Pa. Spring of 1912. H. W. Fowler.

PLATE 73.

Probopyrus pandalicola (Packard).

Original. Left figure ventral view, right figure dorsal view, females. Taken from gills of *Palæmonetes vulgaris* secured at Beach Haven, N. J. Dr. Joseph Leidy.

PLATE 74.

Probopyrus pandalicola (Packard).

Original. Left figure ventral view, right figure dorsal view, males. Taken from female of preceding plate, thus same data.

PLATE 75.

Probopyrus pandalicola (Packard).

Original. Showing location of parasite on gills of *Palæmonetes vulgaris*, as upper figure lateral view of host, lower left and right figures dorsal views and median lower figure ventral view. Enlarged about twice natural size.

PLATE 76.

Leidya distorta (Leidy).

Copied Leidy (Journ. Acad. Nat. Sci. Phila., III, 1855, Pl. 11, figs. 26-32). Upper figure ventral view, and lower left figure dorsal view, both females. Right figure dorsal view of male, and much magnified in proportion to others.

PLATE 77.

Erichsonella filiformis (Say).

Upper figure dorsal view, copied from Harger (Rep. U. S. F. Com., VI, 1878, Pl. 7, fig. 38).

Erichsonella attenuata (Harger).

Lower figure dorsal view, copied from Harger (L. c., Pl. 6, fig. 36).

PLATE 78.

Edotia triloba (Say).

Left figure dorsal view, copied from Harger (L. c., Pl. 7, fig. 42).

Idotea metallica Bosc.

Right figure dorsal view, copied from Harger (L. c., Pl. 6, fig. 30).

PLATE 79.

Idotea balthica (Pallas).

Original. Left figure dorsal view, middle figure lateral view, and right figure ventral view. Ocean City, N. J. June 21st, 1911. W. B. Davis and H. W. Fowler.

PLATE 80.

Chiridotea cœca (Say).

Right figure dorsal view, copied from Harger (L. c., Pl. 4, fig. 16).

Cilicæa caudata (Say).

Middle figure male, right figure female, both dorsal views. Copied H. F. Moore (Bull. U. S. F. Com., XX, pt. 2, 1902, Pl. 10, figs. 5 to 8).

PLATE 81.

Sphæroma quadridentatum Say.

Left figure dorsal view, copied from Harger (L. c., Pl. 9, fig. 53).

Ancinus depressus (Say).

Right figure dorsal view, copied from H. Richardson (Proc. U. S. Nat. Mus., XXXVI, 1909, fig. 1 on p. 175).

PLATE 82.

Cassidisca lunifrons (H. Richardson).

Original. Left figure dorsal view, right figure ventral view. Chester River banks at Chestertown, Kent County, Md. November, 1912. E. G. Vanatta.

PLATE 83.

Limnoria lignorum (Rathke).

Lower right figure dorsal view, copied from Harger (L. c., Pl. 9, fig. 55).

Ceratothoa impressa (Say).

Upper figure adult male, lower left figure adult female, both dorsal views, Copied from Schioedte and Meinert (Naturhist. Tidssk., third series, XIII, 1881-83, Pl. 12, figs. 1 to 3).

PLATE 84.

Ægathoa oculata (Say).

Original. Left figure dorsal view, middle figure lateral view, and right figure ventral view. Rehoboth Beach, Delaware. October 12th, 1910. T. D. Keim and H. W. Fowler.

PLATE 85.

Livoneca ovalis (Say).

Original. Left figure dorsal view, middle figure lateral view, and right figure ventral view. Taken from the gills of *Pomatomus saltatrix*, captured at Ocean City, N. J. September, 1908. D. McCadden and H. W. Fowler.

PLATE 86.

Olencira prægustator (Latrobe).

Original. Left figure dorsal view, middle figure lateral view, and right figure ventral view. Taken from the mouth of *Brevoortia tyrannus*, captured in the lower Patapsco River near Baltimore, Md. August, 1899. W. C. Hildermann and H. W. Fowler.

PLATE 87.

Nerocila munda Harger.

Original. Left figure dorsal view, middle figure lateral view, and right figure ventral view. From the dorsal fin of *Roccus lineatus*, taken at Ocean City, N. J. September 12th, 1910. D. McCadden.

PLATE 88.

Cirolana concharum (Stimpson).

Original. Left figure dorsal view, middle figure lateral view, and right figure ventral view. Beach Haven, N. J. Dr. Joseph Leidy.

PLATE 89.

Cyathura carinata (Kröyer).

Upper figure dorsal view, copied Harger (L. c., Pl. 1, fig. 68).

Leptocheilia savignyi (Kröyer).

Lower figure lateral view, copied Harger (L. c., Pl. 12, fig. 80).

PLATE 90.

Mysis sp.

Original. Upper figure, young, from surface tow in Great Egg Harbor Bay, N. J. F. J. Keeley.

Tanais robustus H. F. Moore.

Lower figure dorsal view, copied from H. F. Moore (Proc. Acad. Nat. Sci. Phila., 1894, Pl. 5, fig. a).

PLATE 91.

Chloridella empusa (Say).

Original. Left figure dorsal view, right figure ventral view. Cape May Point, N. J. Summer, 1911. E. R. Brown.

PLATE 92.

Penæus setiferus (Linnæus).

Original. Atlantic City, N. J. 1901. Charles Buvinger.

PLATE 93.

Crago septemspinosus (Say).

Original. Upper figure dorsal view, middle figure ventral view, and lower figure lateral view. Corson's Inlet, N. J. March 1st, 1909. Dr. R. J. Phillips and H. W. Fowler.

PLATE 94.

Palæmonetes vulgaris (Say).

Original. Figures as preceding. Corson's Inlet, N. J. April 3d, 1910. Dr. R. J. Phillips and H. W. Fowler.

PLATE 95.

Virbius pleuracanthus Stimpson.

Upper figure, copied S. I. Smith (Rep. U. S. F. Com., I, 1871-72, Pl. 3, fig. 11).

Chloridella empusa (Say).

Lower figure copied S. I. Smith (L. c., Pl. 8, fig. 36), larva.

PLATE 96.

Homarus americanus Milne-Edwards.

Dorsal view, copied Goode (Nat. Hist. Aquat. An., 1884, Pl. 96).

PLATE 97.

Homarus americanus Milne-Edwards.

Upper figure adult female red lobster and lower figure adult male lobster. Copied Herrick (Bull. U. S. F. Com., XV, 1895, Pl. 16).

PLATE 98.

Homarus americanus Milne-Edwards.

Upper left figure first larva in dorsal view, upper right figure first larva in lateral view, lower left figure second larval stage in lateral view, and lower right figure third larval stage in lateral view. All copied from Herrick (L. c., Pls. 19 to 22).

PLATE 99.

Homarus americanus Milne-Edwards.

Upper figure sixth stage in dorsal view, middle figure sixth stage in lateral view, and lower figure immature, about one year old. All from Herrick (L. c., Pls. 37 to 39).

PLATE 100.

Cambarus bartonii (Fabricius).

Original. Left figure dorsal view, right figure ventral view, of male. Fairmount Park, Philadelphia, Pa. August 20th, 1910. H. L. Mather, Jr.

PLATE 101.

Cambarus bartonii (Fabricius).

Same data as preceding, except representing female.

PLATE 102.

Cambarus diogenes Girard.

Original. Left figure dorsal view, right figure ventral view, of male. Baden, Pa. Dr. A. E. Ortmann.

PLATE 103.

Cambarus diogenes Girard.

Original. Left figure dorsal view, right figure ventral view, of female. Denton, Md. April, 1912. H. W. Fowler.

PLATE 104.

Cambarus limosus (Rafinesque).

Original. Left figure dorsal view, right figure ventral view. Male. Tullytown, Bucks County, Pa. May 17th, 1912. H. W. Fowler.

PLATE 105.

Cambarus limosus (Rafinesque).

Original. Left figure dorsal view, right figure ventral view. Female. Pitman, N. J. October 1st, 1910. H. L. Mather, Jr. and H. W. Fowler.

PLATE 106.

Cambarus blandingii (Harlan).

Original. Left figure dorsal view, right figure ventral view. Male. Medford Mills, N. J. June 5th, 1903. S. N. Rhoads.

PLATE 107.

Cambarus blandingii (Harlan).

Same data as preceding, except representing female.

PLATE 108.

Upogebia affinis (Say).

Original. Upper figure male, lower female with eggs, both in lateral view. Corson's Inlet, N. J. August 21st, 1912. Dr. R. J. Phillips.

PLATE 109.

Emerita talpoida (Say).

Original. Left figure dorsal view, right figure ventral view. Spray Beach, Ocean County, N. J. September 15th, 1912. Bayard Long.

PLATE 110.

Emerita talpoida (Say).

Stages of young, copied from S. I. Smith (Trans. Conn. Acad. Sci., III, 1879, Pl. 45, figs. 1-5).

Fig. 1. Zoea in second stage, ventral view.

Fig. 2. Zoea in last stage, dorsal view.

Fig. 3. Same as 2, but in ventral view.

Fig. 4. Same as 2, but in lateral view.

Fig. 5. Megalops just changed from last zoea stage.

PLATE 111.

Pagurus pollicaris Say.

Original. Left figure dorsal view, right figure ventral view. Cape May, N. J. 1892. Dr. H. C. Chapman.

PLATE 112.

Pagurus longicarpus Say.

Original. Left figure dorsal view, right figure ventral view. Dias Creek Beach, Cape May County, N. J. May 28th, 1911. H. W. Fowler.

PLATE 113.

Hyas coarctatus Leach.

Original. Upper figure dorsal view, lower ventral view. Male. Mt. Desert, Maine. Dr. H. C. Chapman.

PLATE 114.

Libinia dubia Milne-Edwards.

Original. Male. Upper figure dorsal view, lower ventral view. Beesley's Point, N. J.

PLATE 115.

Libinia emarginata Leach.

Original. Male. Upper figure dorsal view, lower ventral view. Cape May Point, N. J. Summer of 1911. E. R. Brown.

PLATE 116.

Calappa flammea (Herbst).

Original. Young male. Upper figure dorsal view, lower ventral view. Corson's Inlet, N. J. May 16th, 1912. Dr. R. J. Phillips.

PLATE 117.

Eurypanopeus depressus (S. I. Smith).

Original. Male. Upper figure dorsal view, lower ventral view. Great Bay, N. J. July 3d, 1912. W. B. Davis and H. W. Fowler.

PLATE 118.

Eurypanopeus depressus (S. I. Smith).

Female, otherwise same data as preceding.

PLATE 119.

Rhithropanopeus harrisii (Gould).

Original. Male. Upper figure dorsal view, lower figure ventral view. Elk Neck, Cecil County, Md. June 5th, 1911. H. W. Fowler.

PLATE 120.

Rhithropanopeus harrisii (Gould).

Female, otherwise with same data as preceding.

PLATE 121.

Neopanope texana sayi (S. I. Smith).

Original. Male. Upper figure dorsal view, lower ventral view. Spray Beach, Ocean County, N. J. June 16th, 1912. Bayard Long.

PLATE 122.

Eupanopeus herbstii (Milne-Edwards).

Original. Male. Upper figure dorsal view, lower ventral view. Bcesley's Point, N. J. S. Ashmead.

PLATE 123.

Eupanopeus herbstii (Milne-Edwards).

Female, data otherwise as preceding.

PLATE 124.

Eurytium limosum (Say).

Original. Male. Upper figure dorsal view, lower ventral view. New Jersey. Thomas Say.

PLATE 125.

Carcinides mænas (Linnæus).

Original. Male. Upper figure dorsal view, lower ventral view. Atlantic City, N. J. 1892. Dr. H. C. Chapman.

PLATE 126.

Carcinides mænas (Linnæus).

Original. Female. Upper figure dorsal view, lower figure ventral view. Townsend's Inlet, N. J. Dr. B. Sharp.

PLATE 127.

Arenæus cribrarius (Lamarek).

Original. Male. Upper figure dorsal view, lower figure ventral view. Ocean City, N. J. Summer 1908. H. W. Fowler.

PLATE 128.

Callinectes sapidus M. J. Rathbun.

Original. Male. Upper figure dorsal view, lower figure ventral view. Atlantic City, N. J. John Cassin.

PLATE 129.

Callinectes sapidus M. J. Rathbun.

Original. Female. Upper figure dorsal view, lower figure ventral view. Atlantic City, N. J. A. B. Crossdale.

PLATE 130.

Callinectes sapidus M. J. Rathbun.

Upper figure zoea stage, copied from S. I. Smith (Rep. U. S. F. Com., I, 1871-72, Pl. 8, fig. 37).

Lower figure megalops stage, copied from S. I. Smith (L. c., Pl. 8, fig. 37a).

PLATE 131.

Ovalipes ocellatus (Herbst).

Original. Male. Upper figure dorsal view, lower ventral view. Ocean City, N. J. August, 1908. H. W. Fowler.

PLATE 132.

Ovalipes ocellatus (Herbst).

Original. Female. Upper figure dorsal view, lower ventral view. Cape May Point, N. J. Summer, 1911. E. R. Brown.

PLATE 133.

Cancer borealis Stimpson.

Original. Male. Upper figure dorsal view, lower ventral view. Point Judith, R. I. Dr. Joseph Leidy.

PLATE 134.

Cancer irroratus Say.

Original. Male. Upper figure dorsal view, lower ventral view. Mt. Desert, Maine. Dr. H. C. Chapman.

PLATE 135.

Cancer irroratus Say.

Original. Female. Upper figure dorsal view, lower ventral view. Atlantic City Inlet, N. J. 1892. Dr. H. C. Chapman.

PLATE 136.

Pinnotheres maculatus Say.

Original. Male. Upper figure dorsal view, lower ventral view. New Jersey.

PLATE 137.

Pinnotheres maculatus Say.

Original. Female. Upper figure dorsal view, lower ventral view. Sea Isle City, N. J.

PLATE 138.

Pinnotheres ostreum Say.

Original. Female. Upper figure dorsal view, lower ventral view. Taken from oyster from Delaware Bay, December 13th, 1911. H. W. Fowler.

PLATE 139.

Sesarma reticulatum (Say).

Original. Male. Upper figure dorsal view, lower ventral view. Cape May, N. J. H. L. Viereck.

PLATE 140.

Planes minutus (Linnæus).

Original. Male. Upper figure dorsal view, lower ventral view. Cape May, N. J. September 20th, 1904. H. L. Viereck.

PLATE 141.

Planes minutus (Linnæus).

Female, otherwise same data as preceding.

PLATE 142.

Uca pugilator (Bosc).

Original. Male. Upper figure dorsal view, lower ventral view. Cape May, N. J. 1903. H. L. Viereck.

PLATE 143.

Uca pugilator (Bosc).

Female, otherwise same data as preceding.

PLATE 144.

Uca minax (Le Conte).

Original. Male. Upper figure dorsal view, lower ventral view. State Road, Delaware. June, 1912. H. W. Fowler.

PLATE 145.

Uca minax (Le Conte).

Female, otherwise same data as preceding.

PLATE 146.

Uca pugnax (S. I. Smith).

Original. Male. Same data as plate 142.

PLATE 147.

Uca pugnax (S. I. Smith).

Original. Female. Same data as plate 142.

PLATE 148.

Ocypode albicans (Bosc).

Original. Male in dorsal view. Atlantic City, N. J. J. A. G. Rehn.

PLATE 149.

Ocypode albicans (Bosc).

Original. Female. Upper figure dorsal view, lower ventral view. Cedar Island, Accomac County, Va. May, 1911. H. W. Fowler.

PLATE 150.

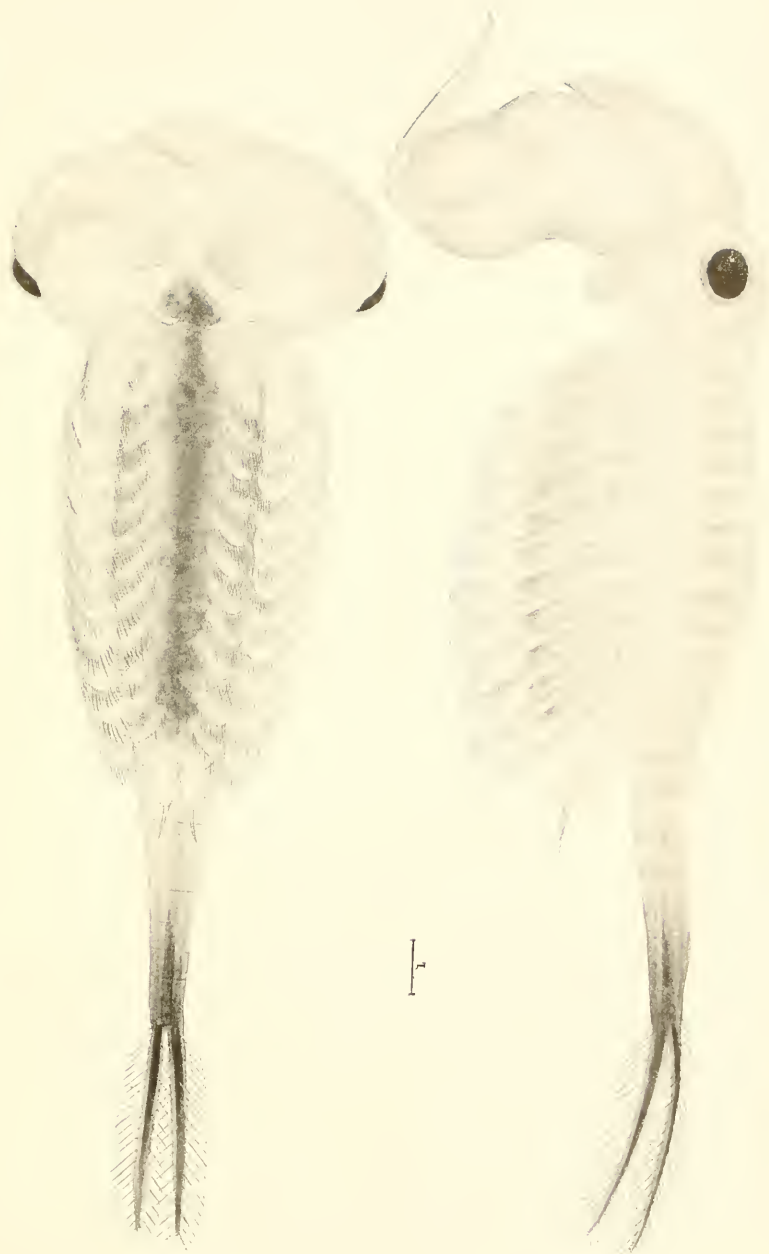
This plate was sketched in 1889 by Mr. Witmer Stone, to illustrate the Crustacea of Point Pleasant, N. J.

- Fig. 1. *Pandarus sinuatus* Say.
- Fig. 2. *Idotea metallica* Bosc.
- Fig. 3. *Idotea balthica* (Pallas).
- Fig. 4. *Unciola irrorata* Say.
- Fig. 5. *Gammarus locusta* (Linnæus).
- Fig. 6. *Carinogammarus mucronatus* (Say).
- Fig. 7. *Talitrus megalophthalmus* (Bate).
- Fig. 8. *Talitrus longicornis* Say.
- Fig. 9. *Haustorius arenarius* (Slabber).
- Fig. 10. *Lepas fascicularis* Ellis and Solander.
- Fig. 11. *Balanus balanoides* (Linnæus).
- Fig. 12. *Balanus eburneus* Gould.

ERRATA TO LEGENDS ON PLATES.

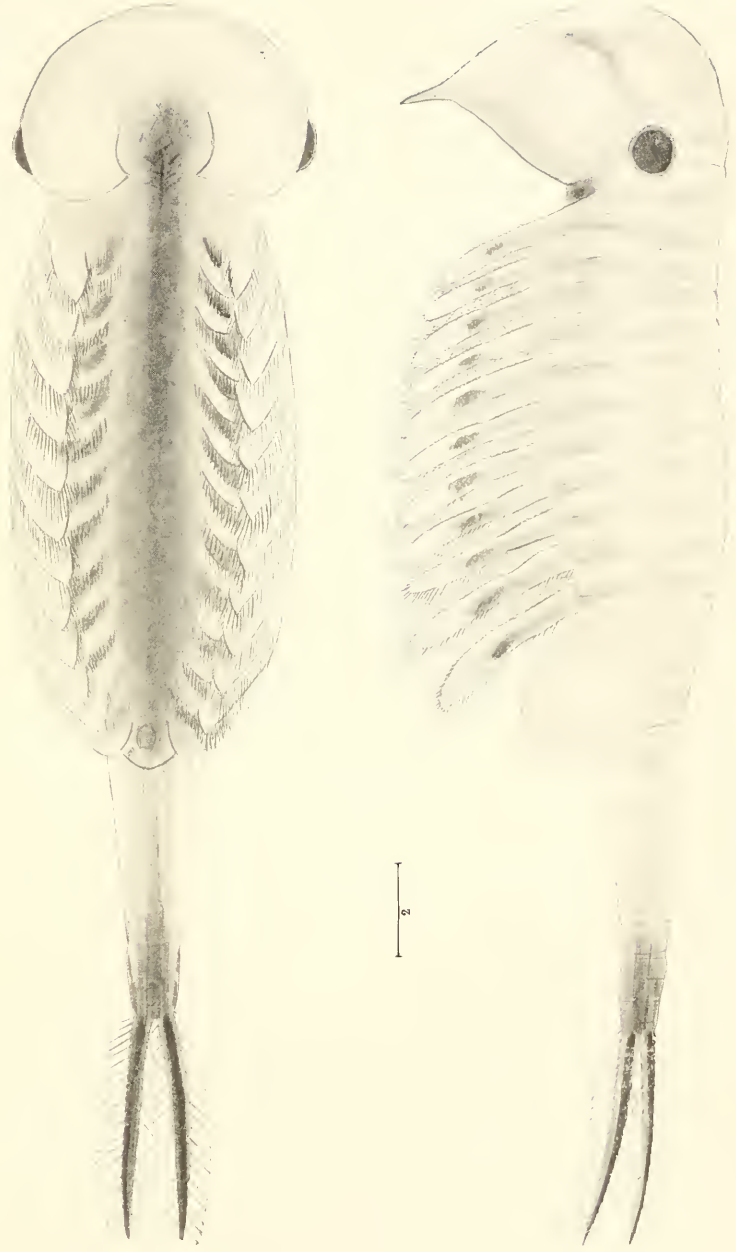
- Plate 1. Read *Eubbranchipus*.
- Plate 10. Read *Scapholeberis mucronata* (Müller).
- Plate 15. Read *Spirocypris passaica* Sharpe.
- Plate 32. Read *Lepeophtheirus*.
- Plate 35. Read *Calanus*.
- Plate 40, Plate 44, figure 2, and Plate 150, figure 10. Read *Lepas fascicularis* Ellis and Solander.
- Plate 58. Read *Elasmopus levis* (S. I. Smith).
- Plate 60. Read (Montagu).
- Plate 61. Read *Orchestia agilis* S. I. Smith.
- Plate 62. Read *Orchestia palustris* S. I. Smith.
- Plate 73. Line indicating scale should read 5.
- Plate 81. Read *Ancinus depressus* (Say).
- Plate 101. Read (Fabricius).
- Plate 127. Read *Arenæus cribrarius* (Lamareck).
- Plate 150. Figure 3 should read *Idotea balthica* (Pallas). Figure 5 should read *Gammarus locusta* (Linnæus).

PLATES.

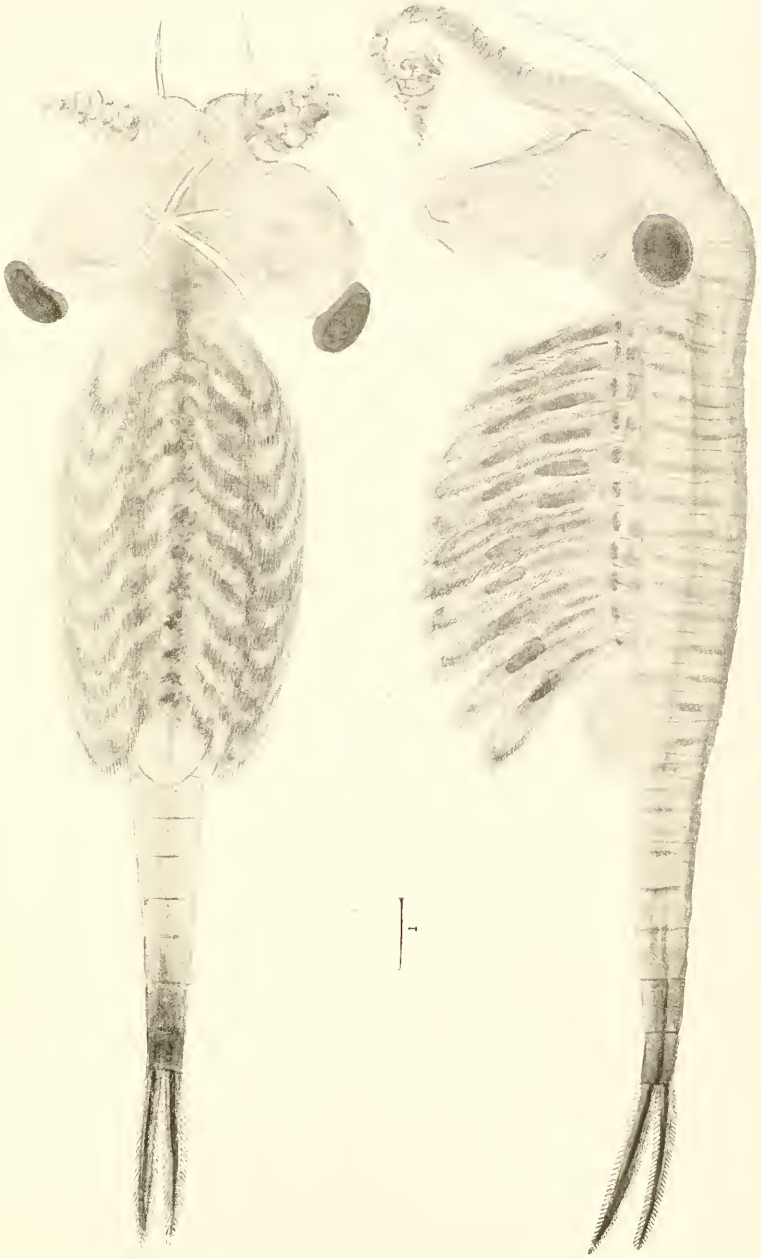


FAIRY SHRIMP. *Eubranchipus vernalis* (Verrill). (Male.)

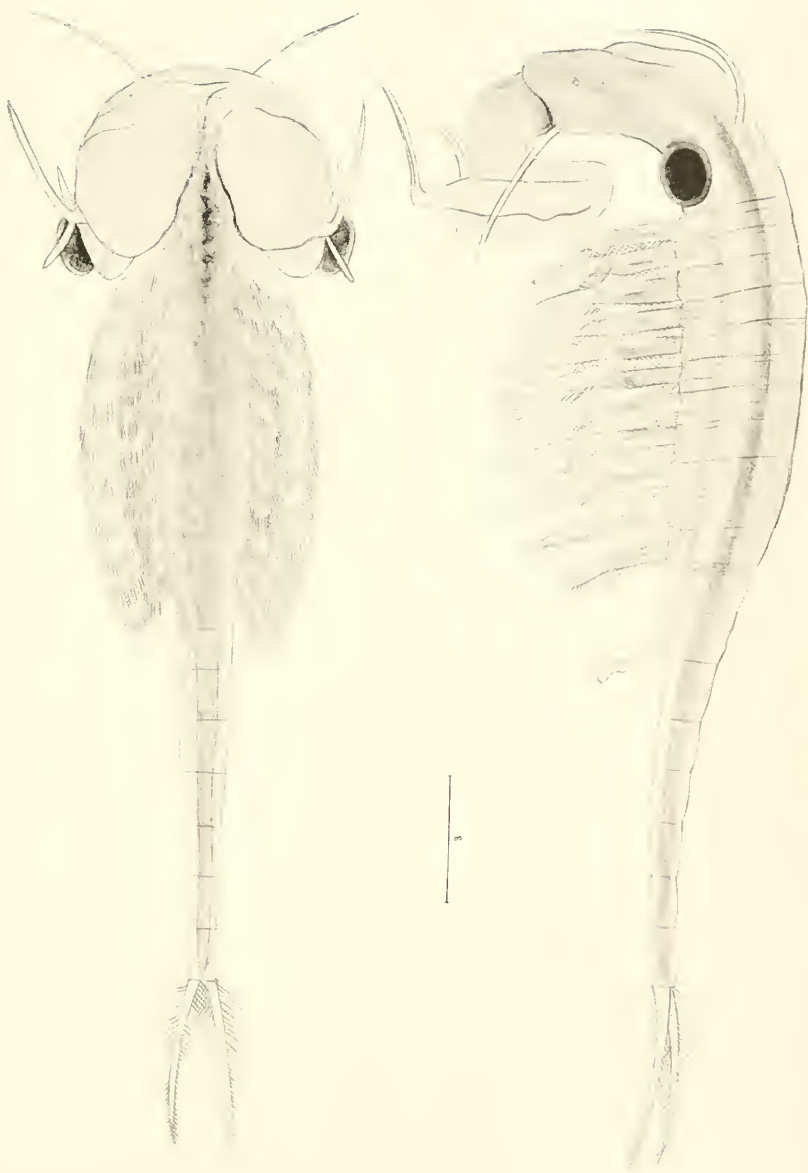
PLATE 2.



FAIRY SHRIMP. *Eubranchipus vernalis* (Verrill). (Female.)



Green Fairy Shrimp. *Ino holmanii* (Ryder). (Male.)



Streptocephalus sealii Ryder. (Male.)

PLATE 5.



3



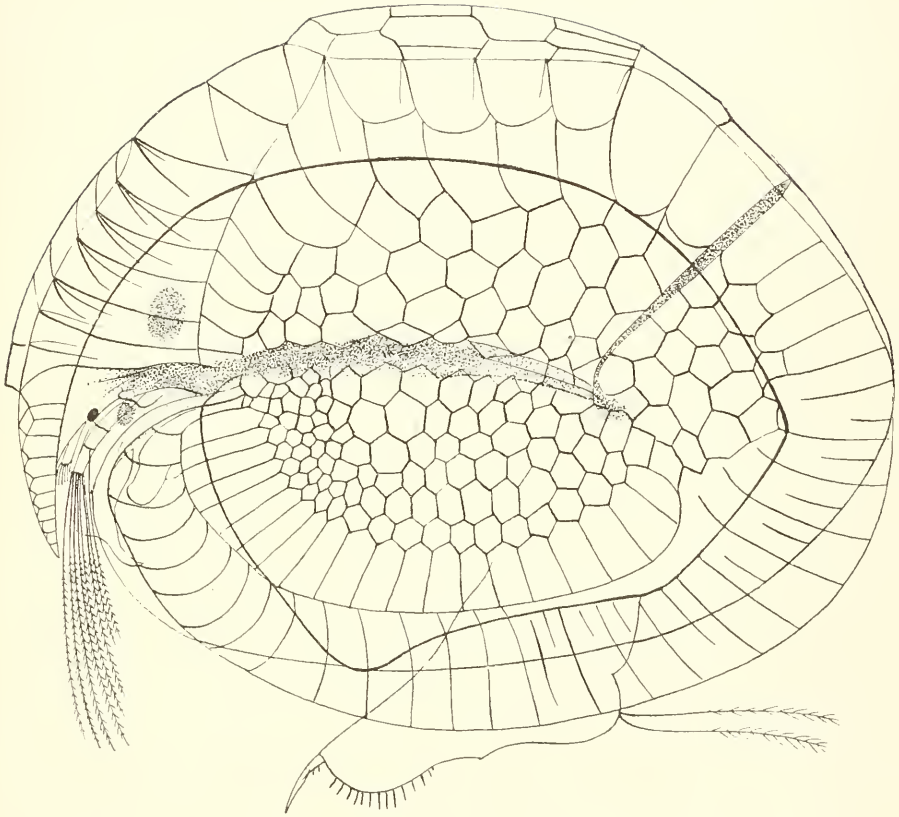
Streptocephalus sealii Ryder. (Female.)



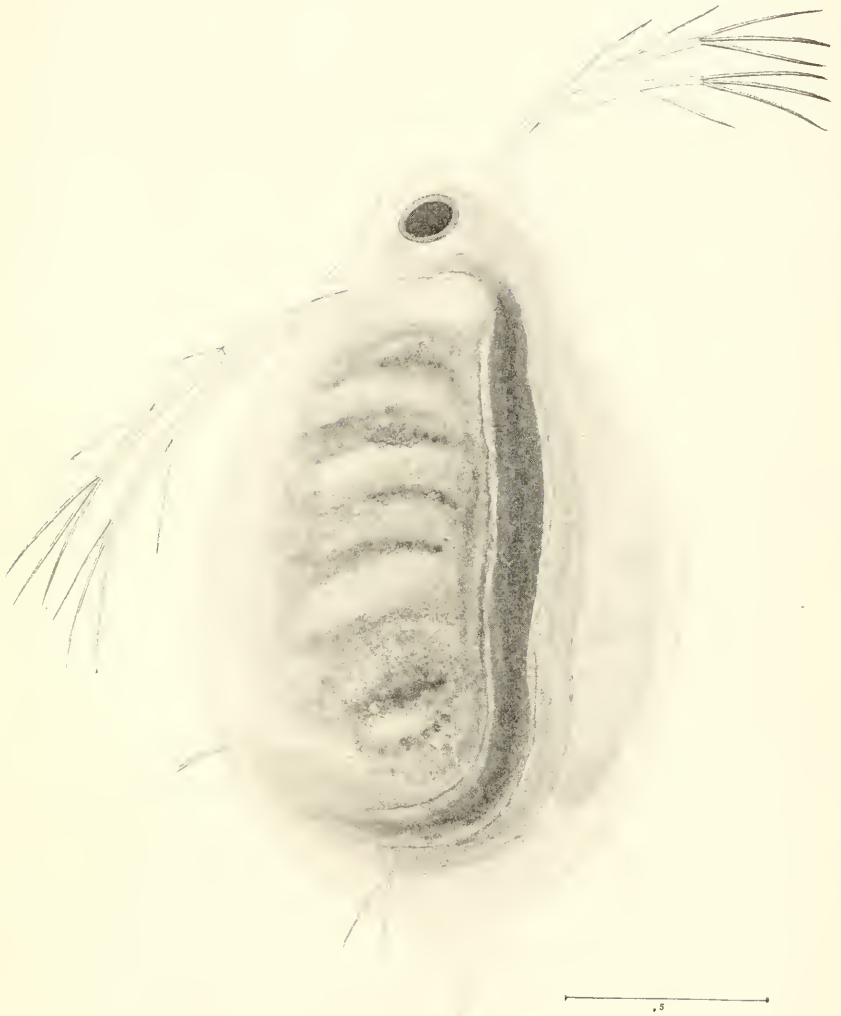
Eurycercus lamellatus (Müller).



Chydorus sphaericus (Müller).



Chydorus bicornutus Doolittle.



DAPHNIA. *Daphne pulex* (Linnæus).



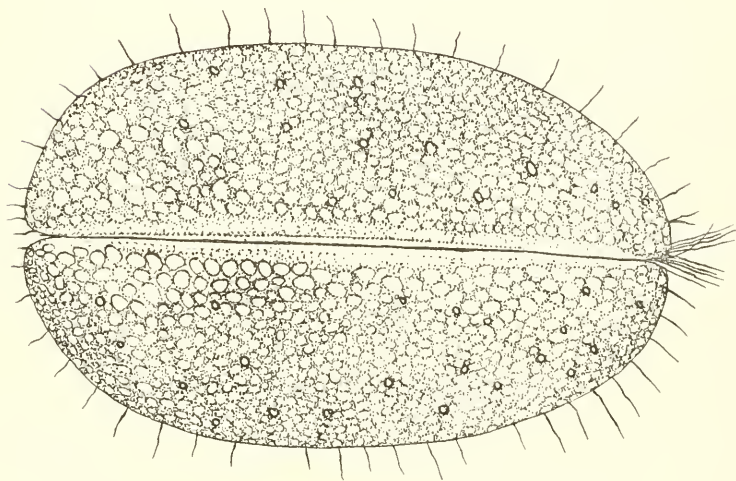
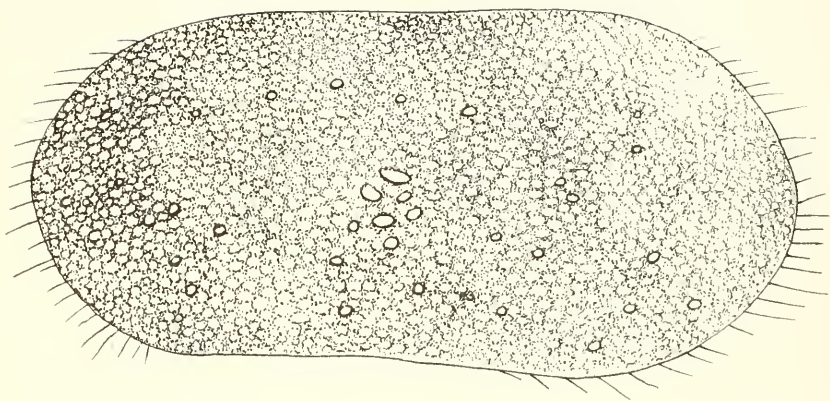
Scapholeberis mucronata Müller.



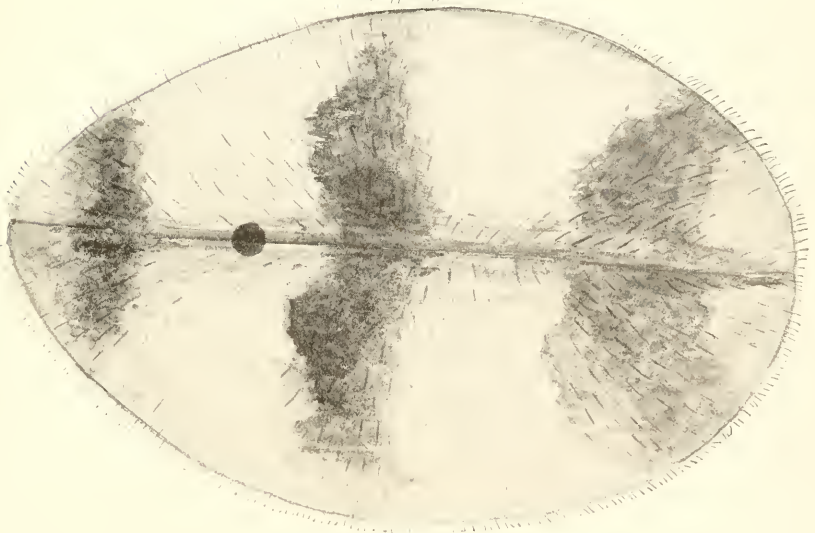
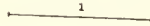
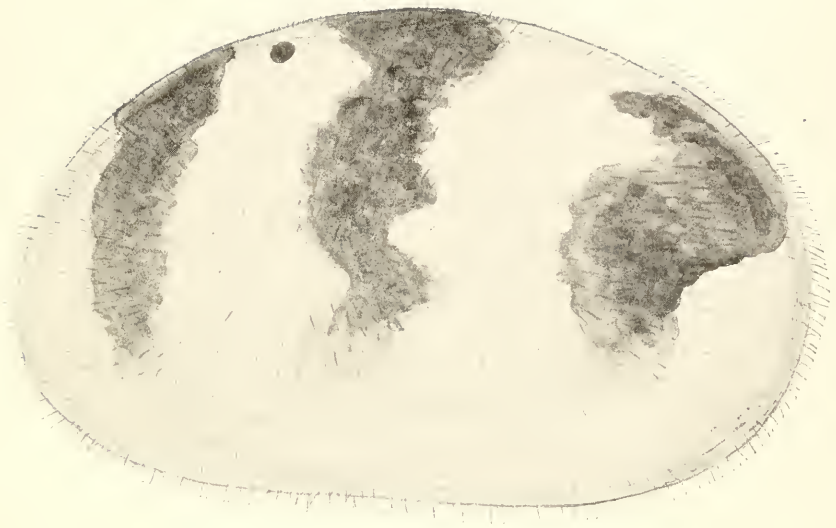
Scapholeberis armata Herrick.



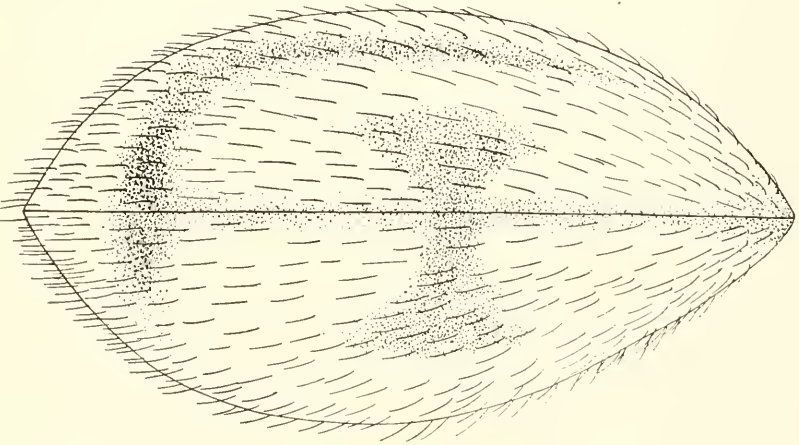
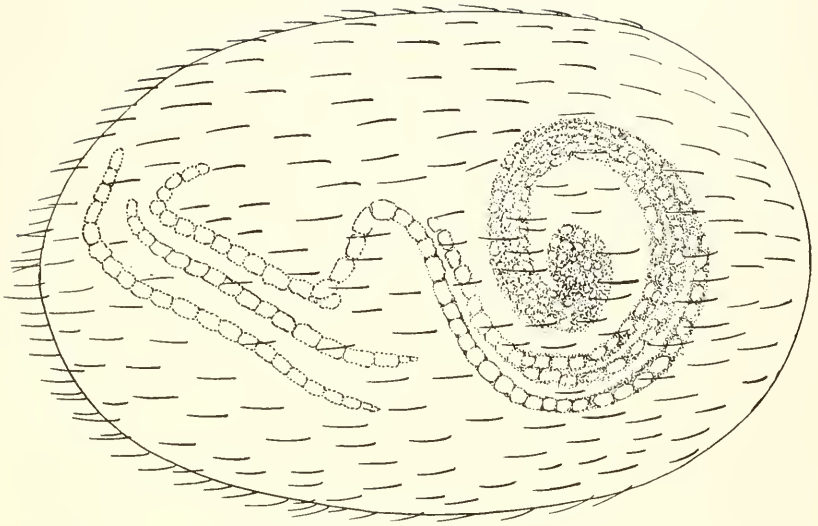
Sida crystallina (Müller).



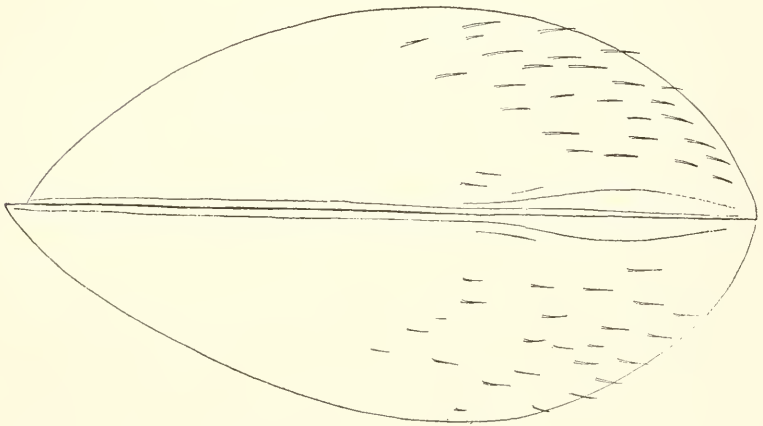
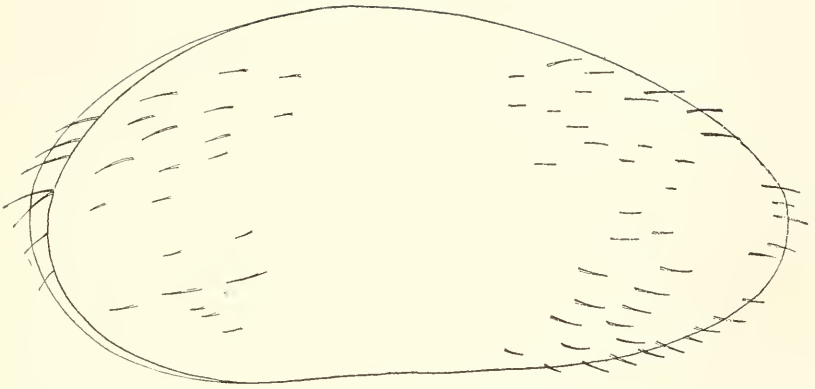
Paracandona euplectella (Brady and Norman).



Cypridopsis vidua (Müller).



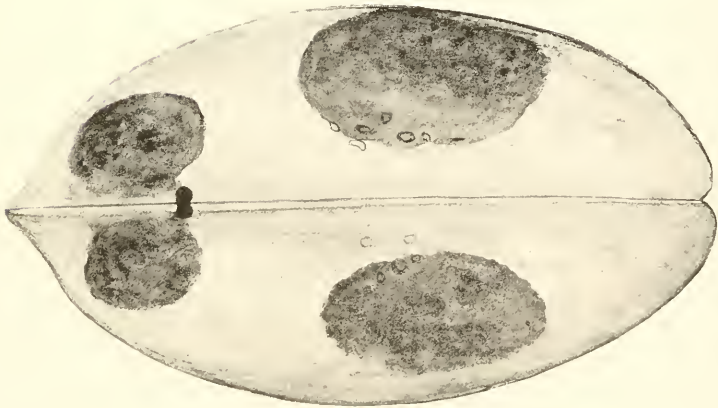
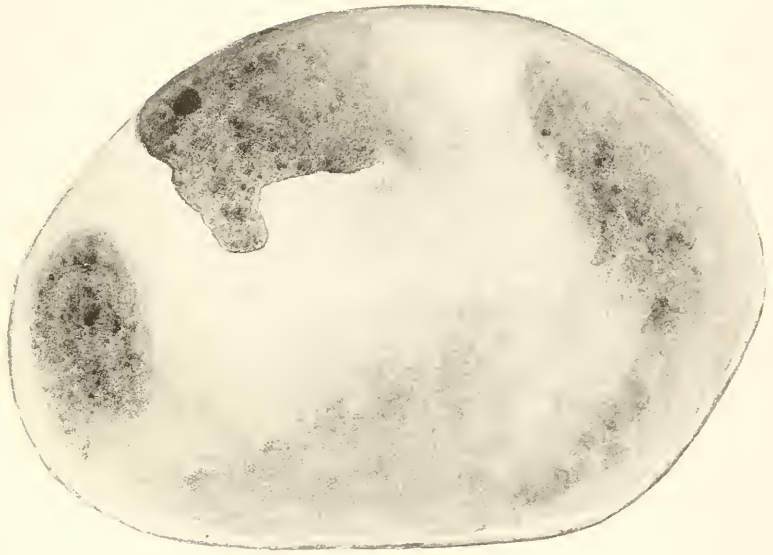
Spirocypris passaica (Sharpe).



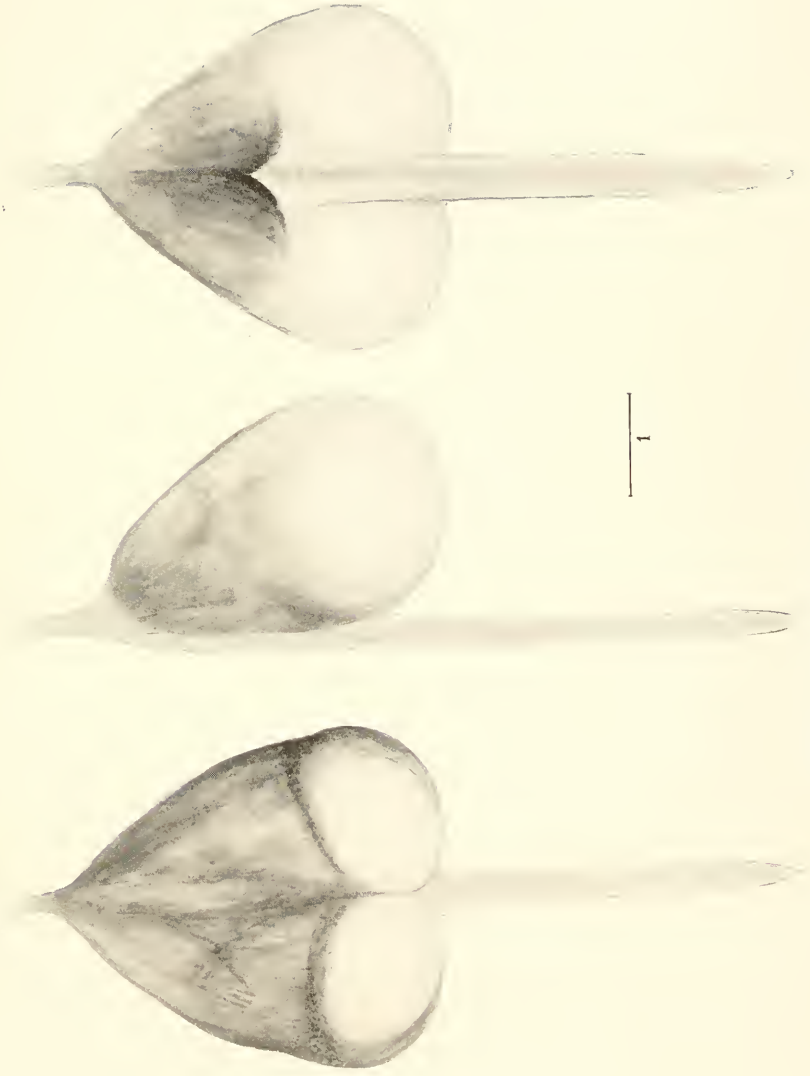
Cypris reticulata Zaddach.

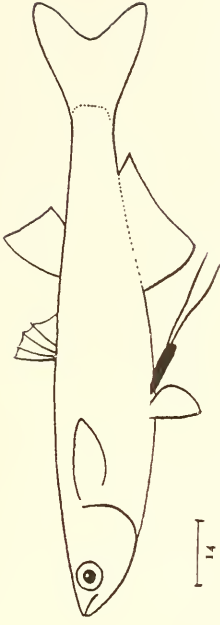


Cyclocypris lævis (Müller).

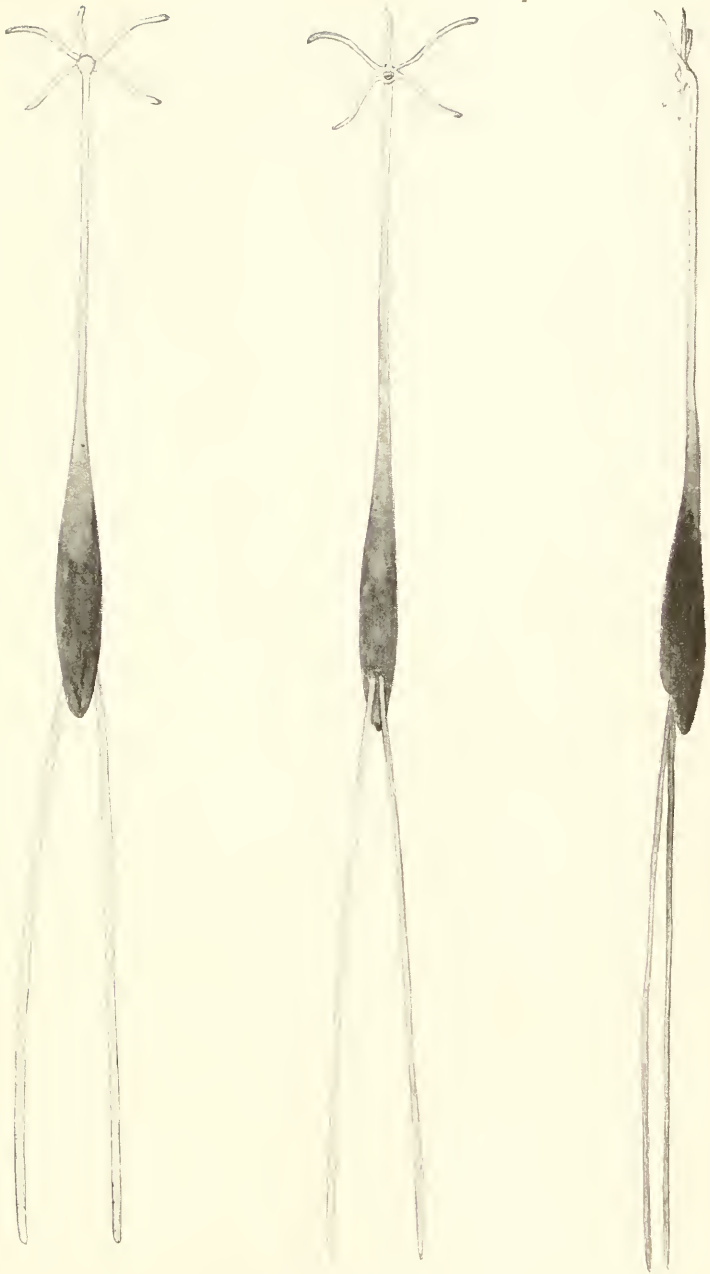


Cypria dentifera Sharpe.





Lernean parasites on Fishes.

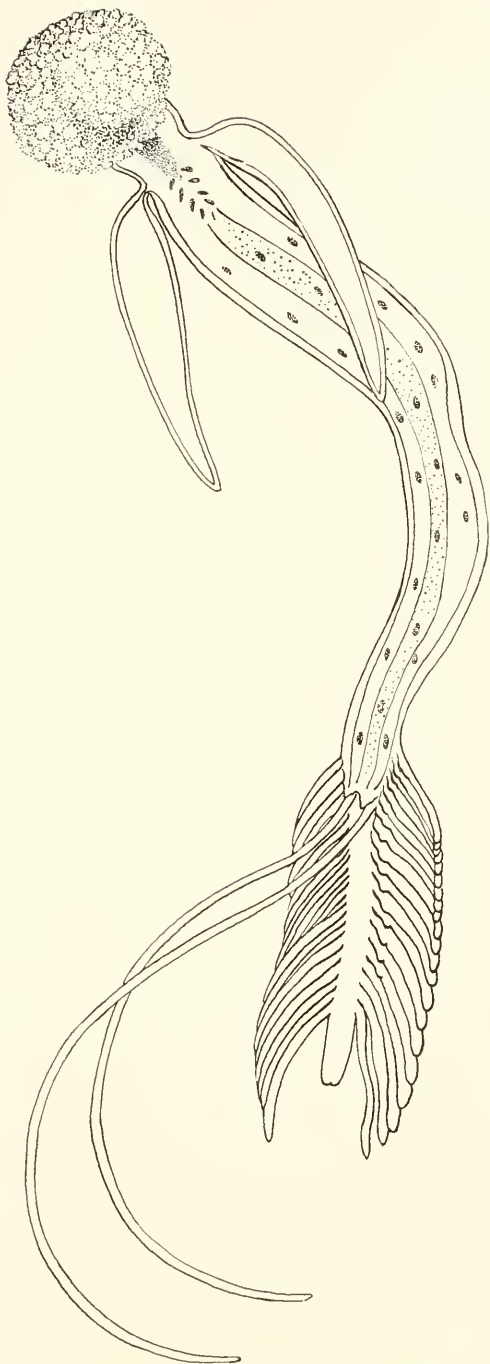


10

Lerneænicus radiatus (Le Sueur). (Female.)



Pennella filosa (Linnæus). (Female.)

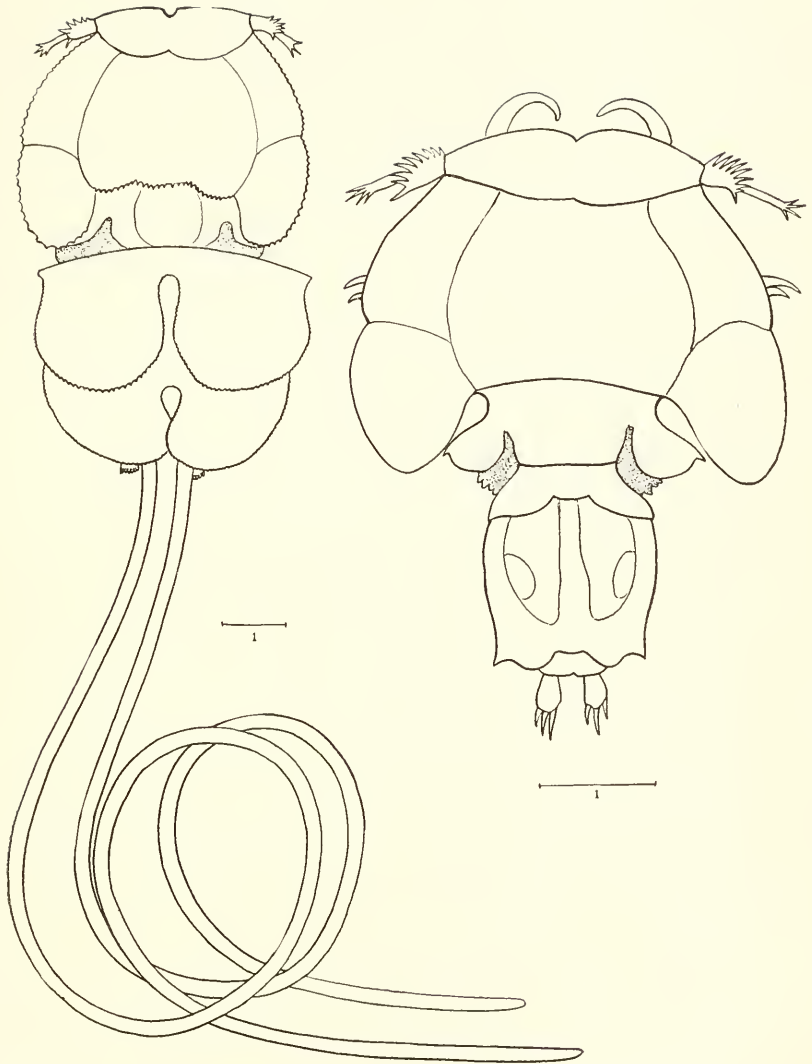


Pennella sagitta (Linnæus). (Female.)

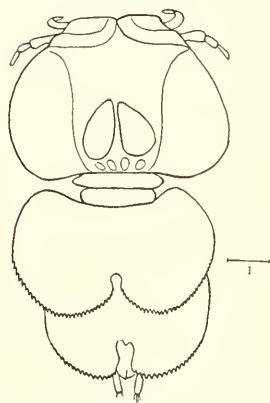
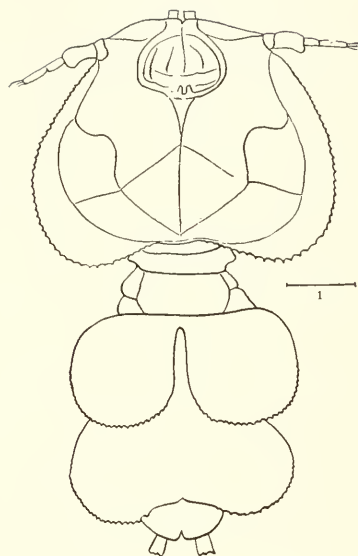
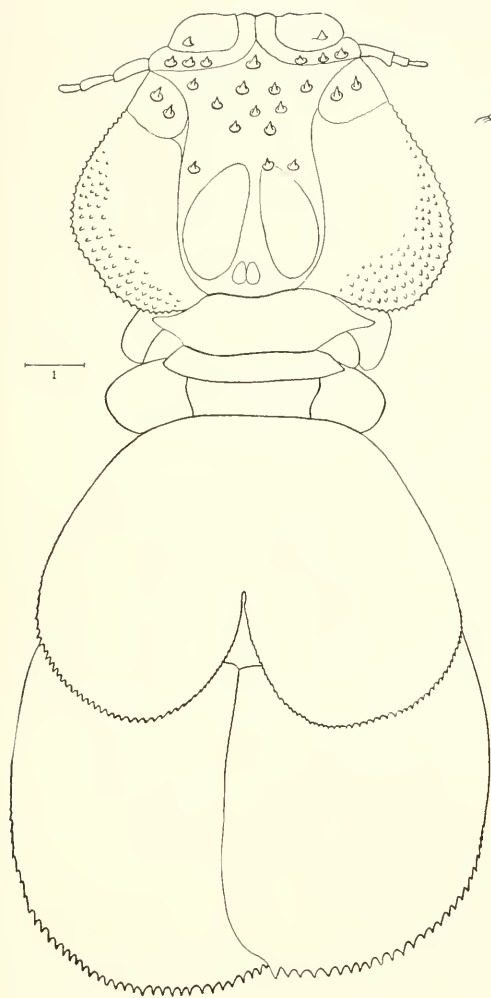


10

Lerneocropsis septemramosus Fowler. (Female.)

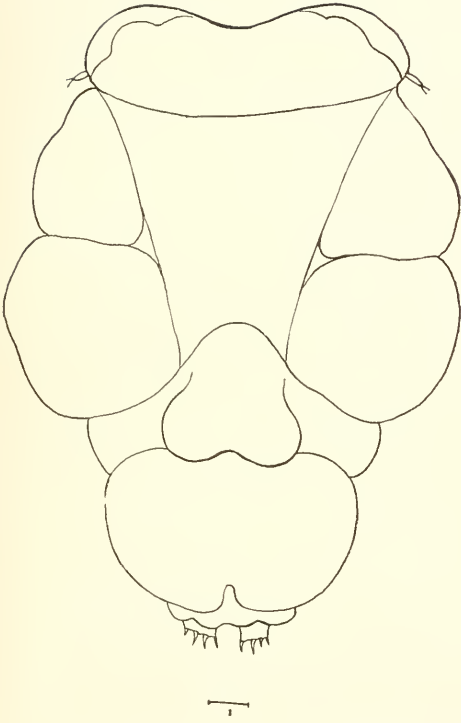


Philorthragoriscus serratus (Kröyer).
 (Female.) (Male.)

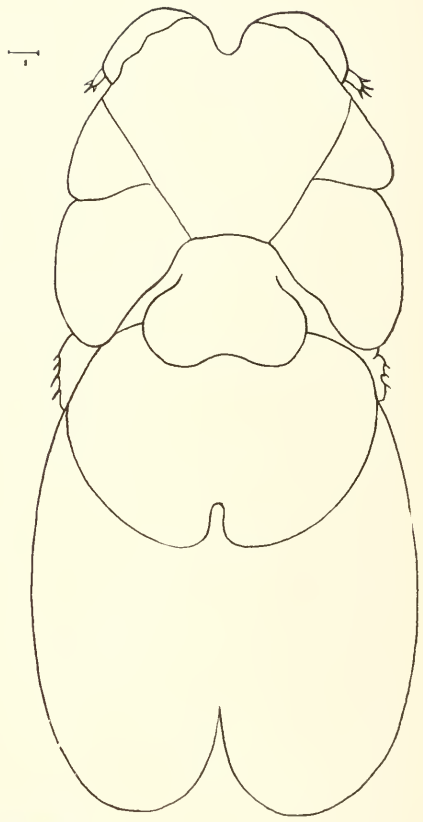


Orthogoriscicola muricata (Kröyer).
(Female.)

(Male.)
(Chalimus.)

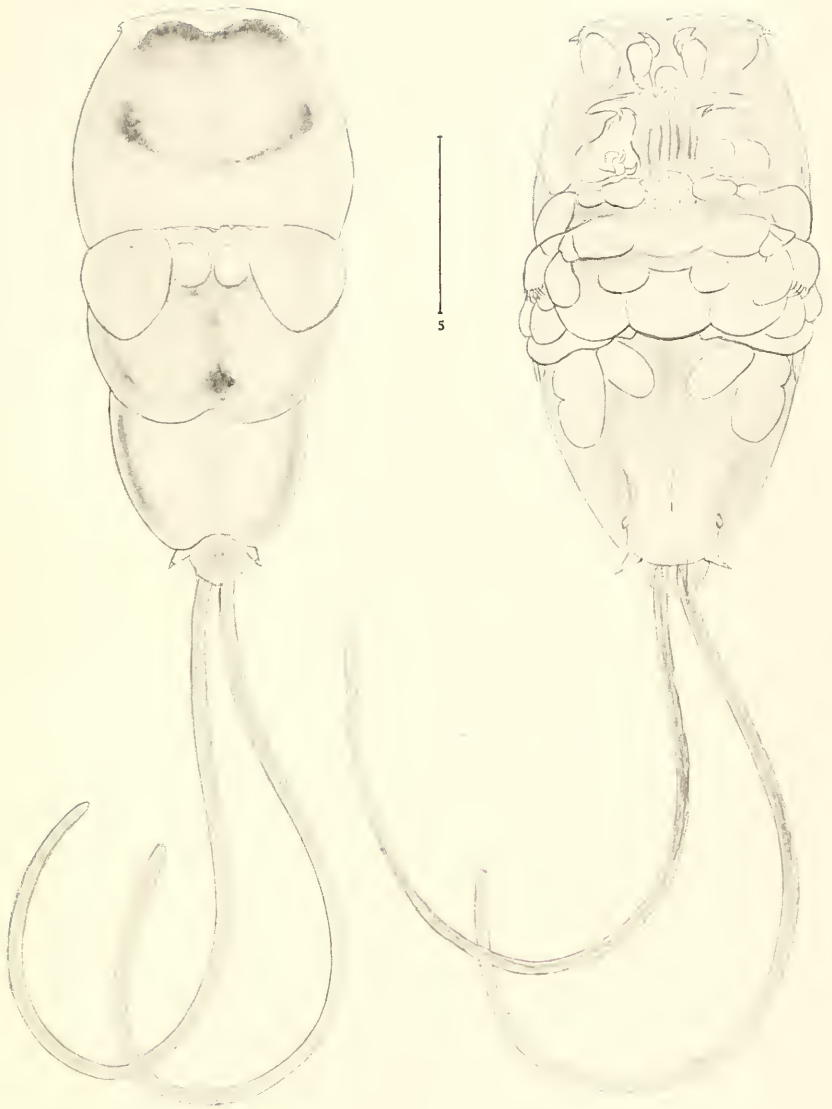


(Male.)

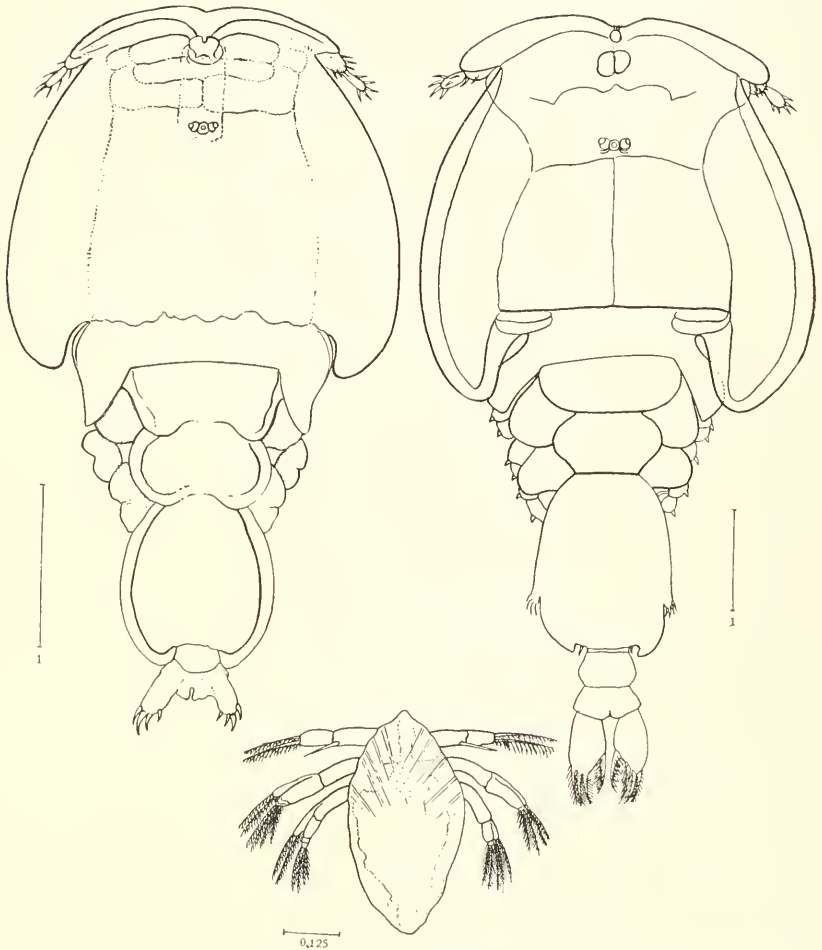


(Female.)

Cecrops latreillii Leach.



Pandarus sinuatus Say. (Female.)

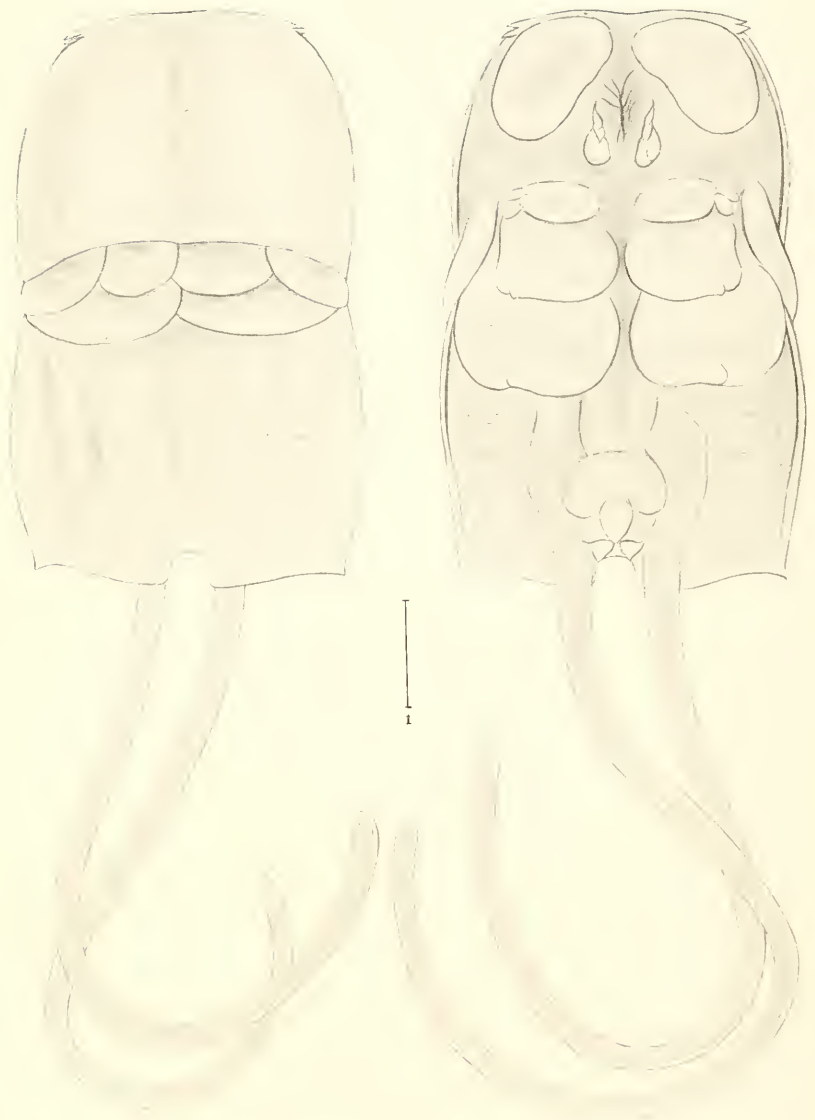


Pandarus sinuatus Say.

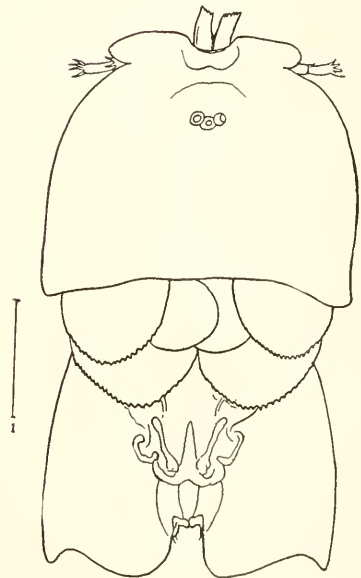
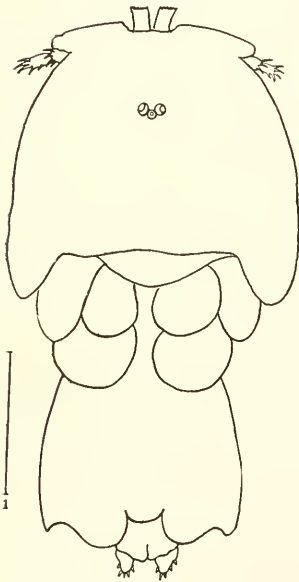
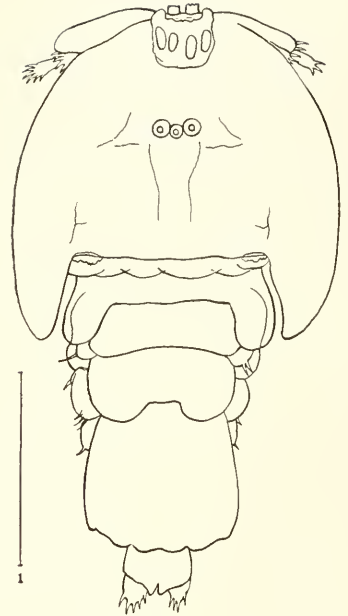
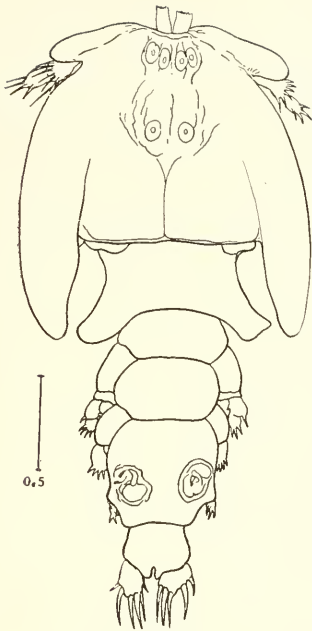
(Young female.)

(Male.)

(Nauplius, posterior filaments omitted.)



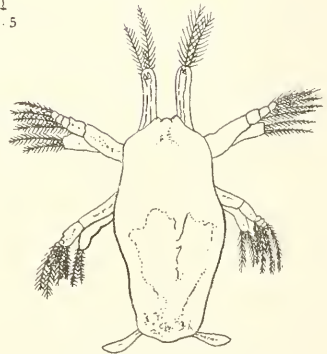
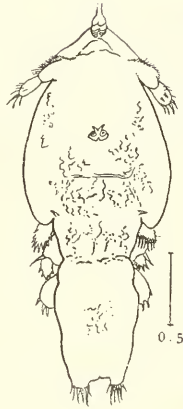
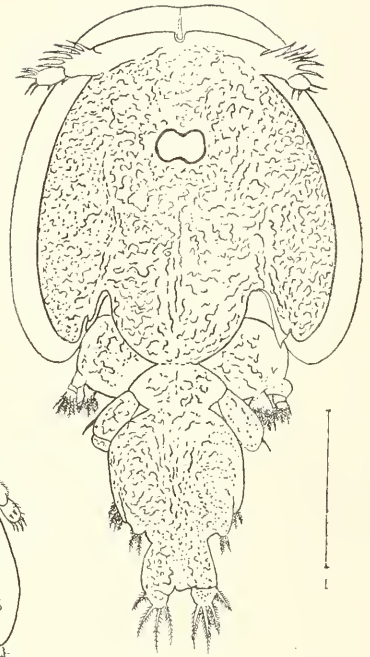
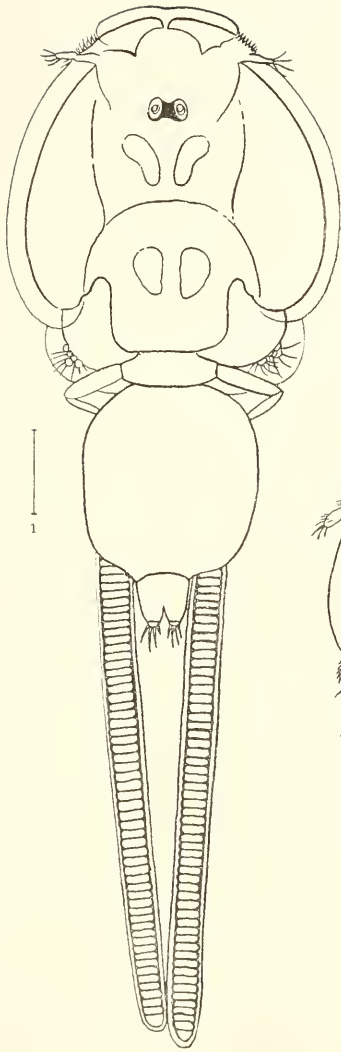
Perissopus communis R. Rathbun. (Female.)



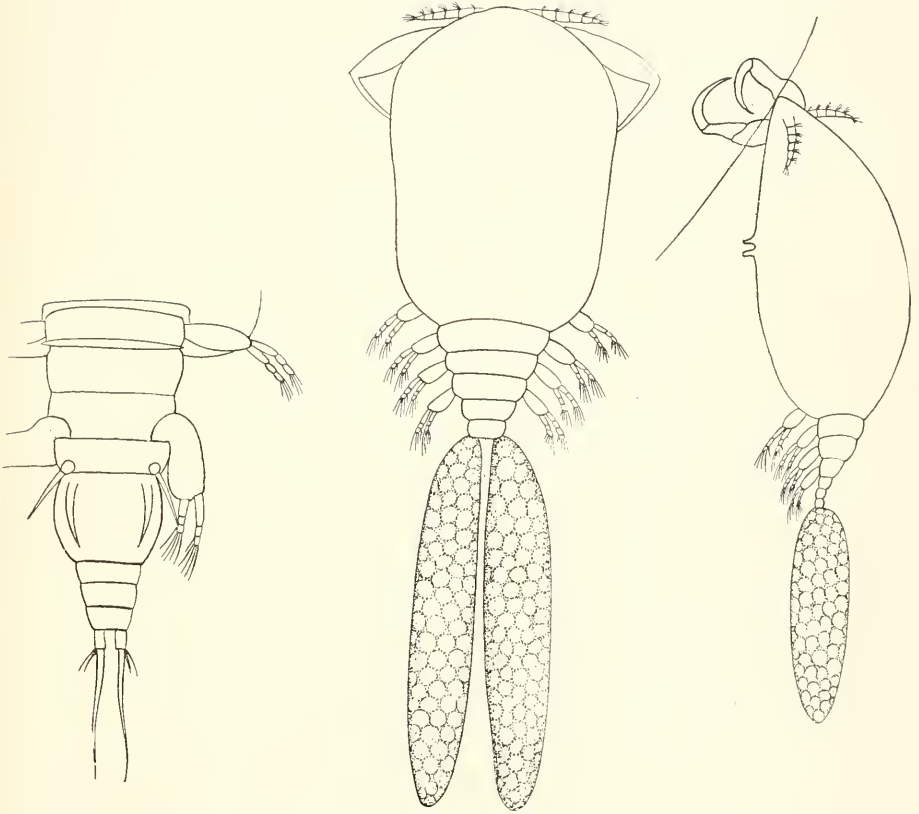
Perissopus communis R. Rathbun.

(Male.)
(Chalimus.)

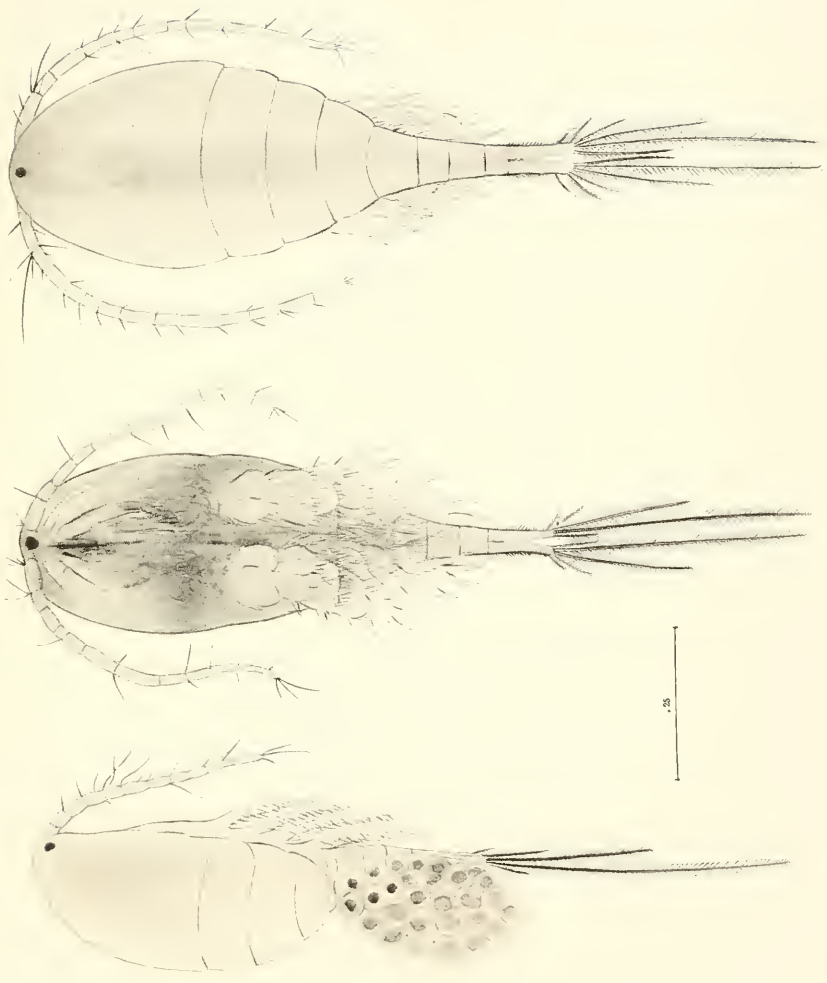
(Chalimus.)
(Chalimus fully developed.)



Lepeiophtheirus edwardsi C. B. Wilson.
 (Female.) (Male.)
 (Chalimus.) (Nauplius.)



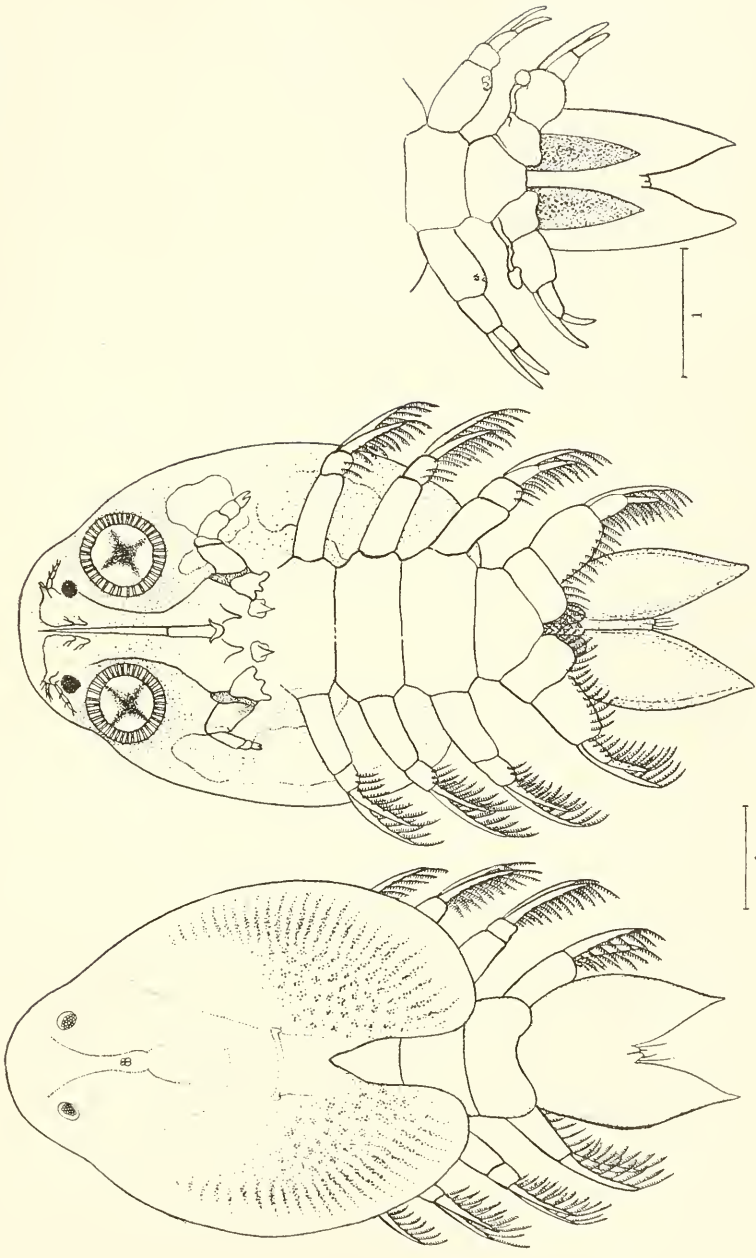
Ergasilus labracis Kröyer.
(Females.)



Cyclops serrulatus Fischer.



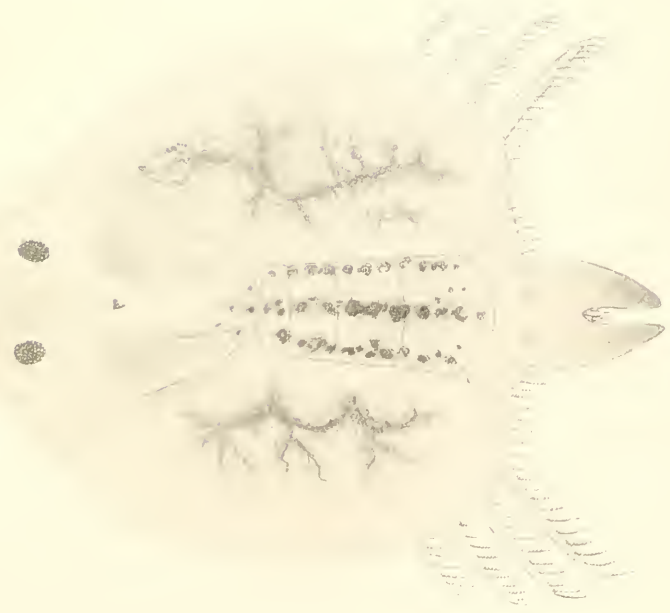
BRIT. *Calamus finmarchicus* (Gunner).



HERRING LOUSE. *Argulus aloose* Gould.
(Female above and below, and lower half of male.)



1



1

GOLDFISH LOUSE. *Argulus trilineatus* C. B. Wilson.



1

PIKE LOUSE. *Argulus versicolor* C. B. Wilson.



Lepas anserifera Linnæus. (Four upper figures.)
Conchoderma virgata (Spengler). (Three lower figures.)



Lepas fascicularis Ellis and Solander.



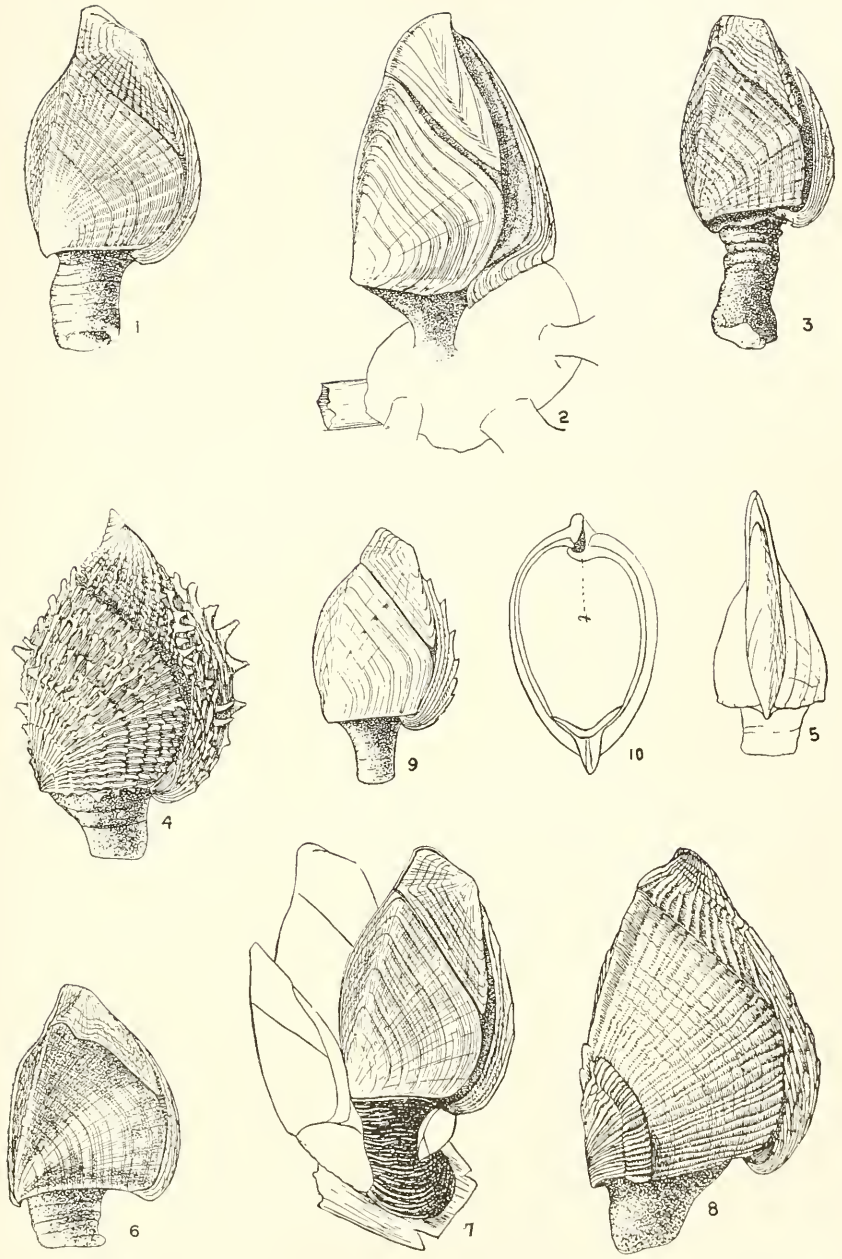
GOOSE BARNACLES. *Lepas anatifera* Linnæus.



Lepas anatifera Linnæus.



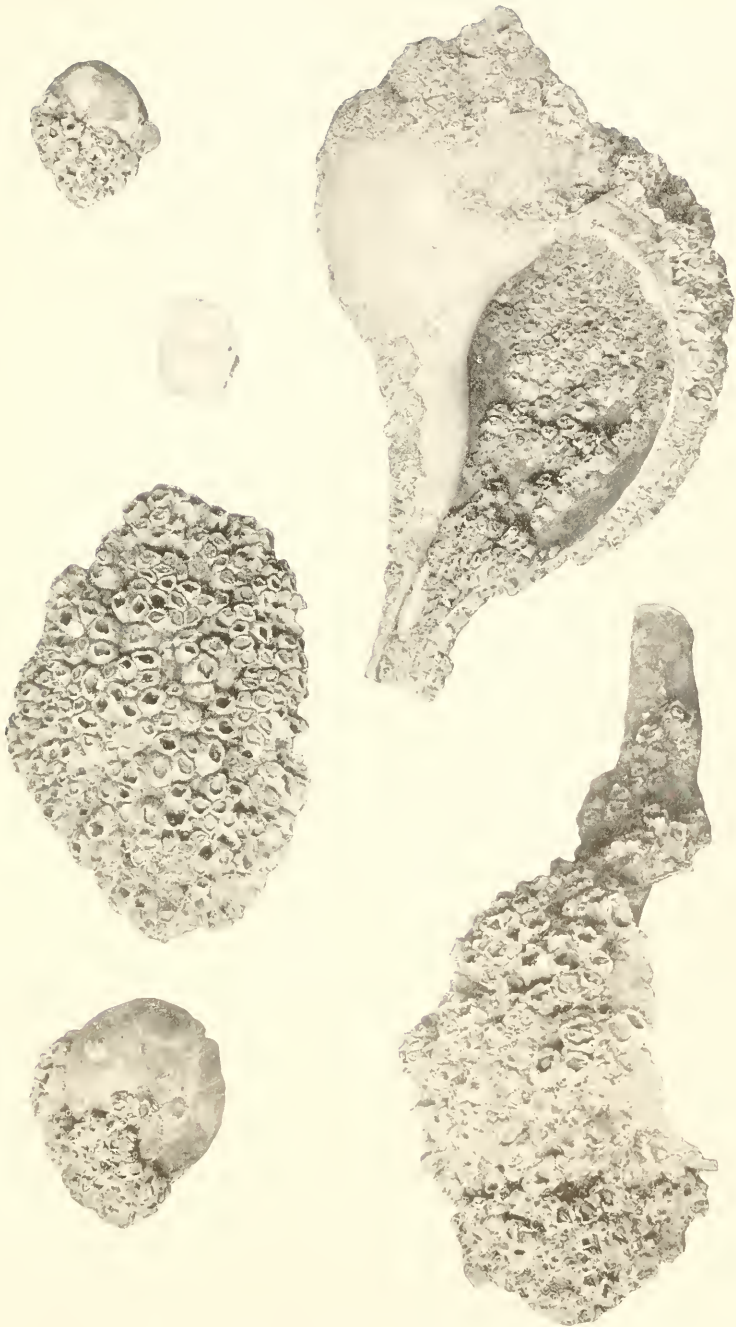
Lepas pectinata Spengler.



1, 3 *Lepas anserifera* Linnæus. 4, 5, 6, 8 *Lepas pectinata* Spengler.
 2 *Lepas fascicularis* Ellis and Solander. 7, 9, 10 *Lepas anatifera* Linnæus.



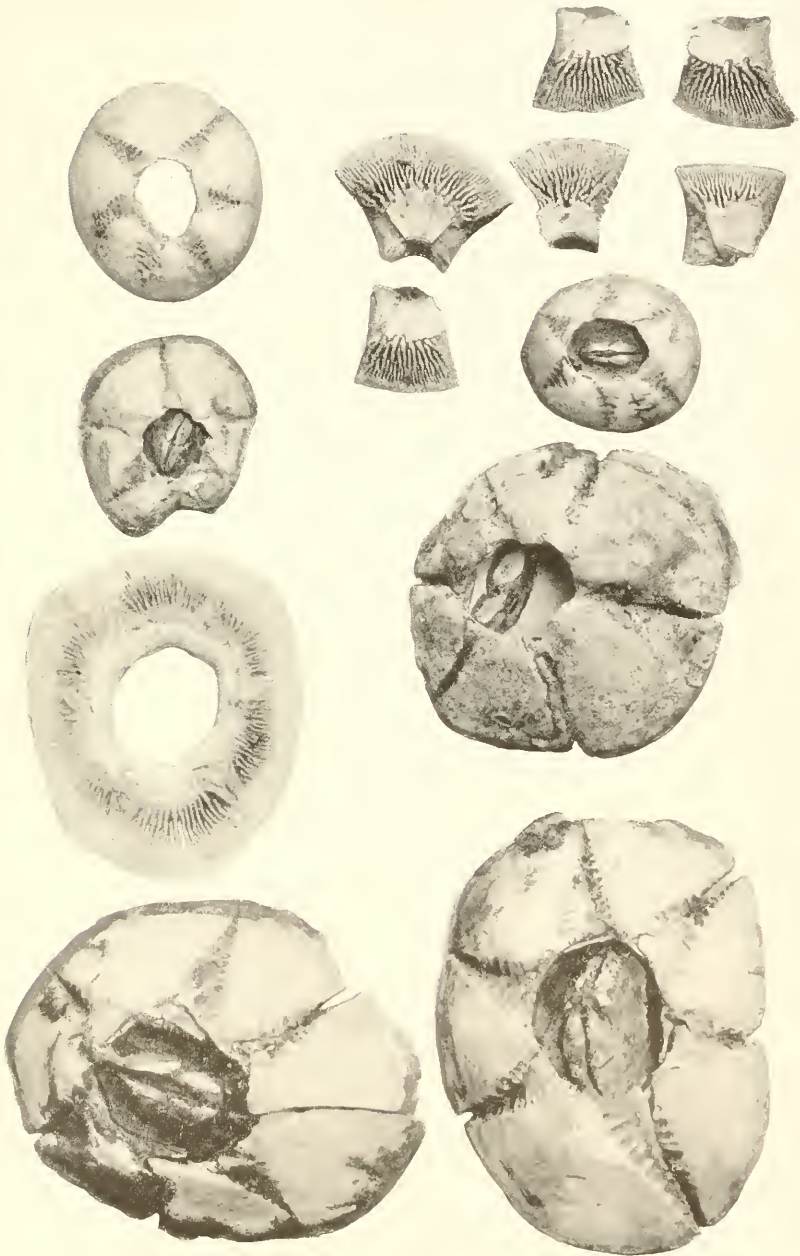
ROCK BARNACLES. *Balanus balanoides* (Linnæus).



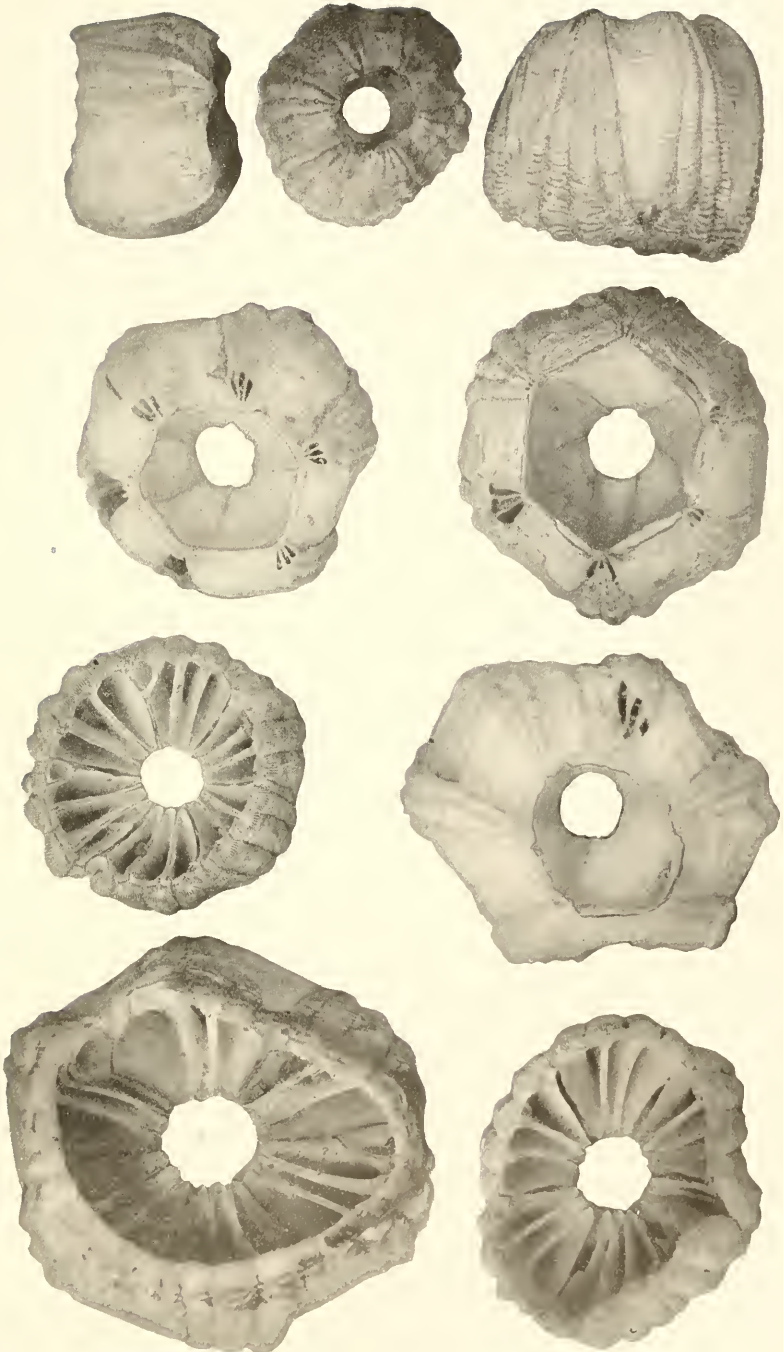
Balanus crenatus Bruguère.



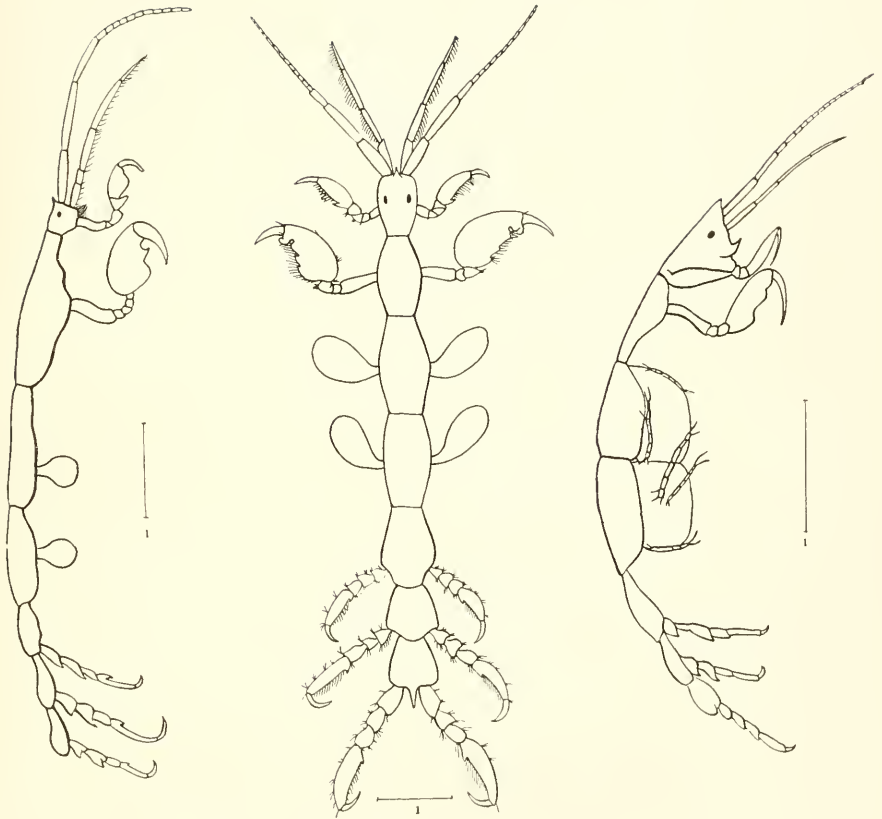
IVORY BARNACLES. *Balanus eburneus* Gould.



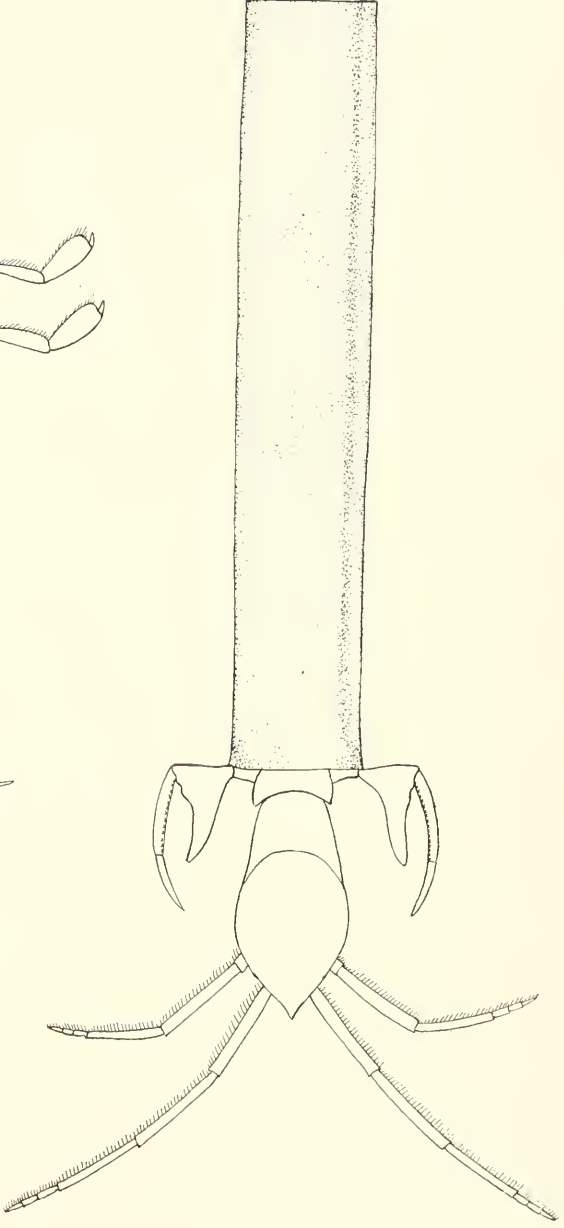
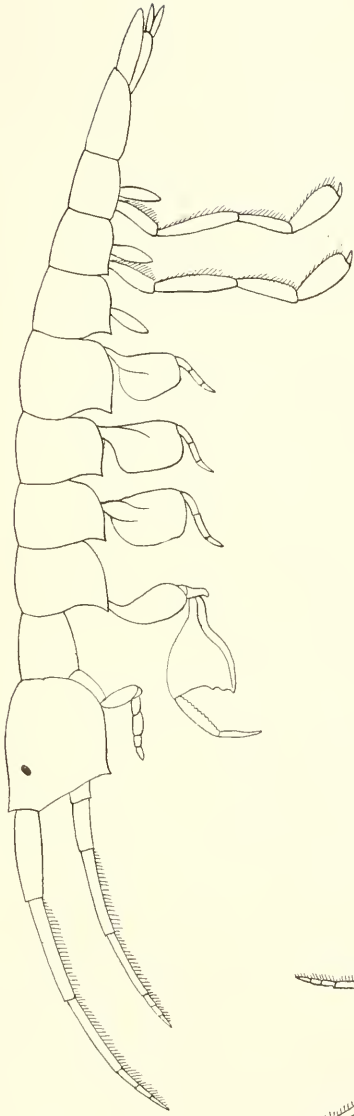
TURTLE BARNACLES. *Chelonobia testudinaria* (Linnæus).



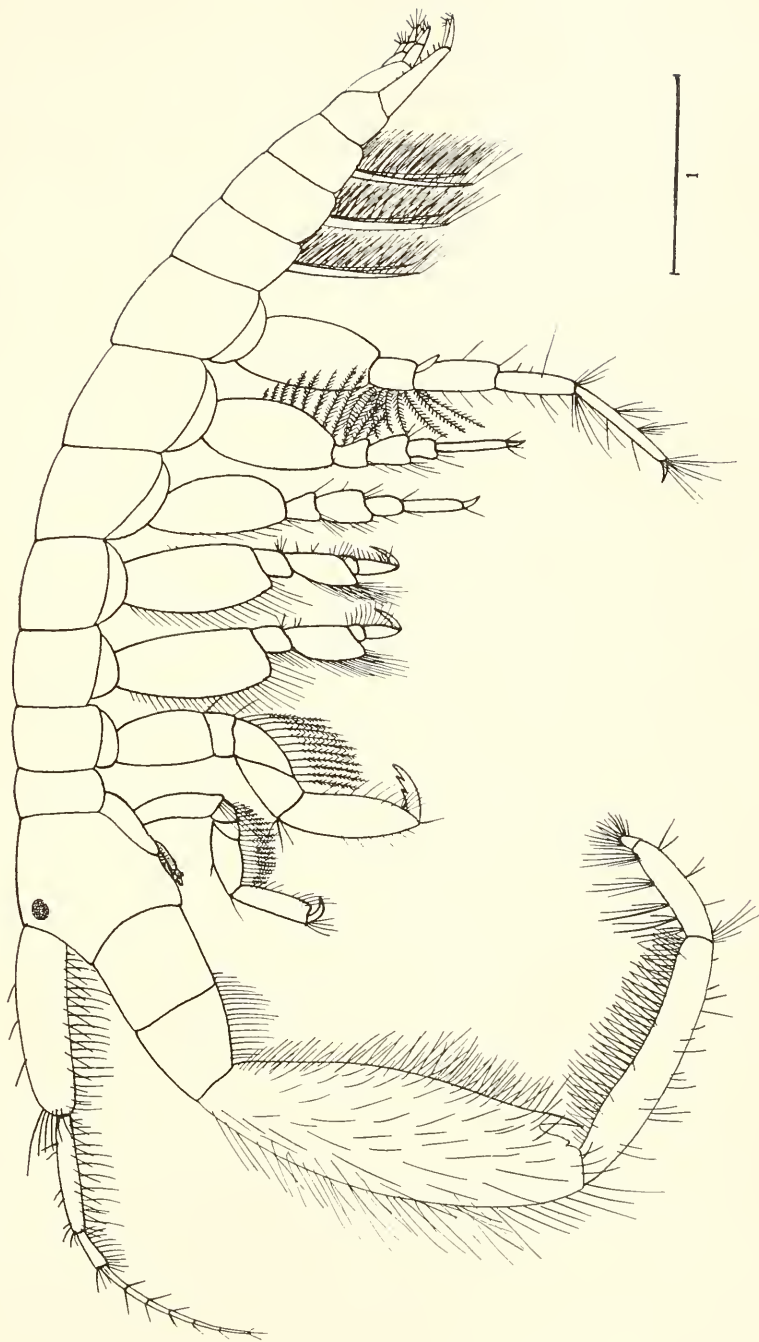
WHALE BARNACLES. *Coronula diadema* (Linnæus).



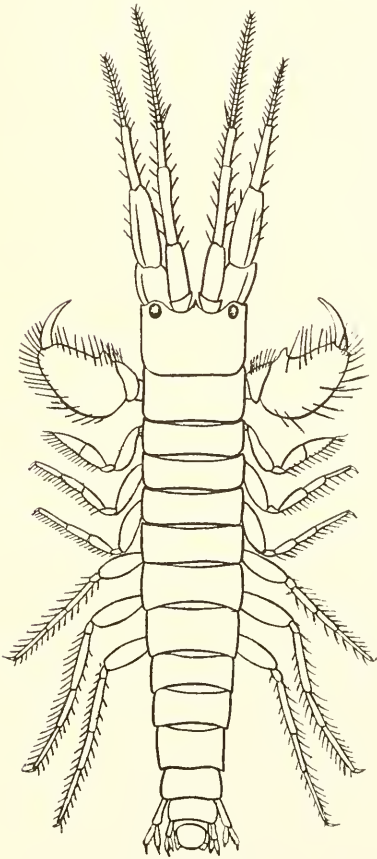
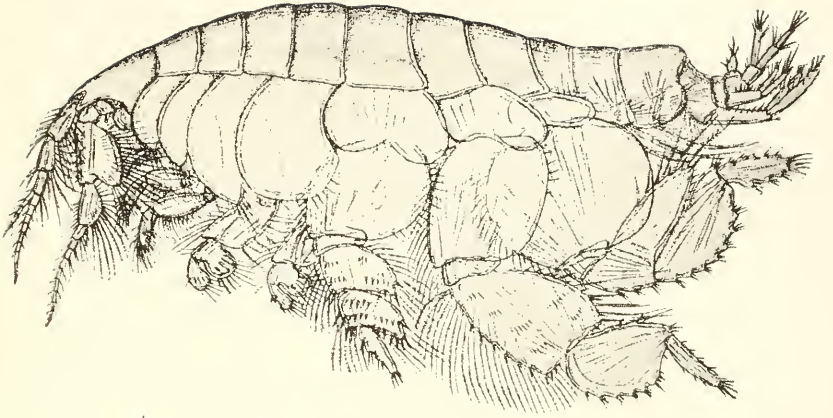
SKELETON SHRIMPS. *Caprella acutifrons* Latreille.



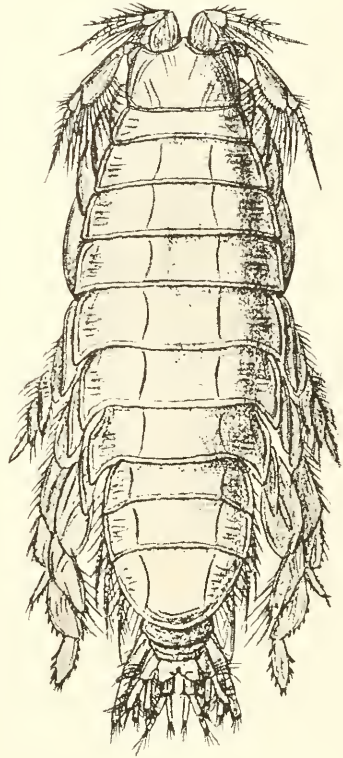
TUBE SHRIMPS. *Cerapus tubularis* Say.



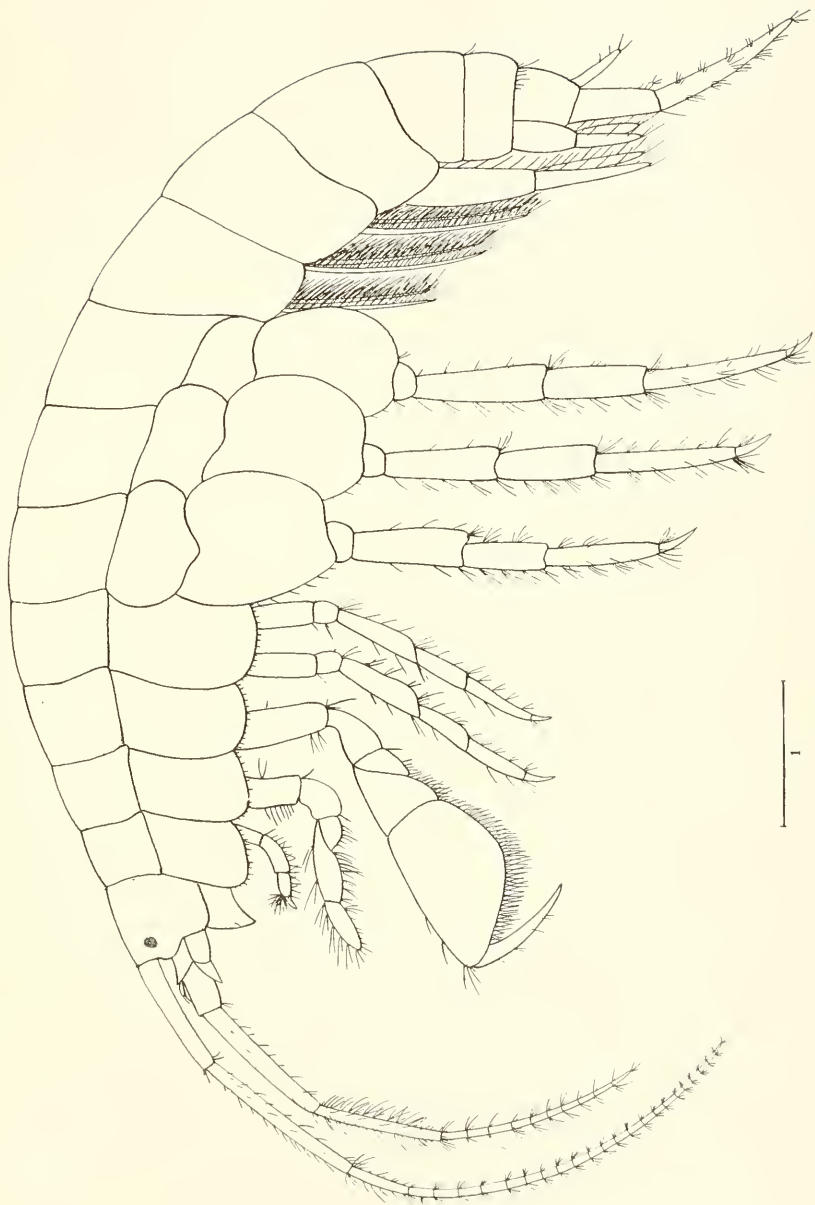
Corophium cylindricum (Say).



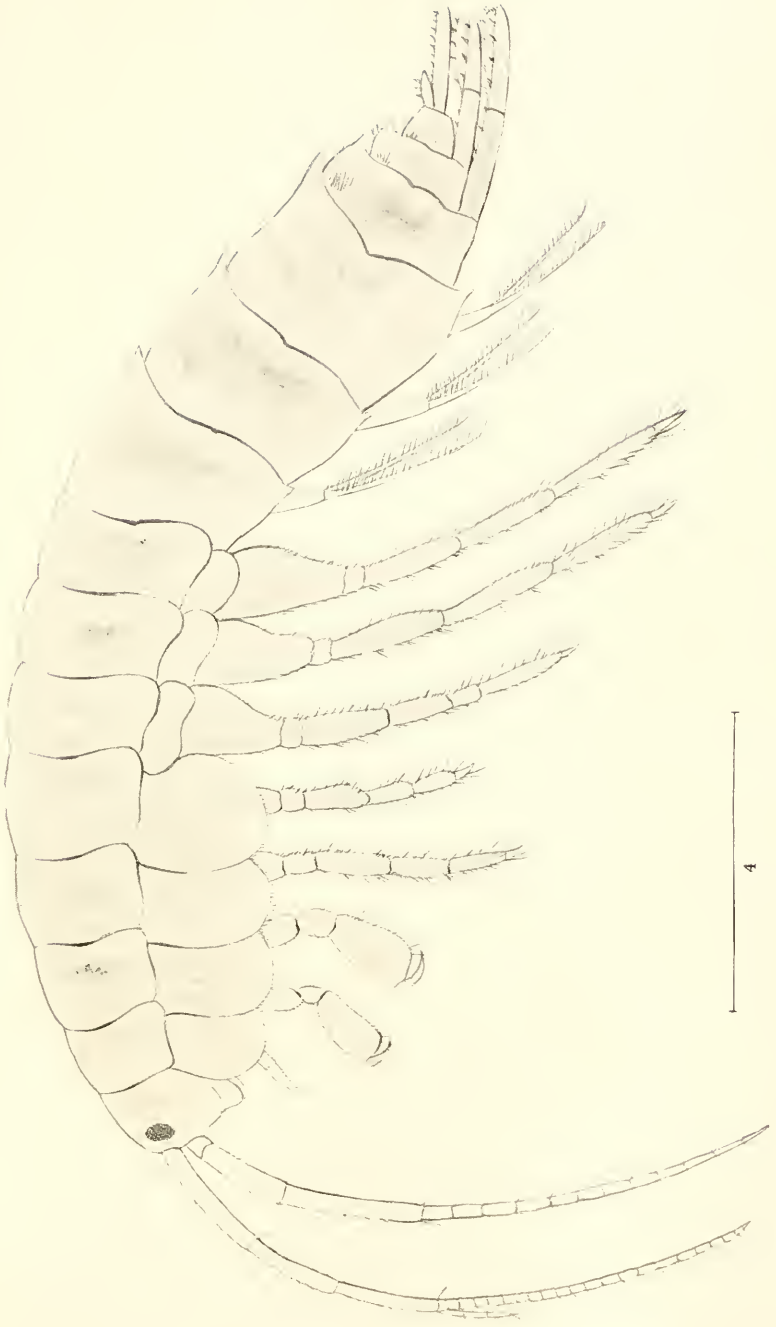
Unciola irrorata Say.



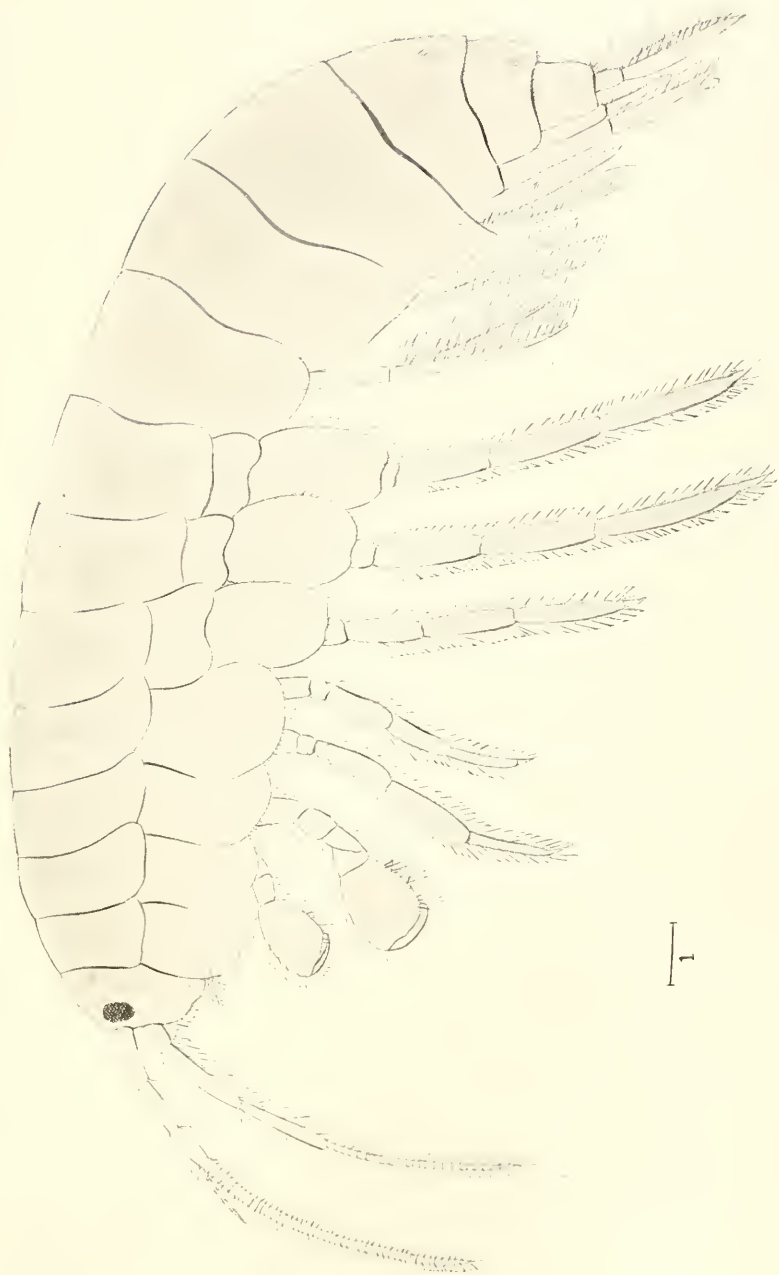
Haustorius arenarius (Slabber).
(Lateral and dorsal views.)



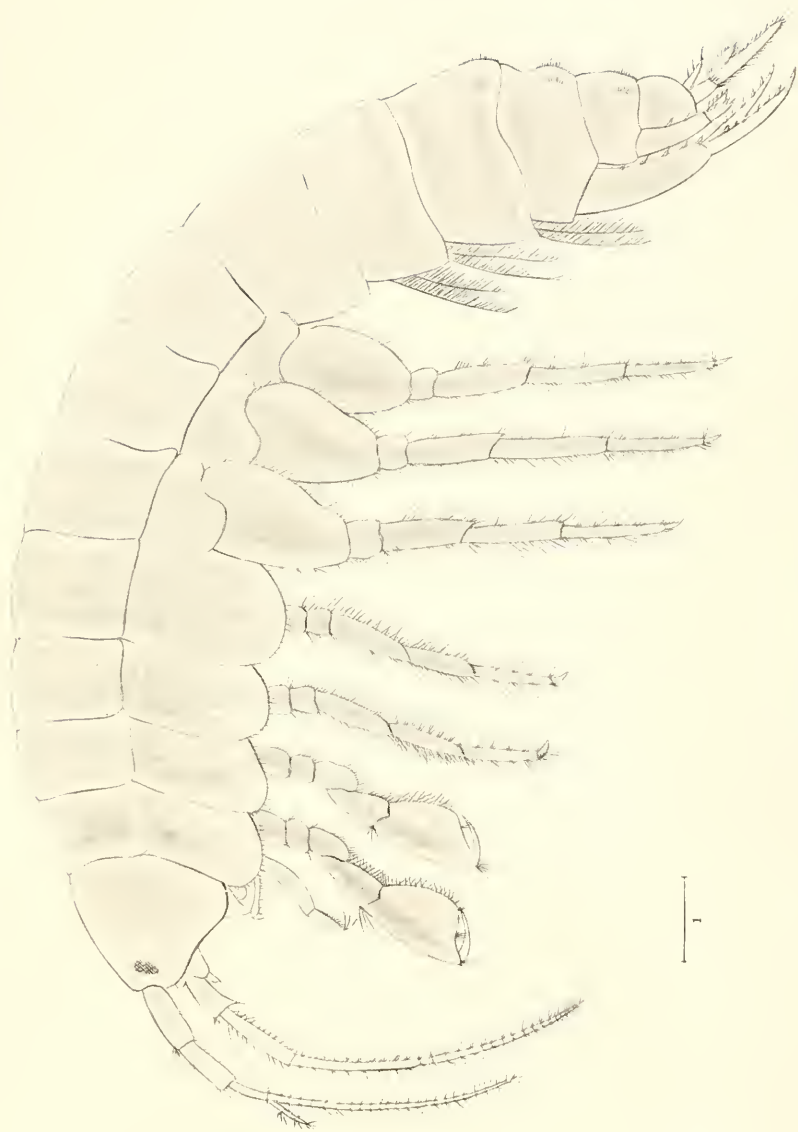
Melita nitida S. I. Smith.



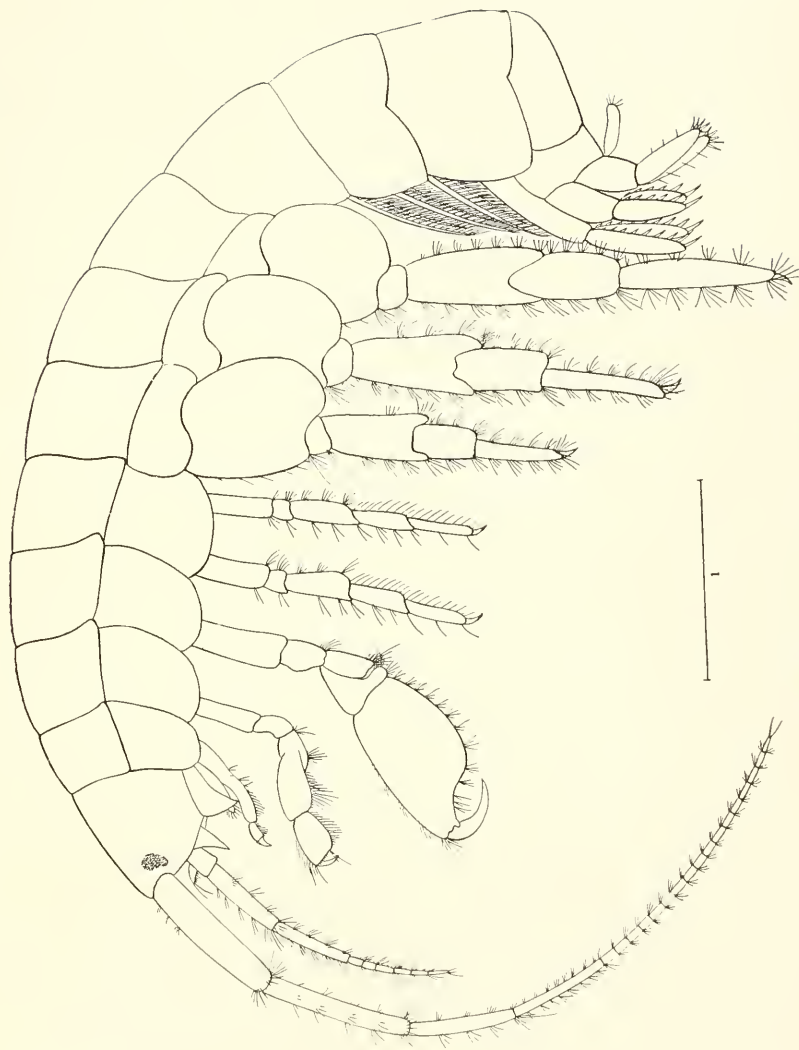
Carinogammarus mucronatus (Say). (Male.)



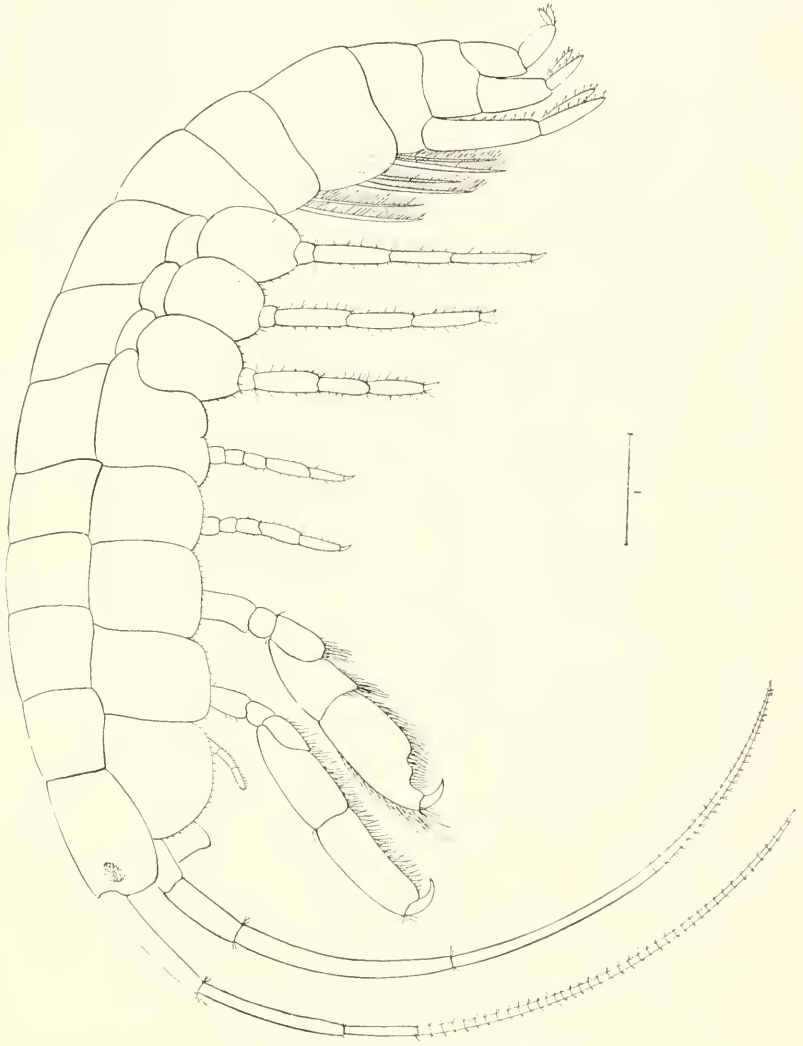
SCUDS. *Gammarus locusta* (Linnaeus). (Male.)



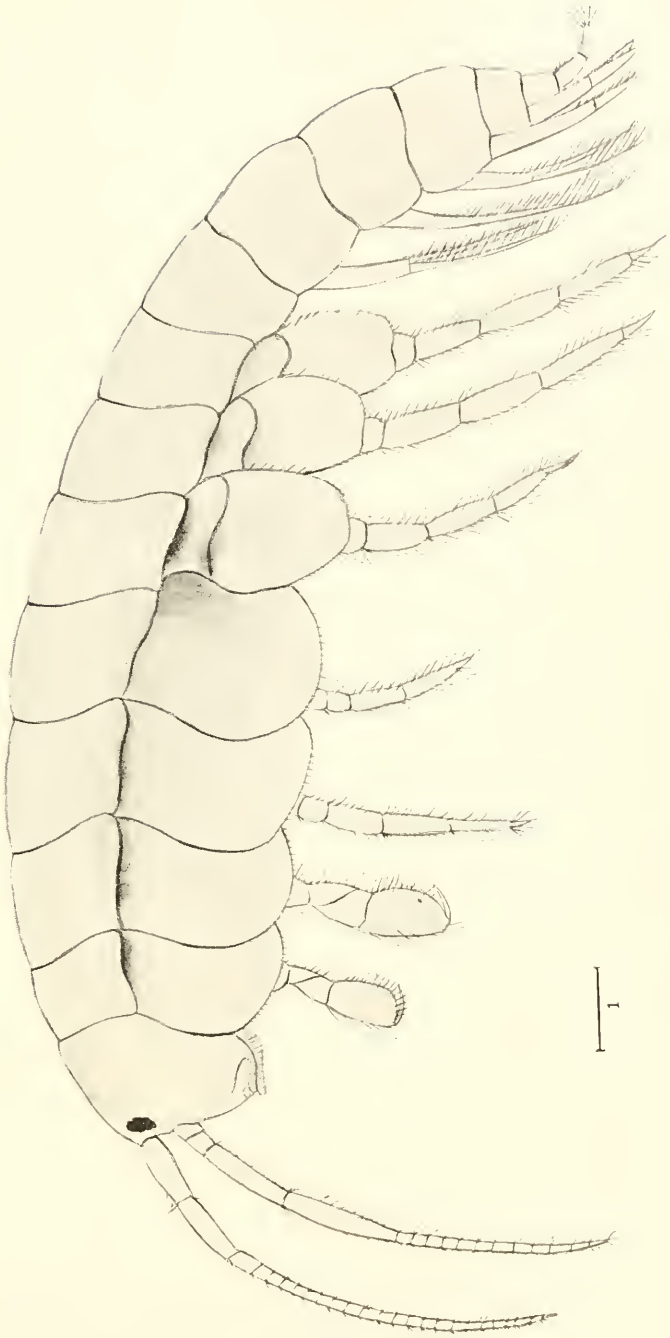
Gammarus fasciatus Say. (Male.)



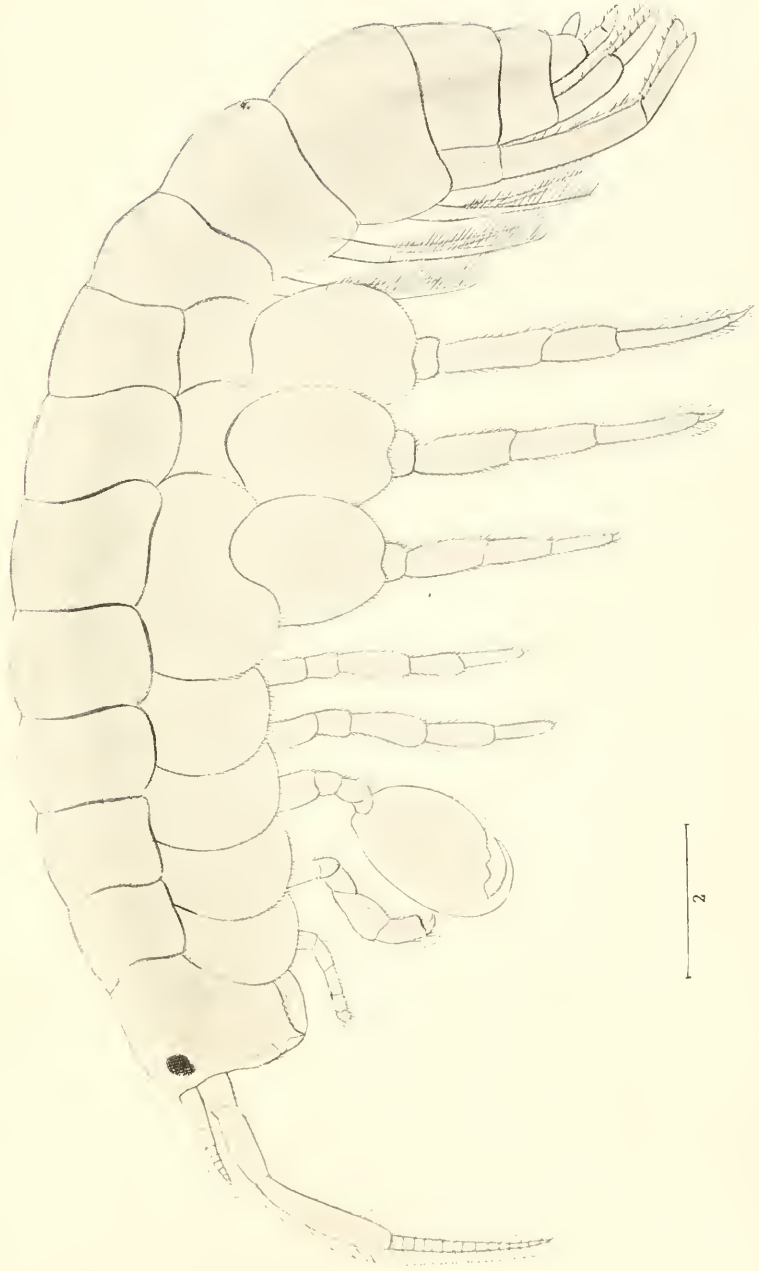
Elasmopus laevis (S. I. Smith).



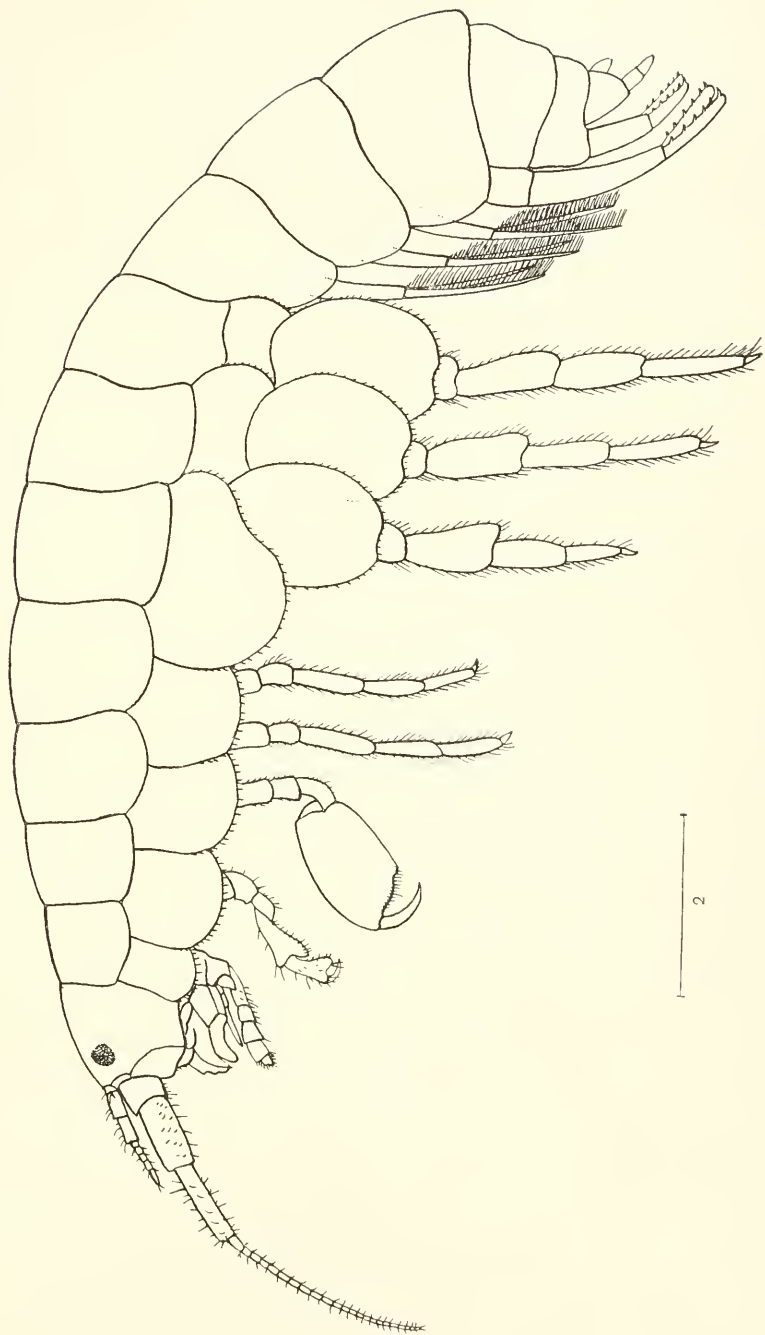
Amphipthoe longimana (S. I. Smith).



Ampithoe rubricata (Montagne). (Male.)



BEACH FLEA. *Orchestes agilis* (S. I. Smith). (Male.)



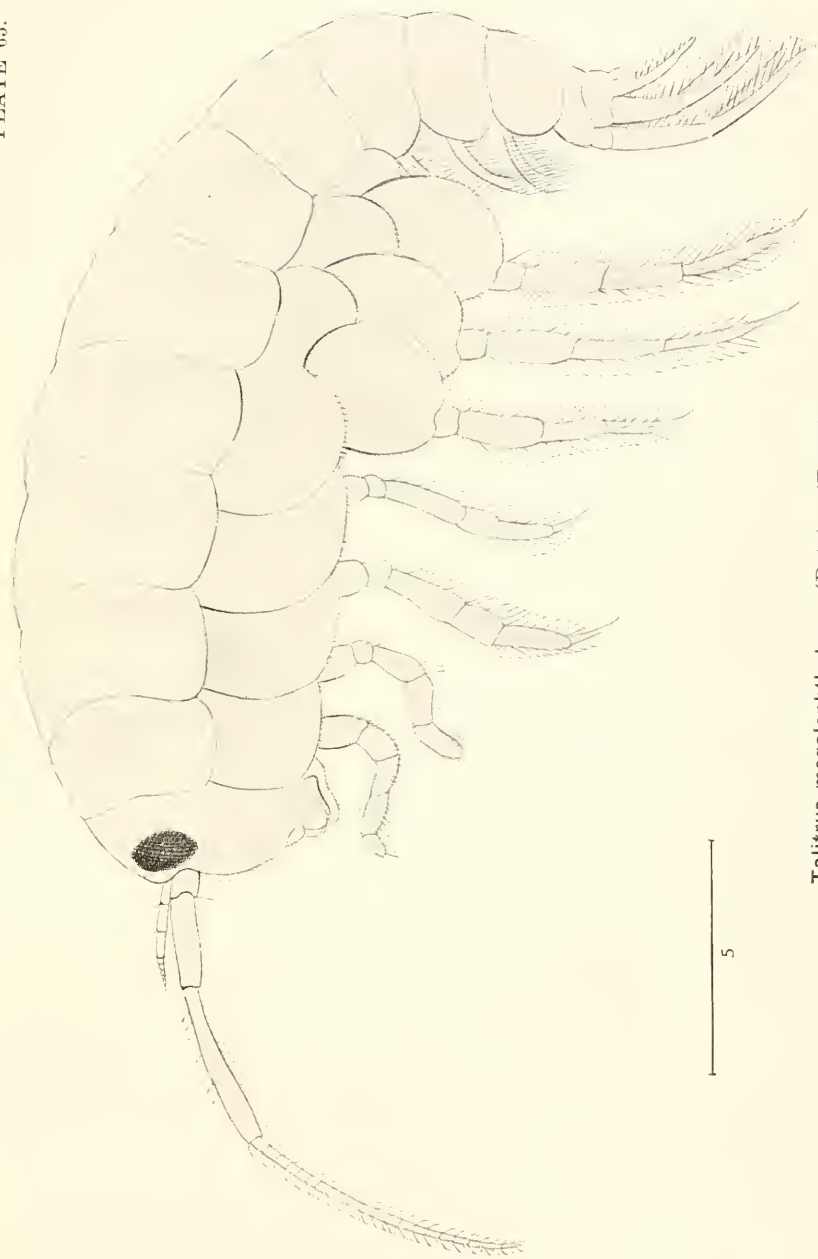
Orchestes palustris (S. I. Smith).



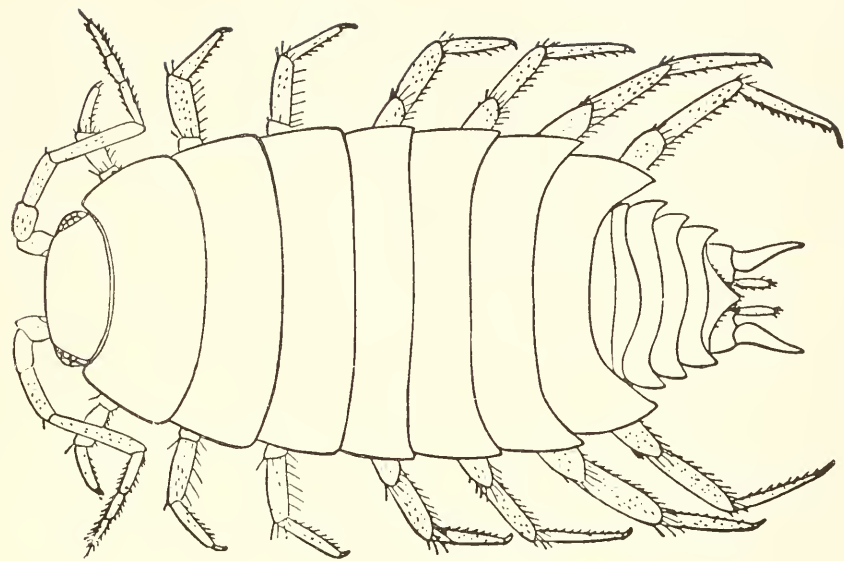
Talitrus longicornis Say. (Male.)



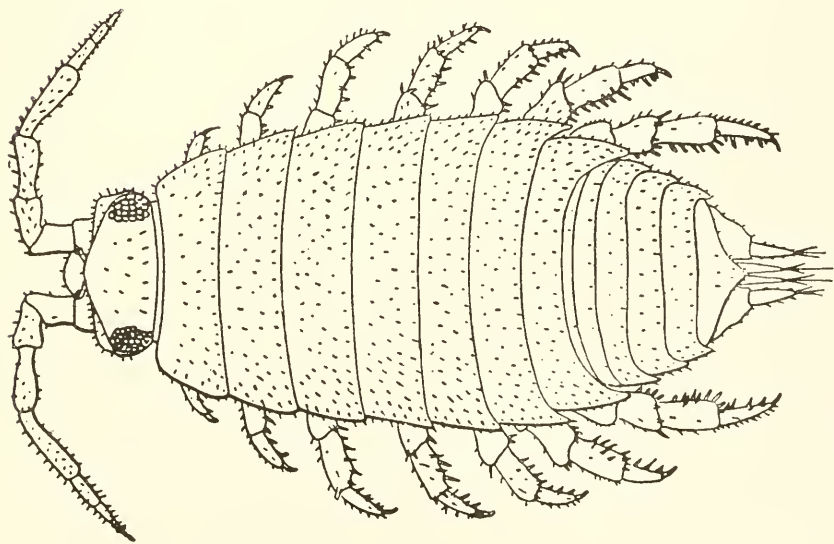
Talitrus megalophthalmus (Bate).



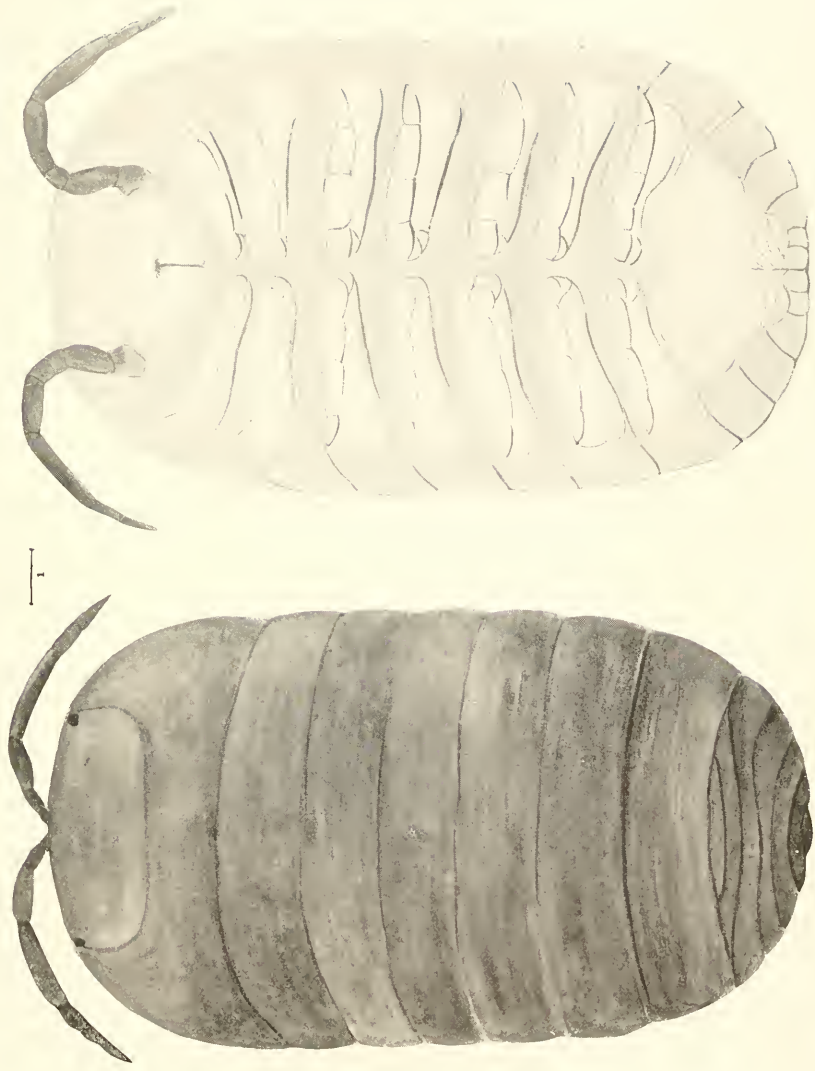
Talitrus megalophthalmus (Bate). (Female.)



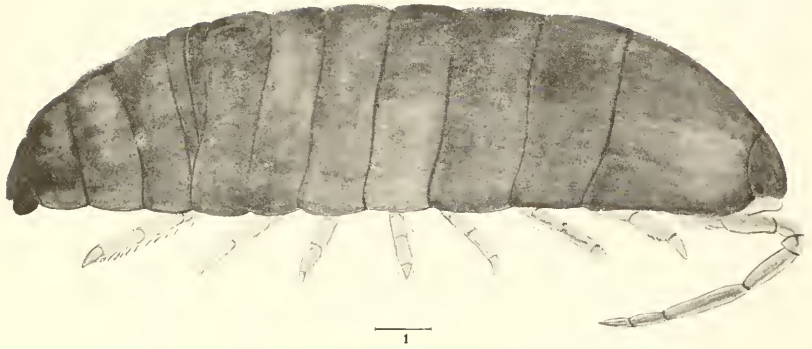
Philoscia vittata Say.



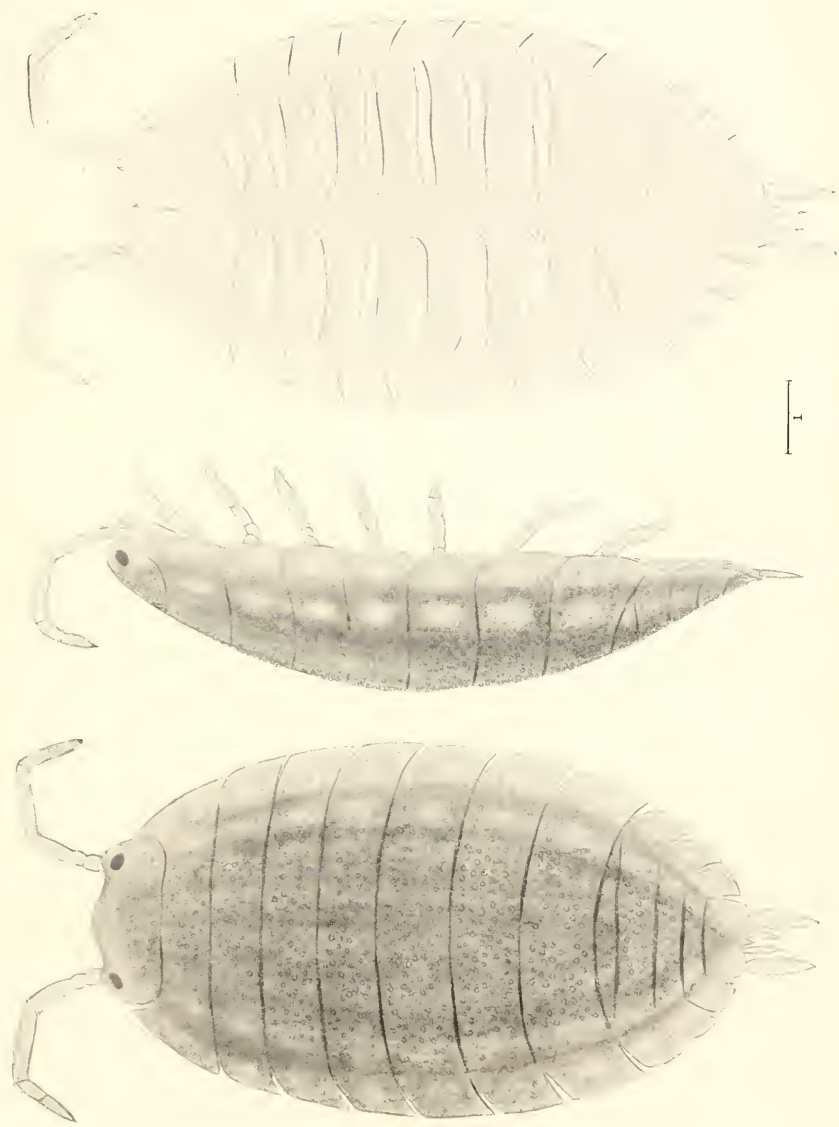
Scyphacella arenicola S. I. Smith.



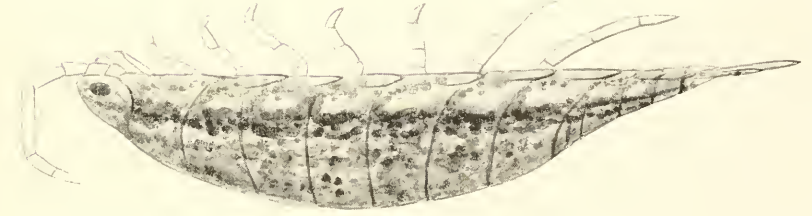
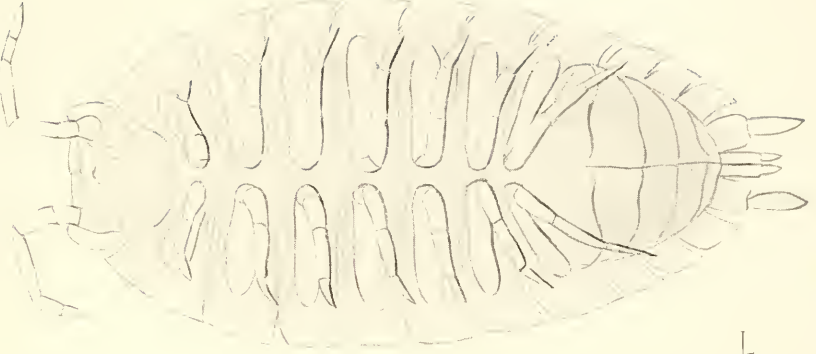
PILL BUG. *Armadillidium vulgare* (Latreille).



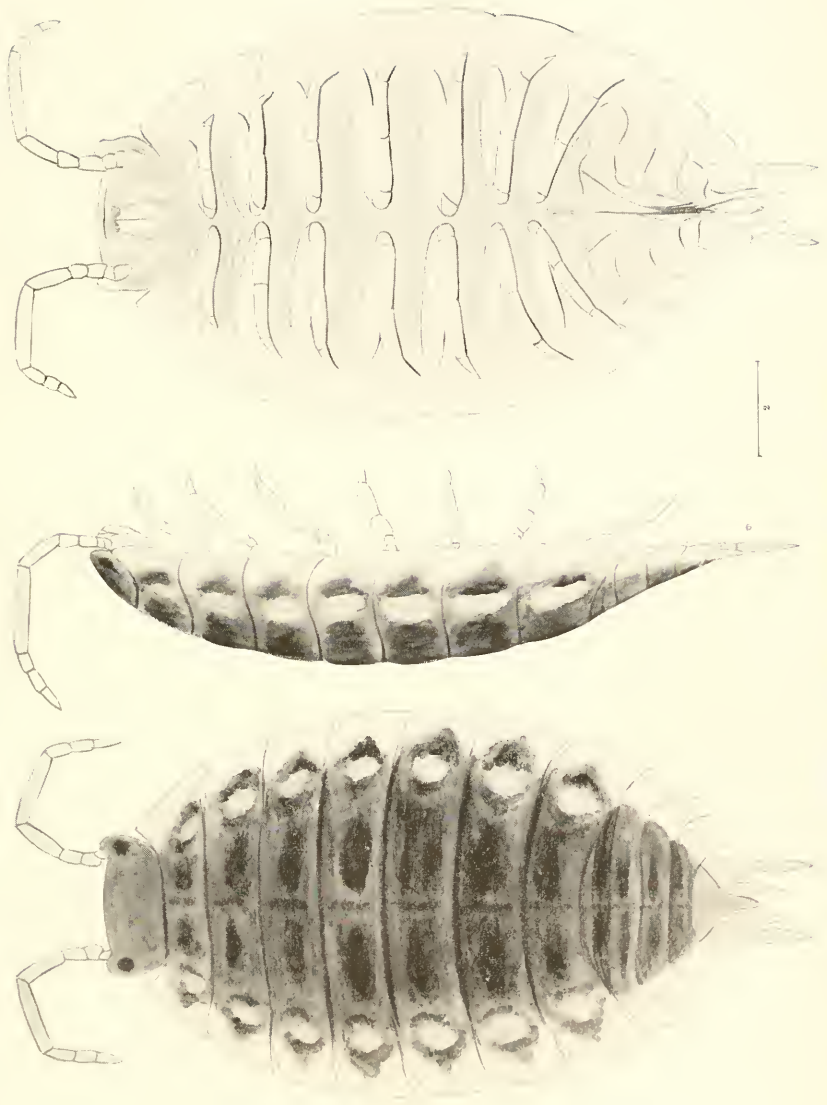
PILL BUG. *Armadillidium vulgare* (Latreille).



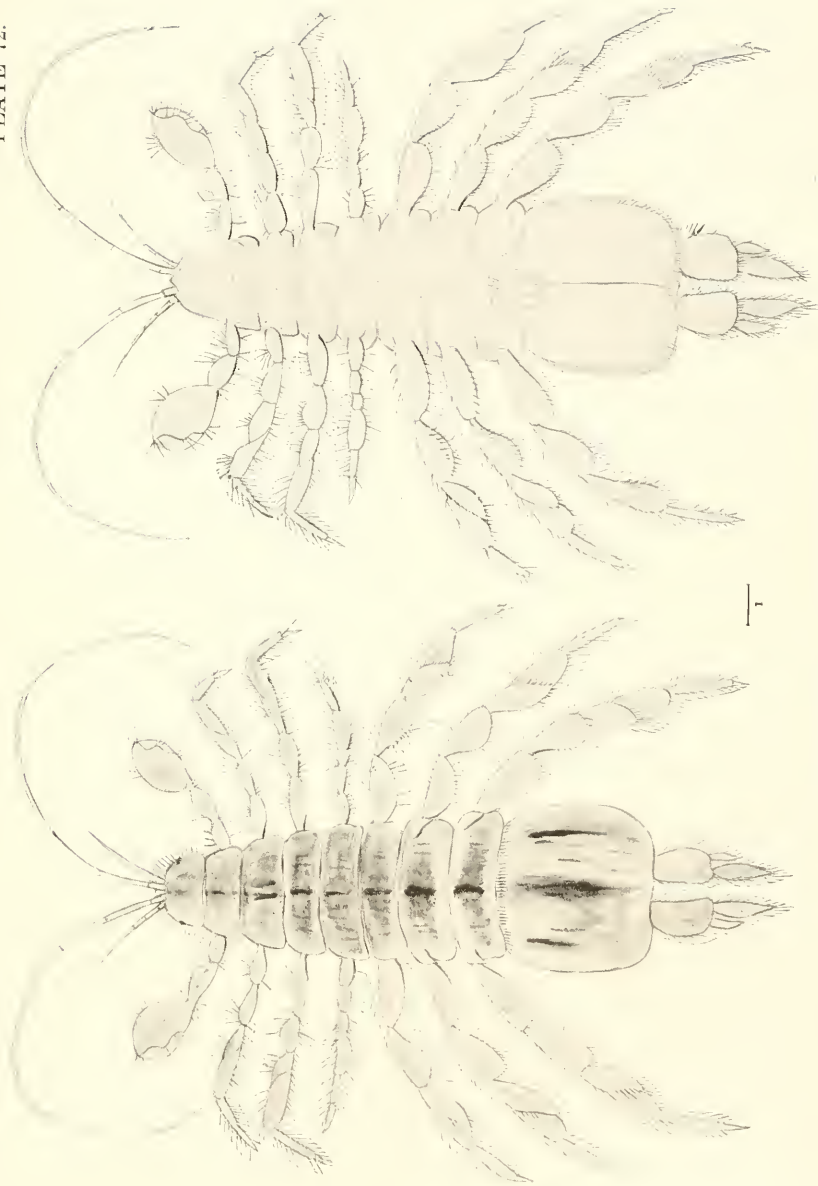
SOW BUG. *Porcellio scaber* Latreille.



SMOOTH PILL BUG. *Porcellio laevis* Latreille.



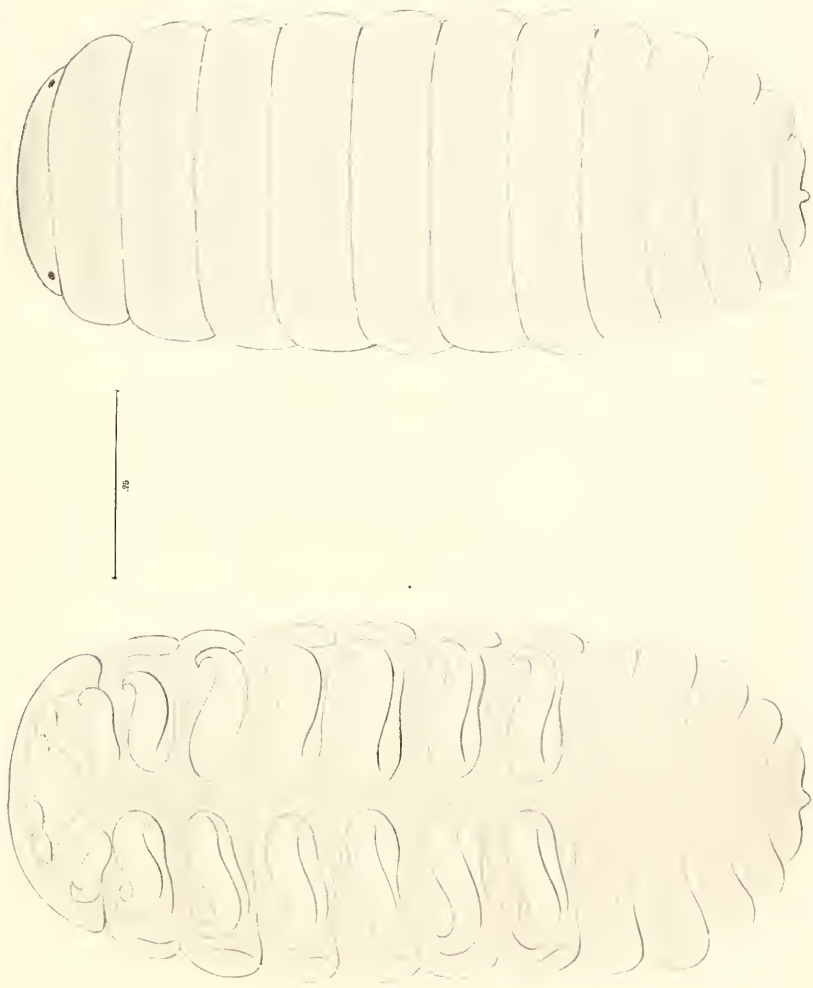
WOOD LOUSE. *Oniscus asellus* Linnæus.



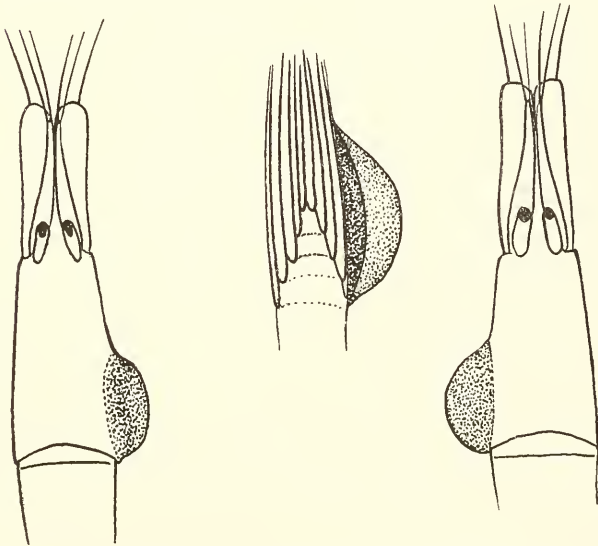
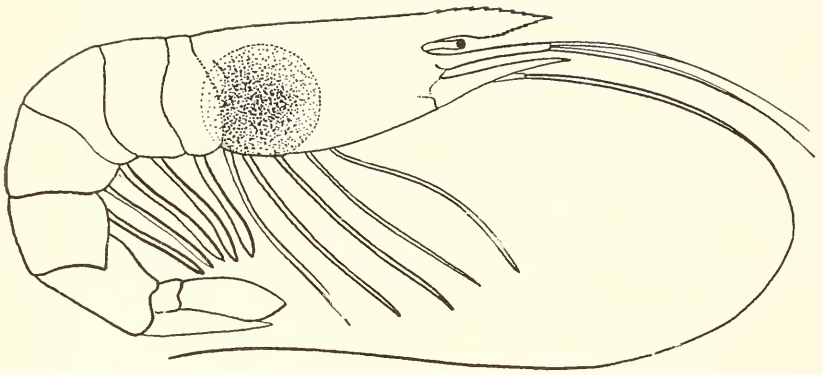
WATER ASEL. *Asellus communis* Say.



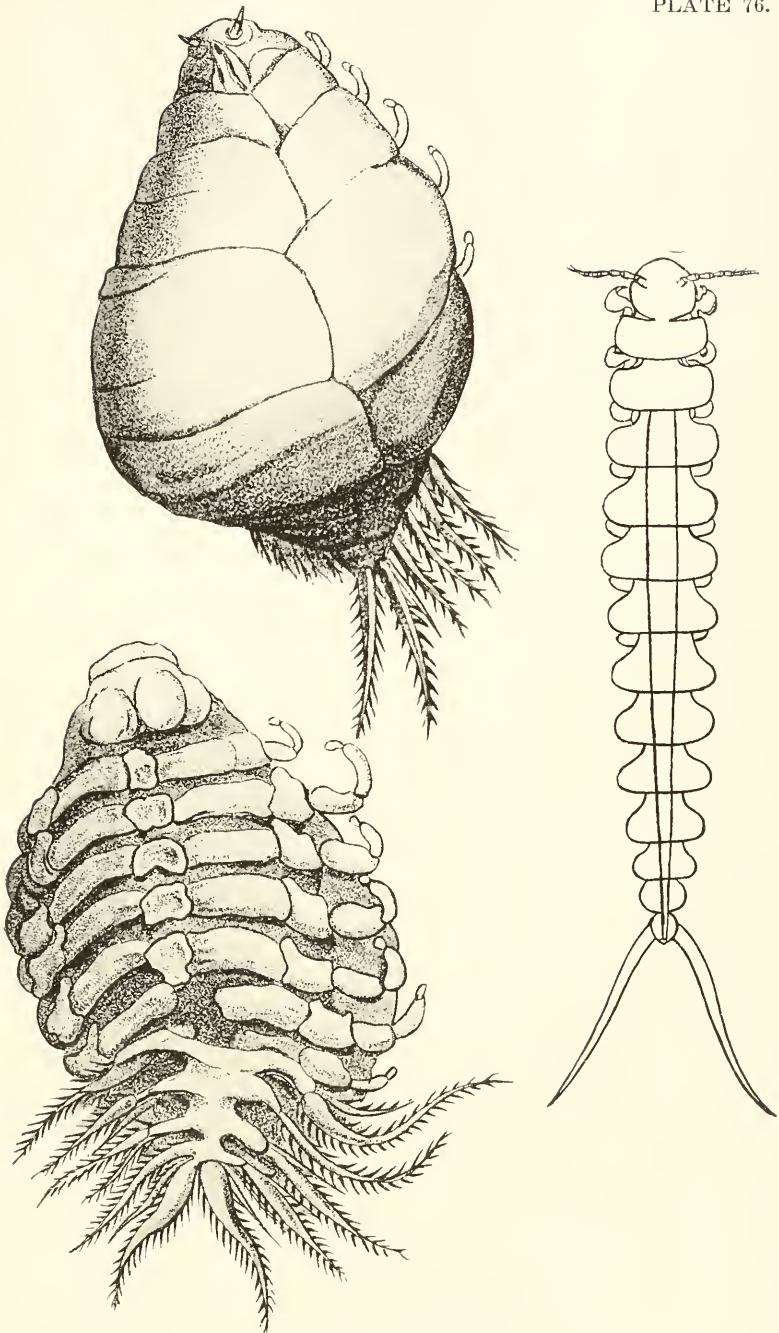
PRAWN LOUSE. *Probopyrus pandalicola* (Packard). (Female.)



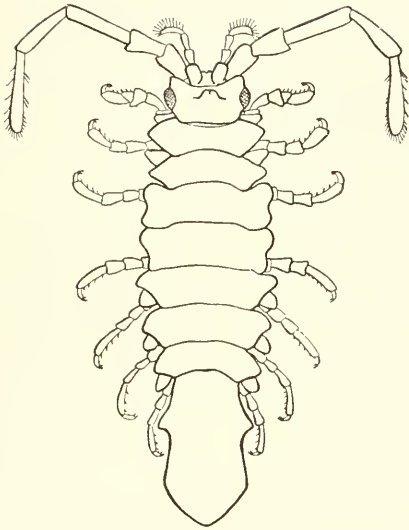
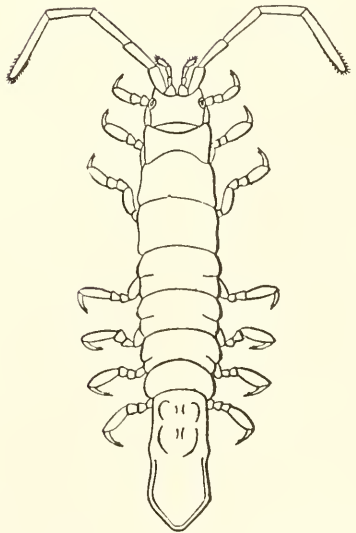
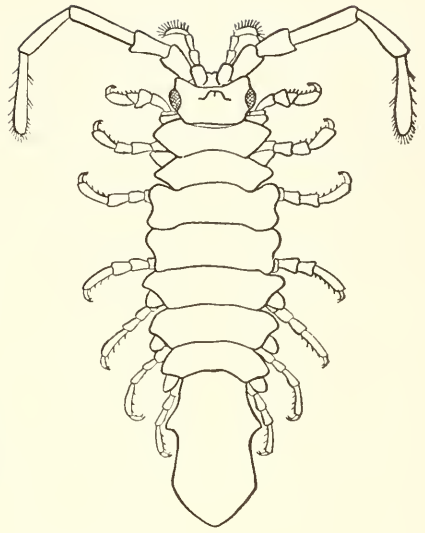
PRAWN LOUSE. *Probopyrus pandalicola* (Packard). (Male.)



PRAWN LOUSE. *Probopyrus pandalicola* (Packard).
 (Attached to *Palæmonetes vulgaris*.)

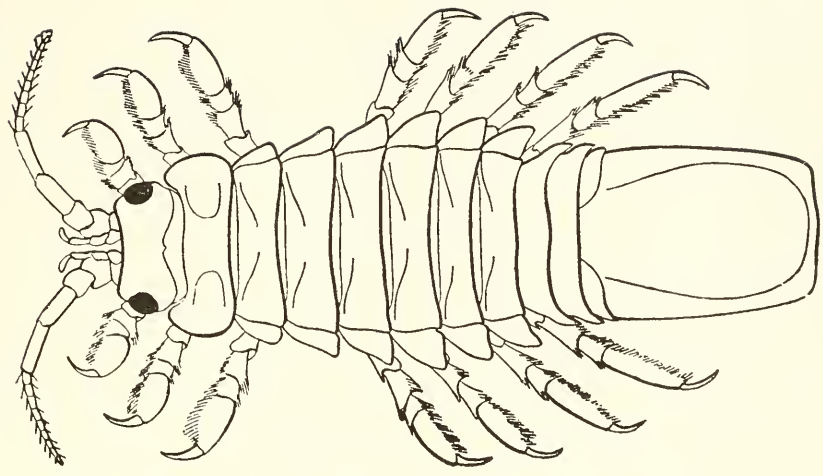


Leidyia distorta (Leidy).
(Females, and male to right.)

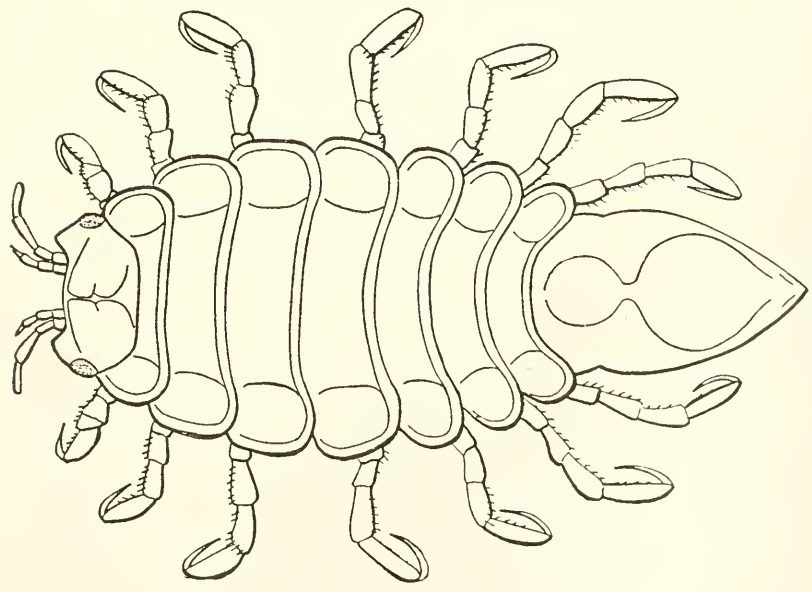


Erichsonella filiformis (Say).
(Two upper figures.)

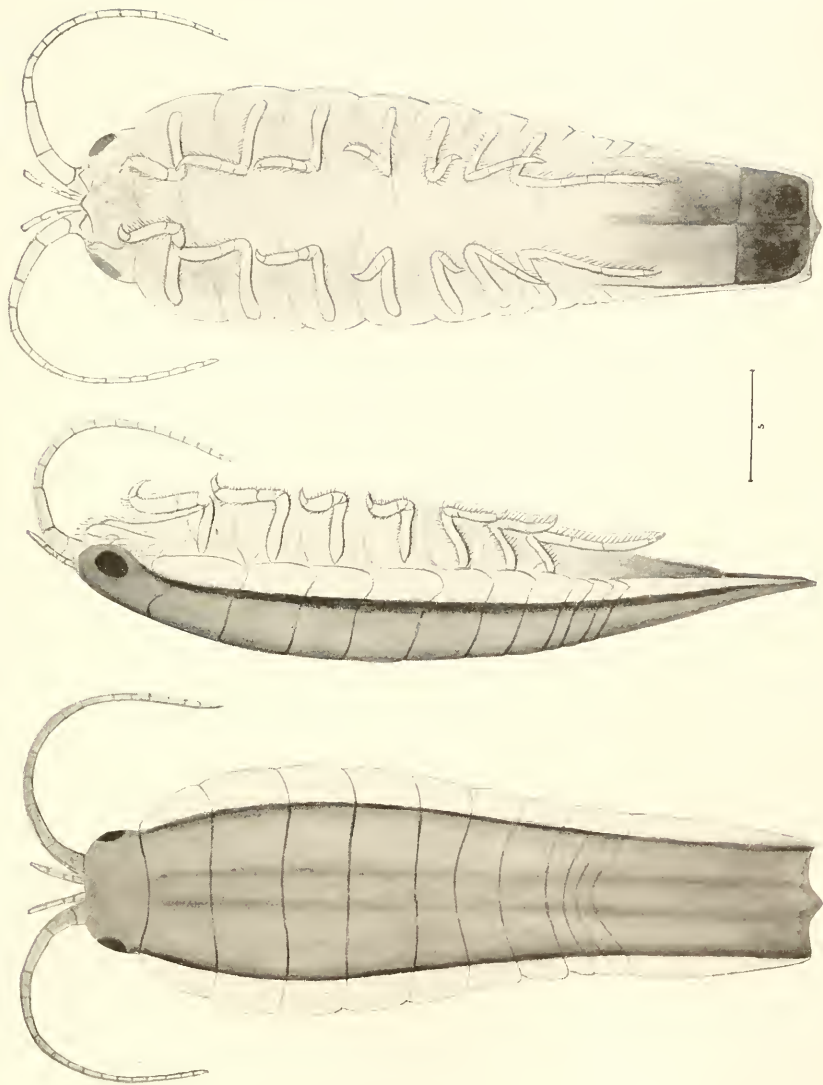
Erichsonella attenuata (Harger).



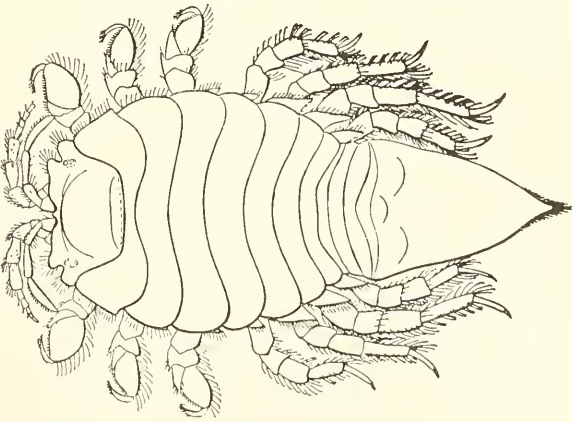
Idotea metallica Bosc.



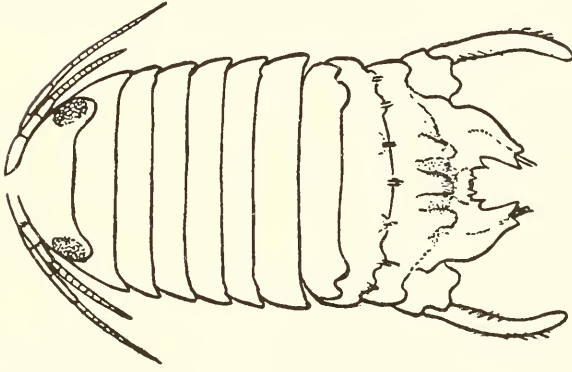
Edotia triloba (Say).



Idotea balthica (Pallas).

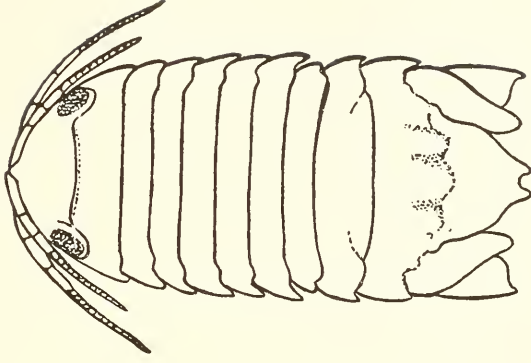


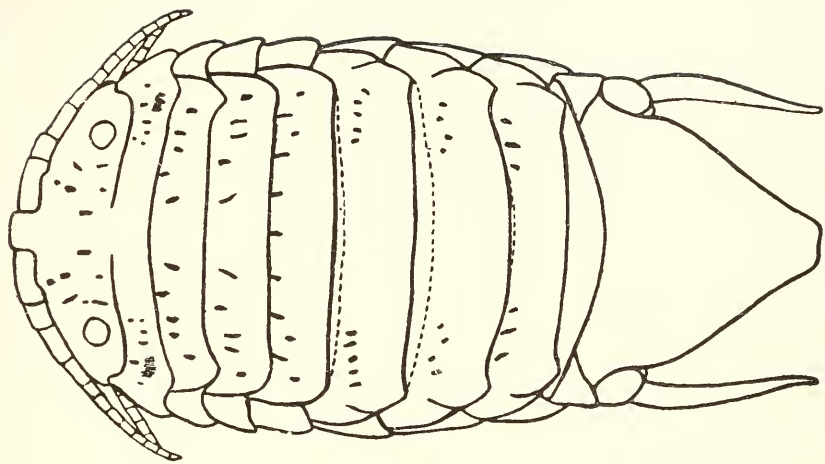
Chiridotea coeca (Say).



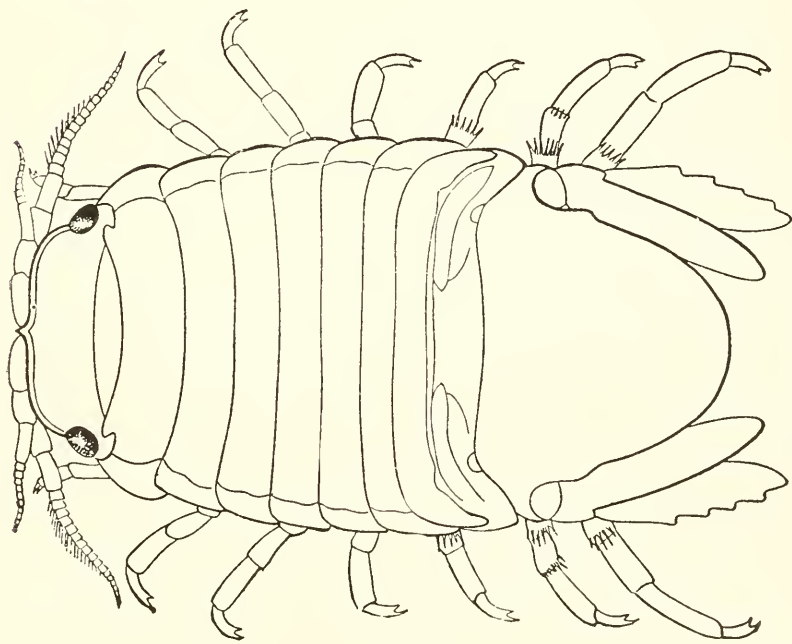
Ciliocæa caudata (Say).

(Middle figure male, right figure female.)

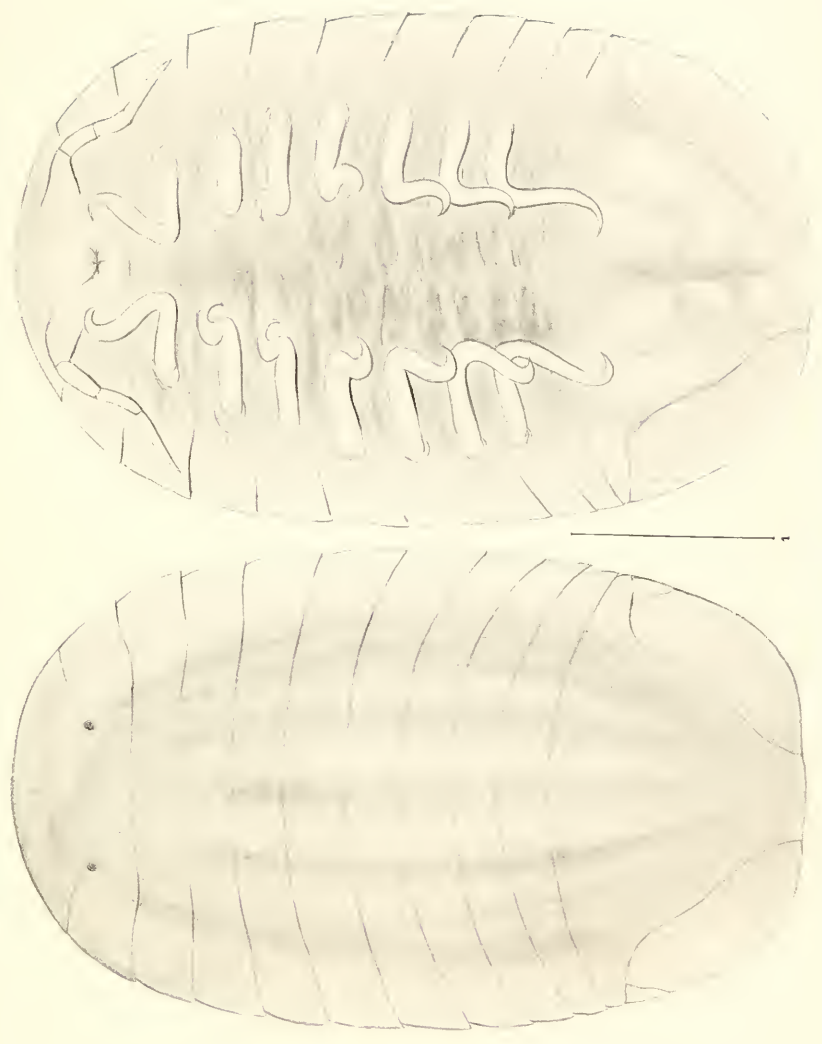




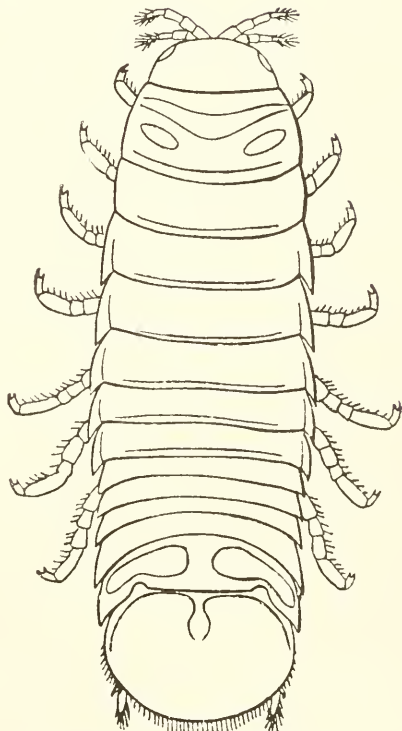
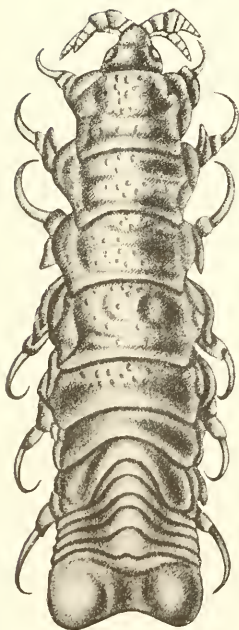
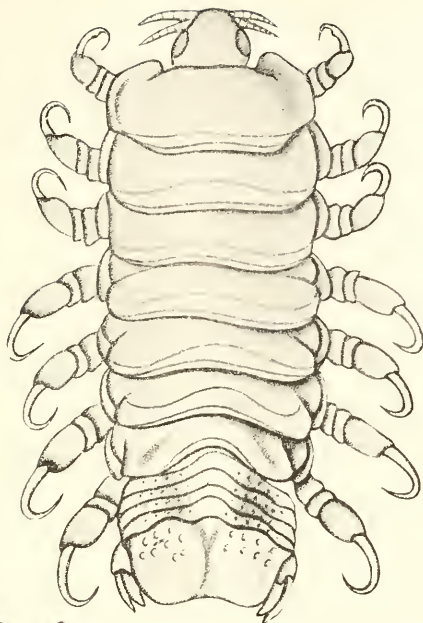
Ancinus depressus (Say)



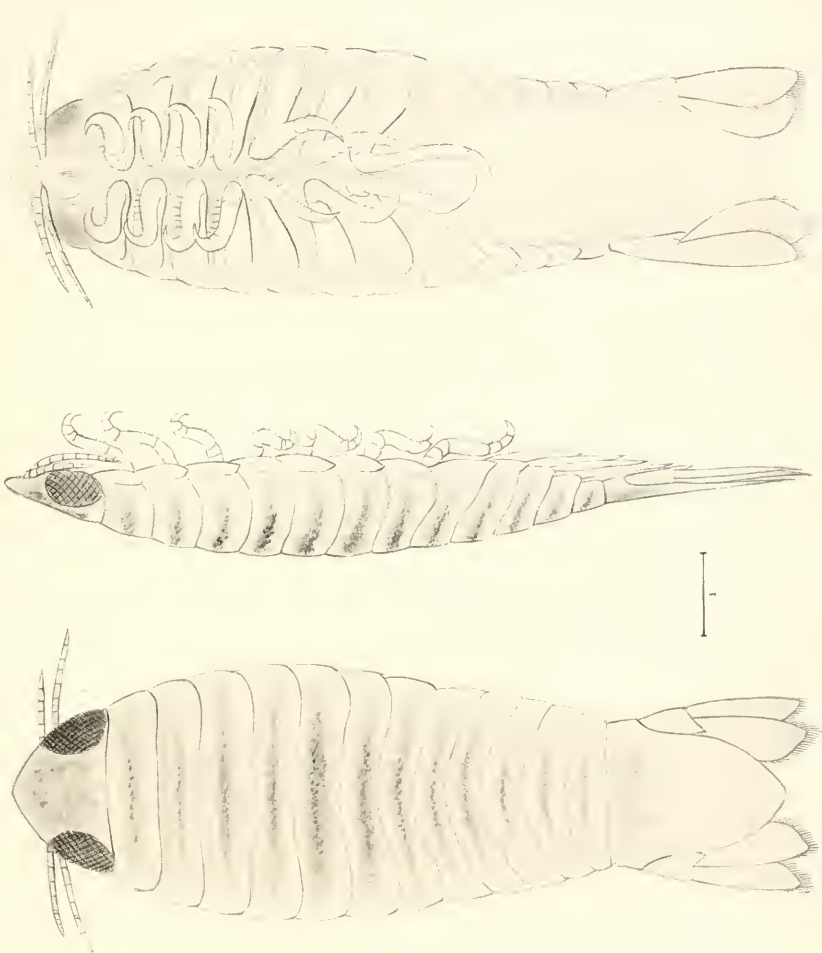
Sphaeroma quadridentatum Say.



Cassidiscus lunifrons (H. Richardson).



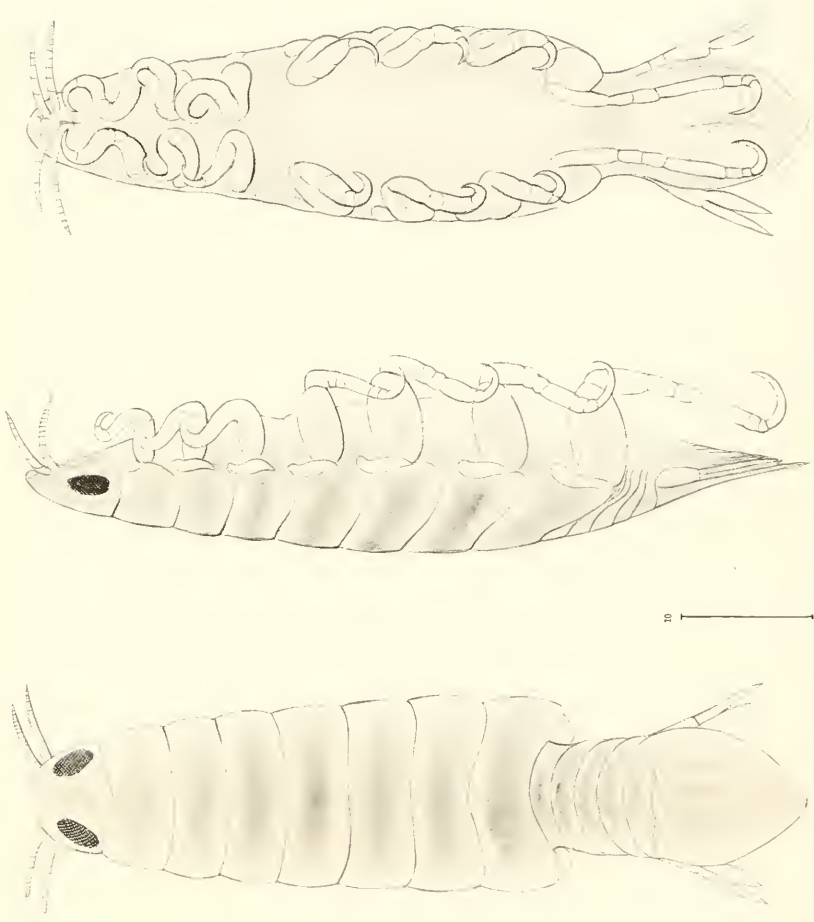
Ceratothoa impressa (Say). *Limnoria lignorum* (Rathke).
 (Upper male, lower left figure female.) (Lower right figure.)



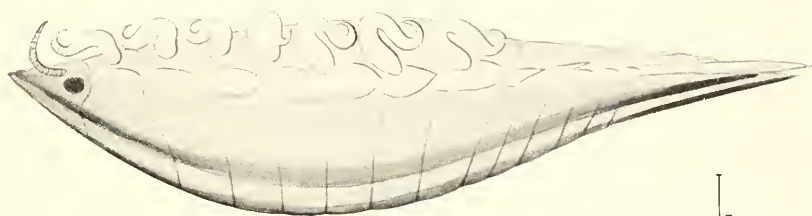
Egathoa oculata (Say).



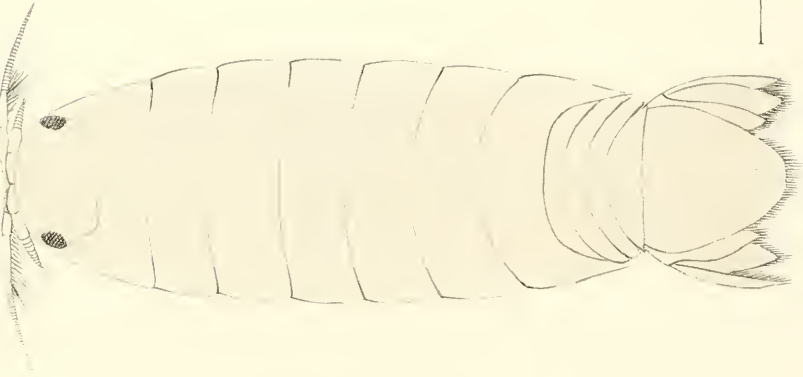
Livoneca ovalis (Say).



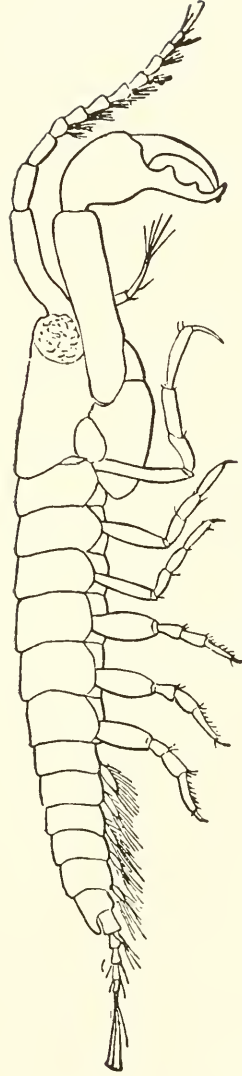
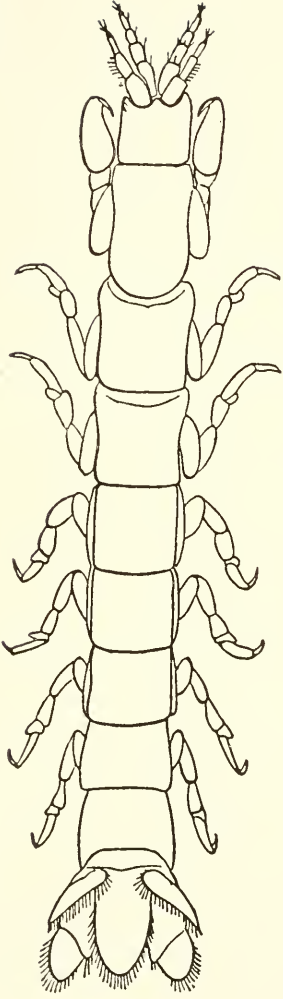
Olencira prægustator (Latrobe).



Nerocila munda Harger.

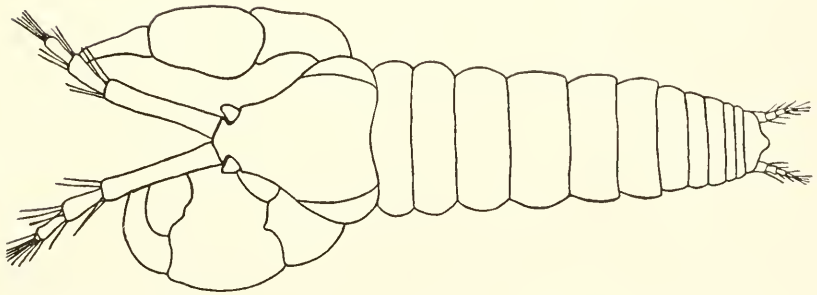
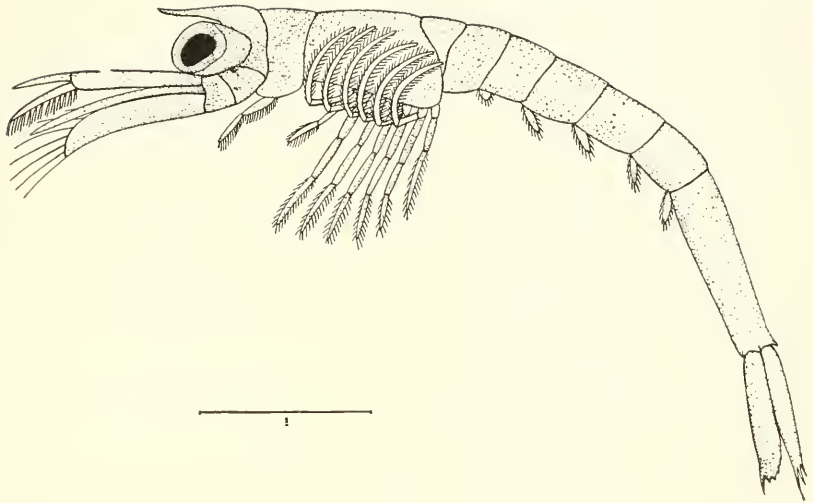


Cirolana concharum (Stimpson).

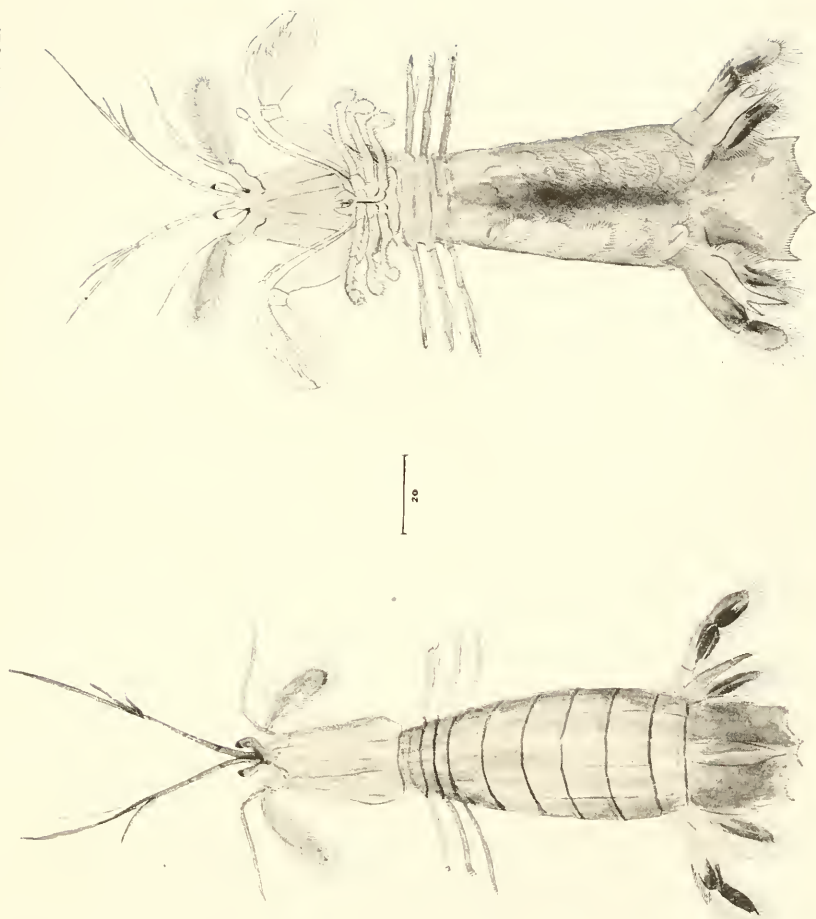


Cyathura carinata (Kröyer).
Leptochelia savignyi (Kröyer).

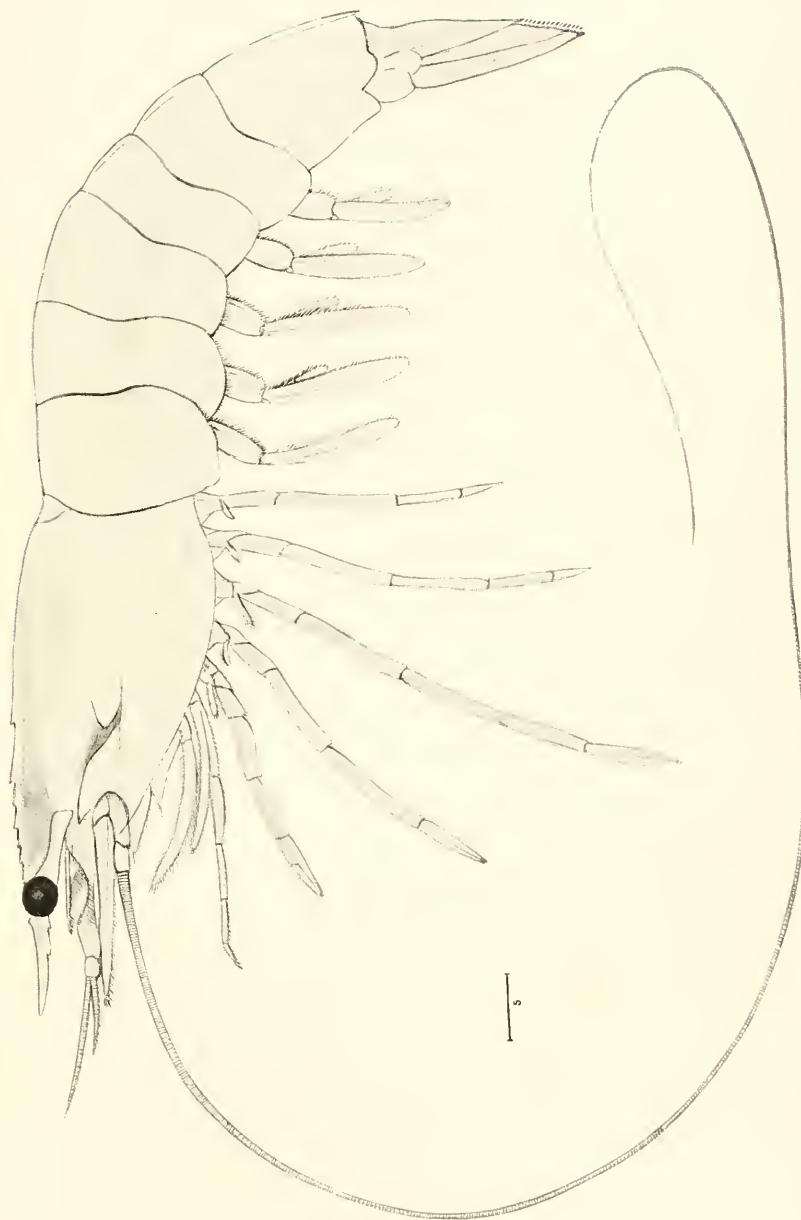




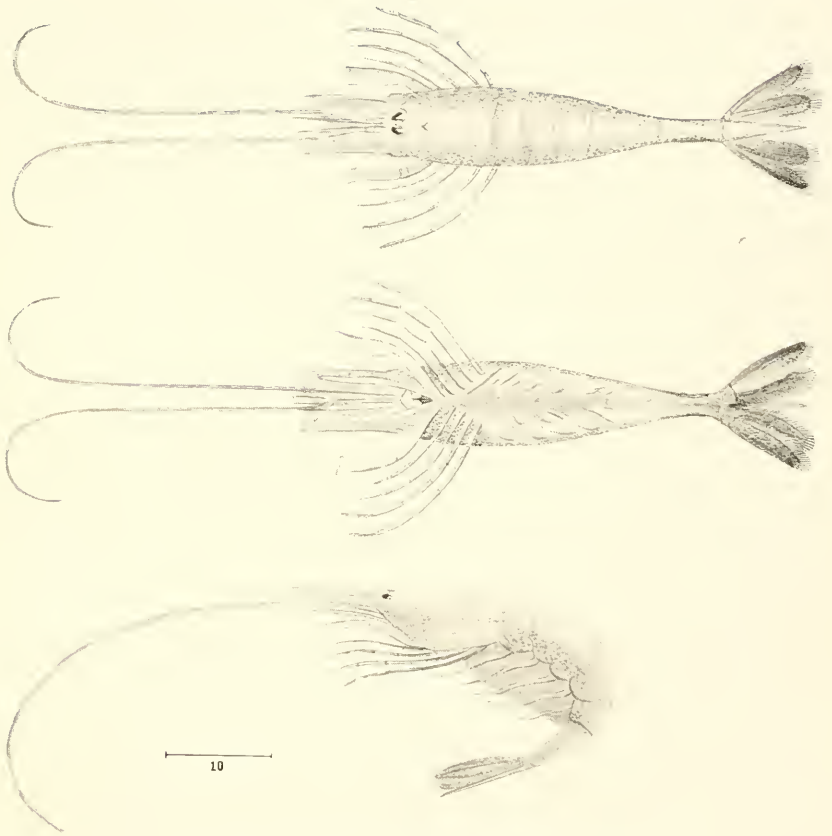
OPOSSUM SHRIMP. *Mysis* sp. (Young).
Tanais robustus H. F. Moore.



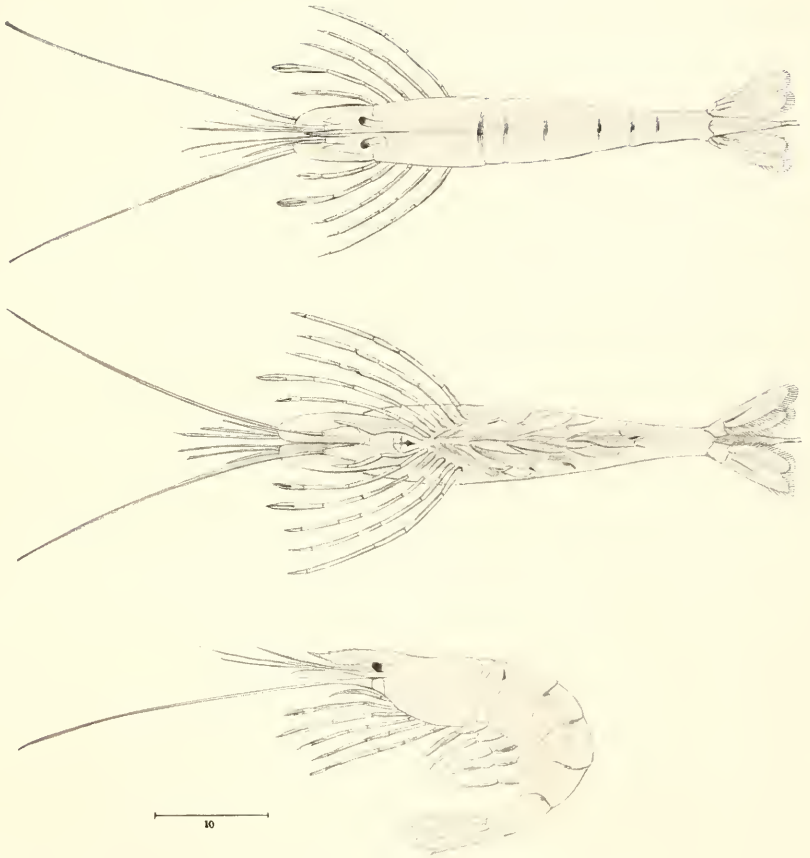
SQUILL. *Chloridella empusa* (Say).



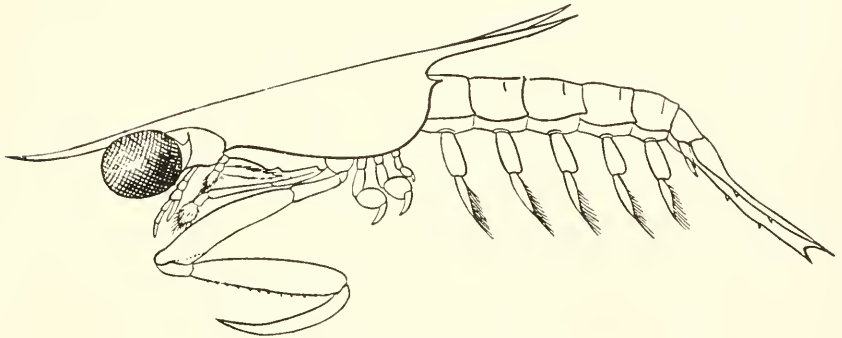
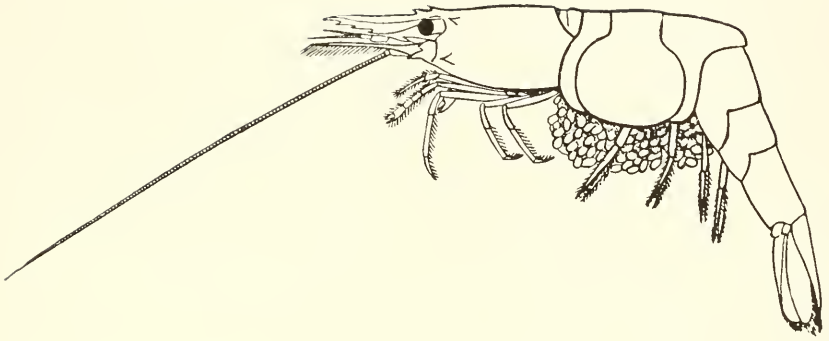
SOUTHERN PRAWN. *Penaeus setiferus* (Linnaeus).



SHRIMP. *Crago septemspinosa* (Say).

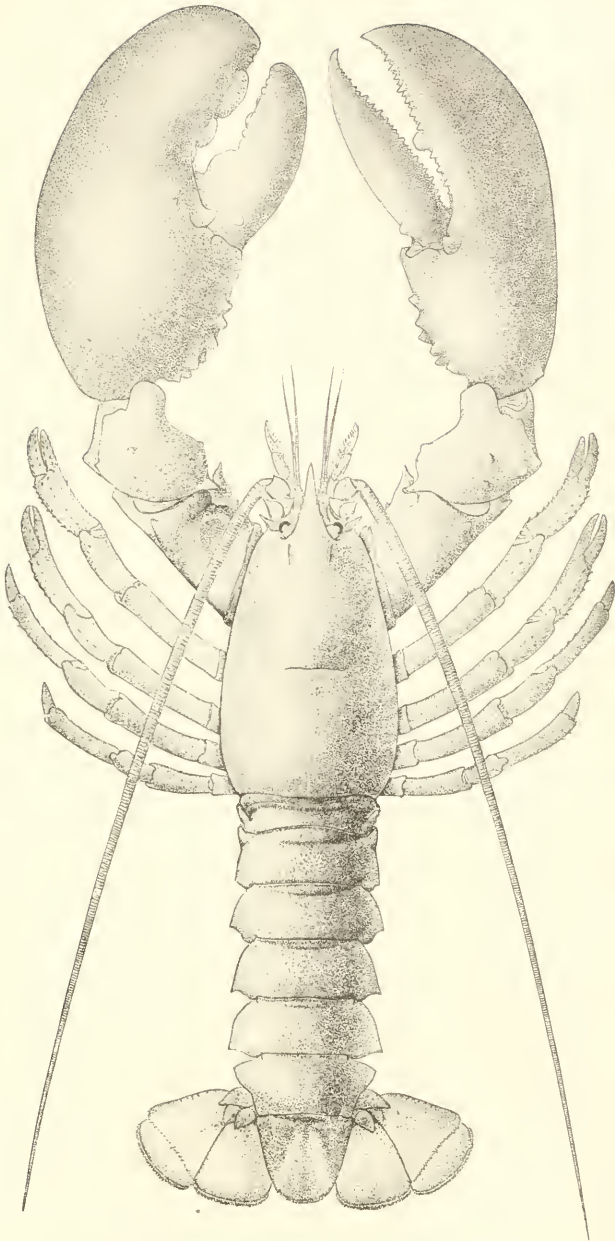


PRAWN. *Palæmonetes vulgaris* (Say).

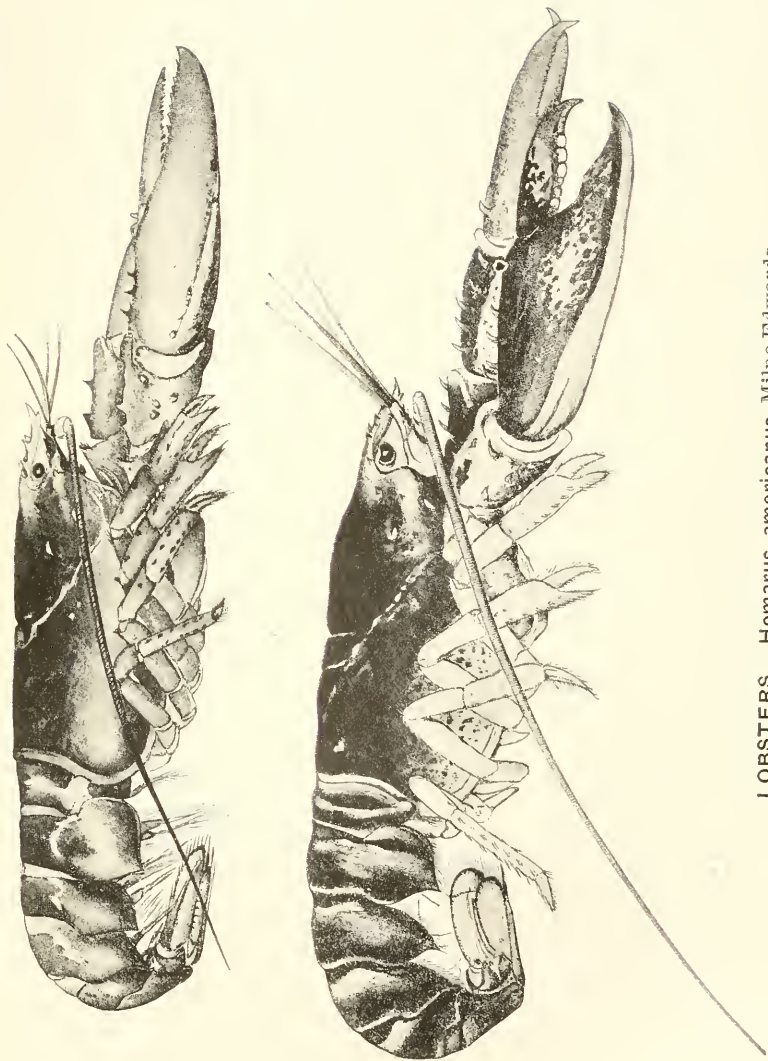


Virbius pleuracanthus Stimpson.

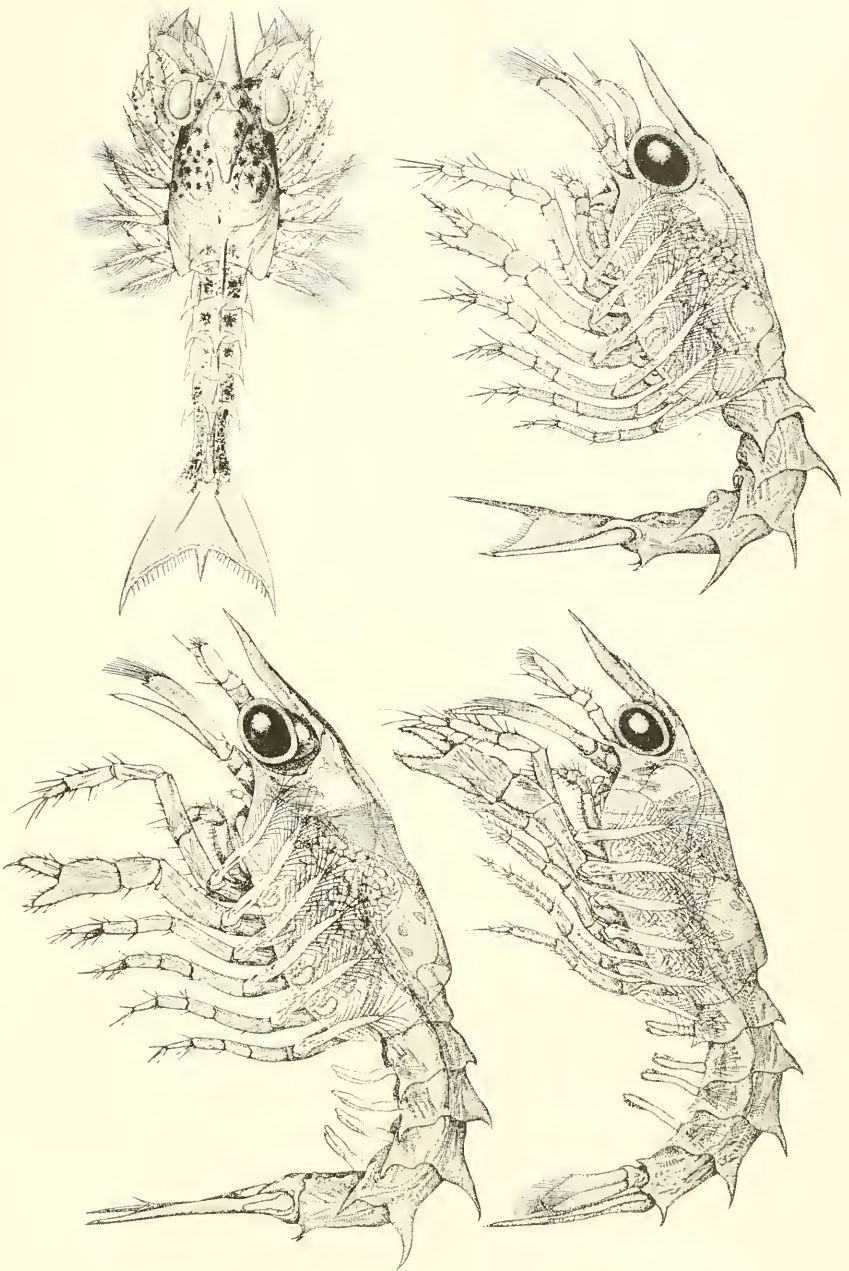
SQUILL. *Chloridella empusa* (Say).
(Lower figure, young.)



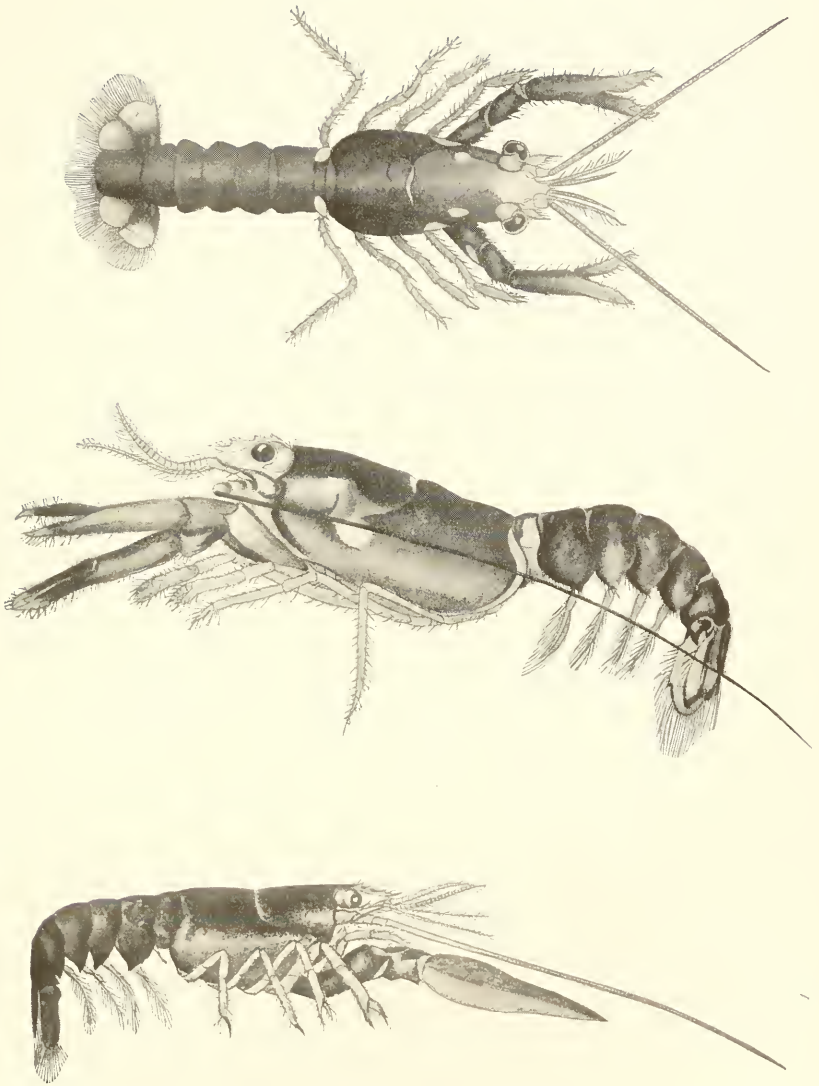
LOBSTER. *Homarus americanus* Milne-Edwards.



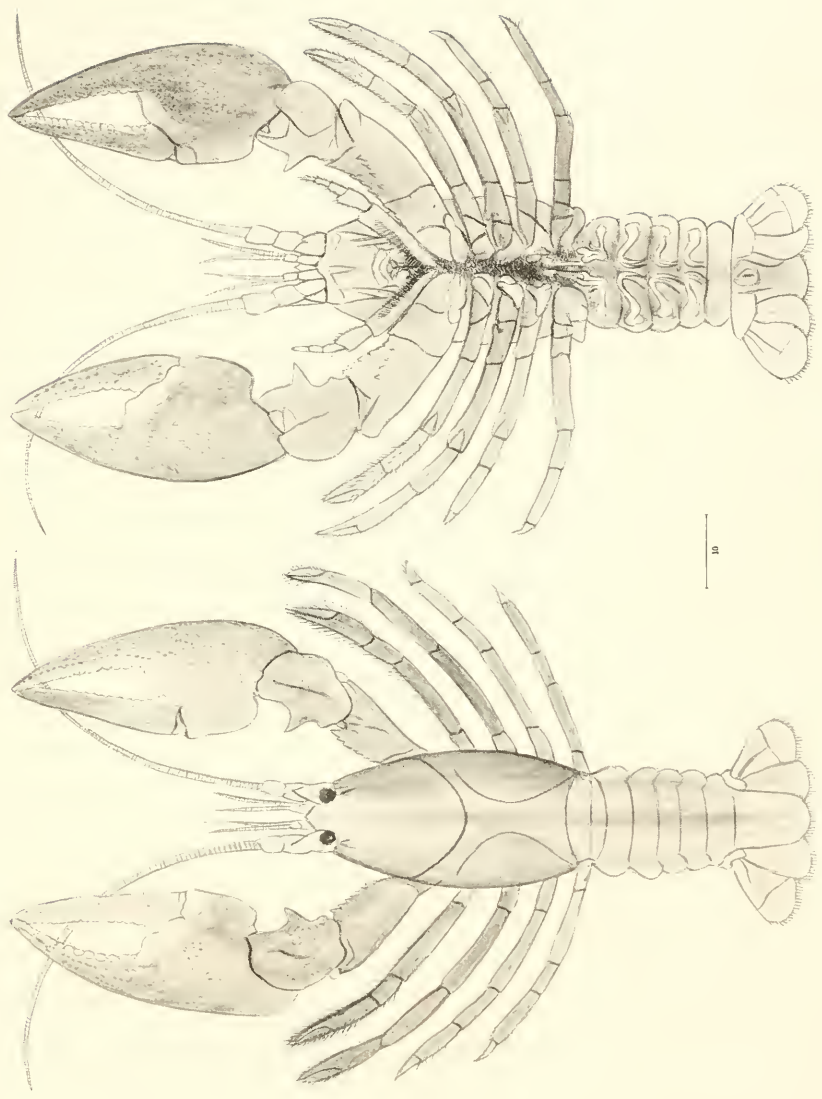
LOBSTERS. *Homarus americanus* Milne-Edwards.



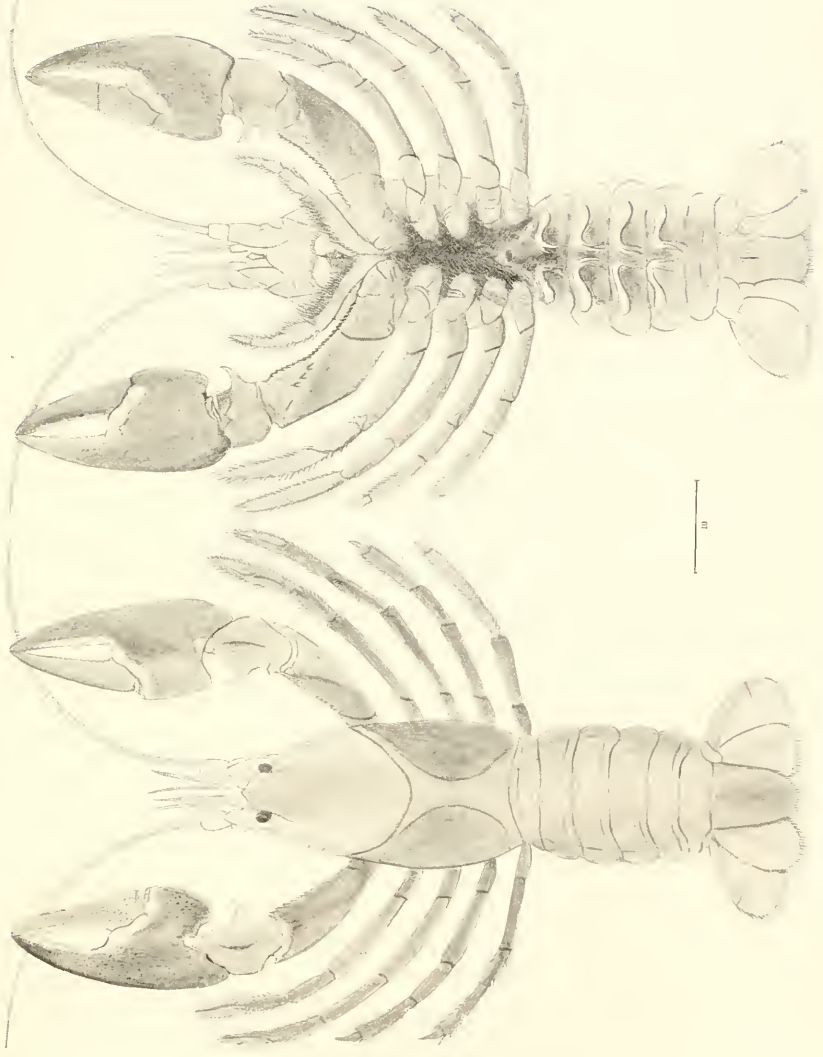
LOBSTERS. *Homarus americanus* Milne-Edwards. (Larvæ.)



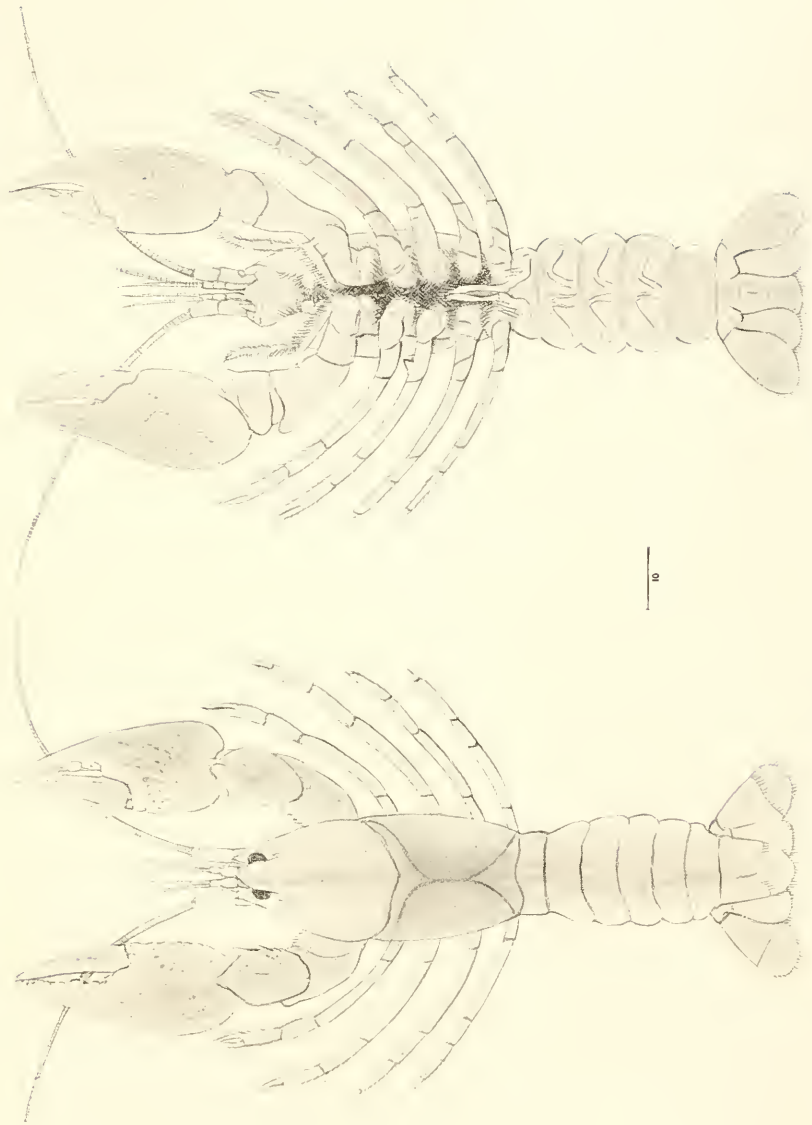
LOBSTERS. *Homarus americanus* Milne-Edwards. (Young.)



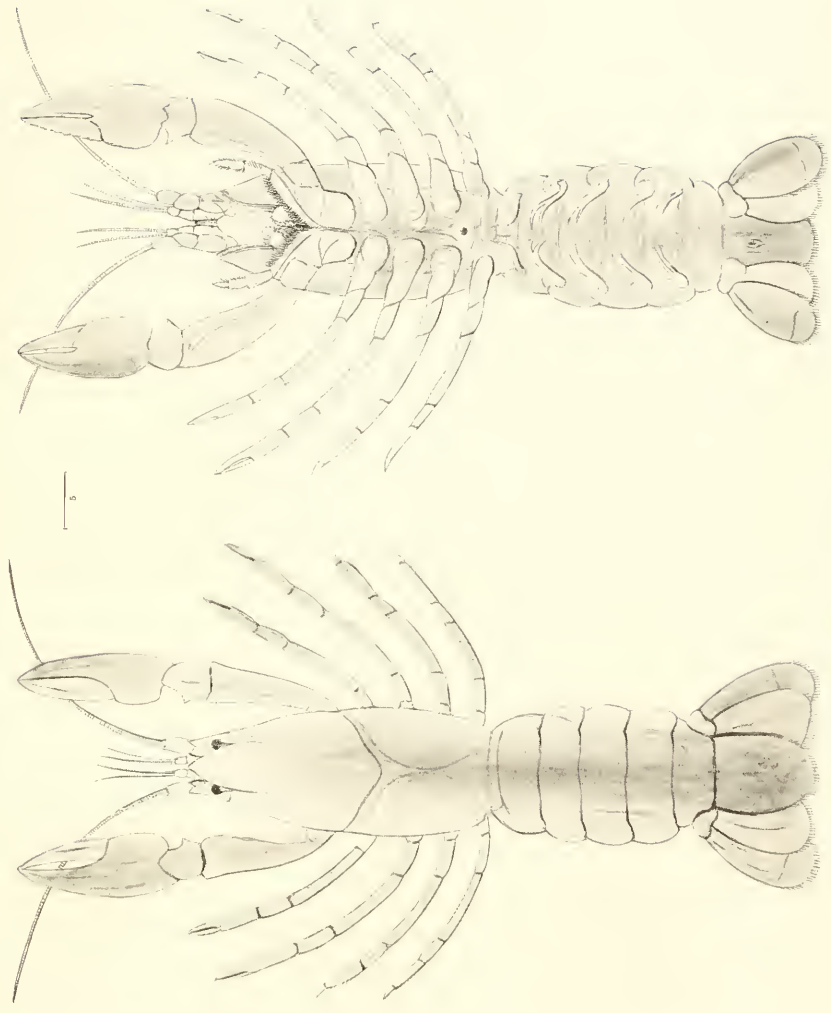
BROOK CRAWFISH. *Cambarus bartonii* (Fabricius). (Male.)



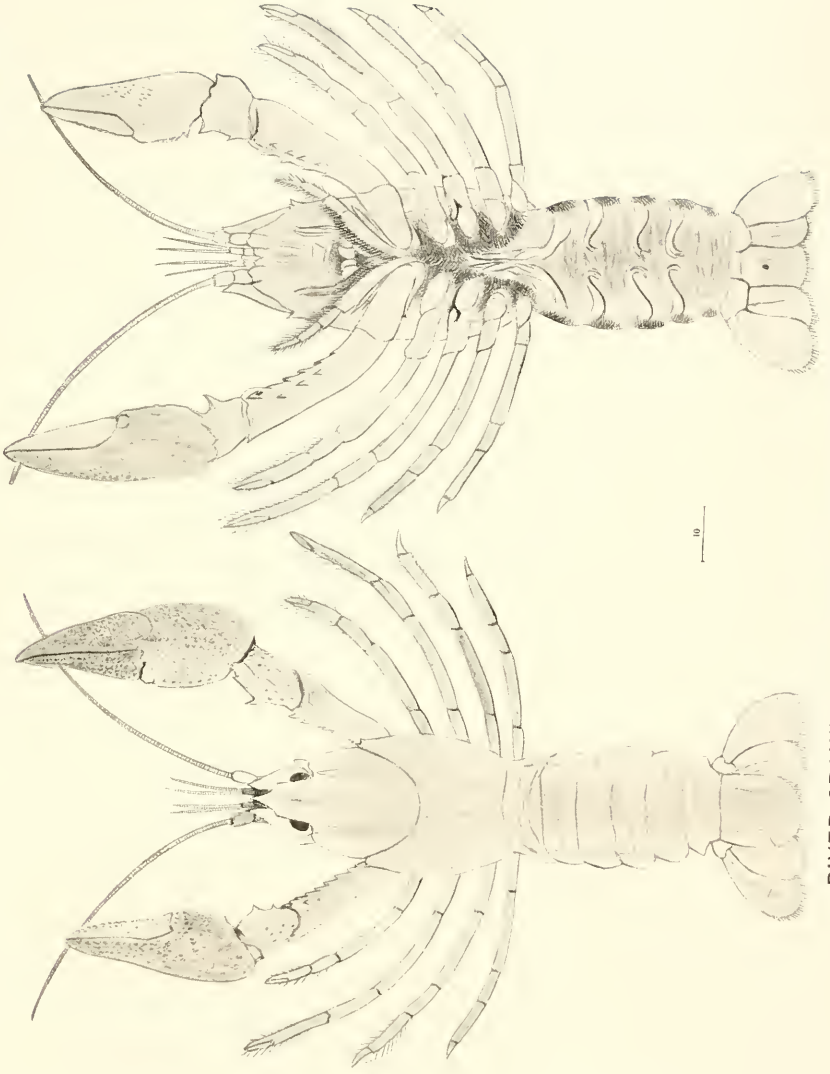
BROOK CRAWFISH. *Cambarus bartonii* (Fabricius). (Female.)



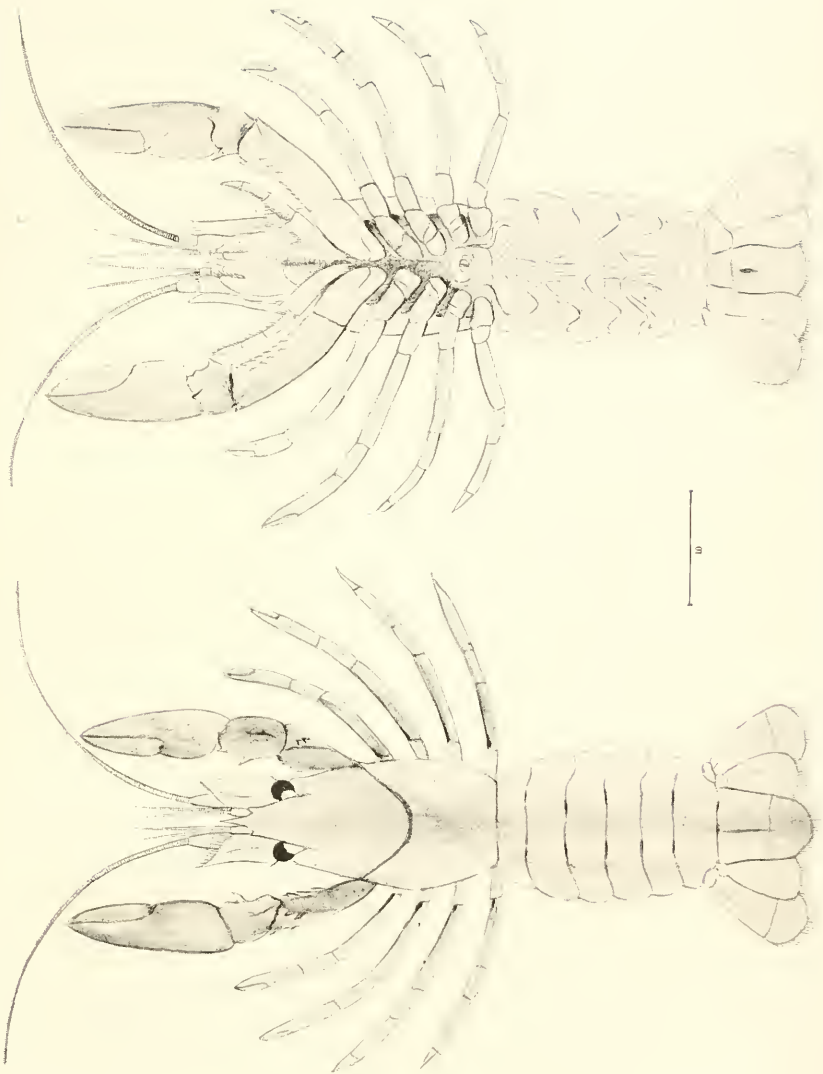
CHIMNEY CRAWFISH *Cambarus diogenes* Girard. (Male.)



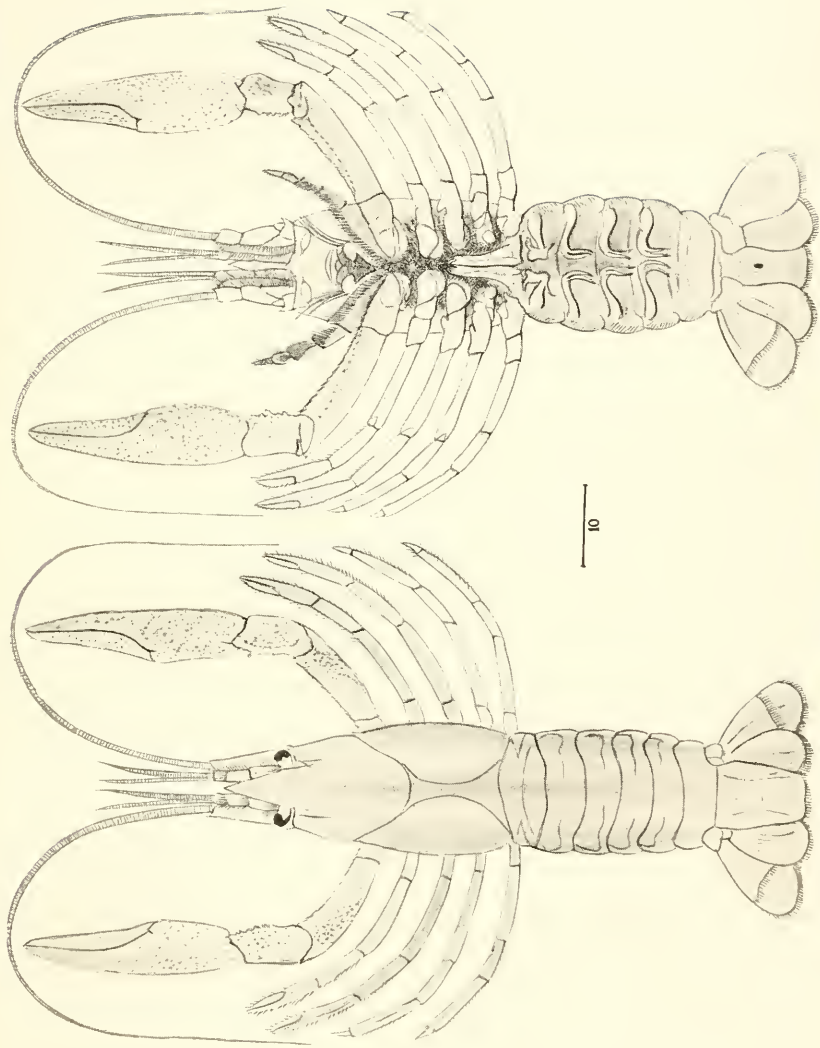
CHIMNEY CRAWFISH. *Cambarus diogenes* Girard. (Female.)



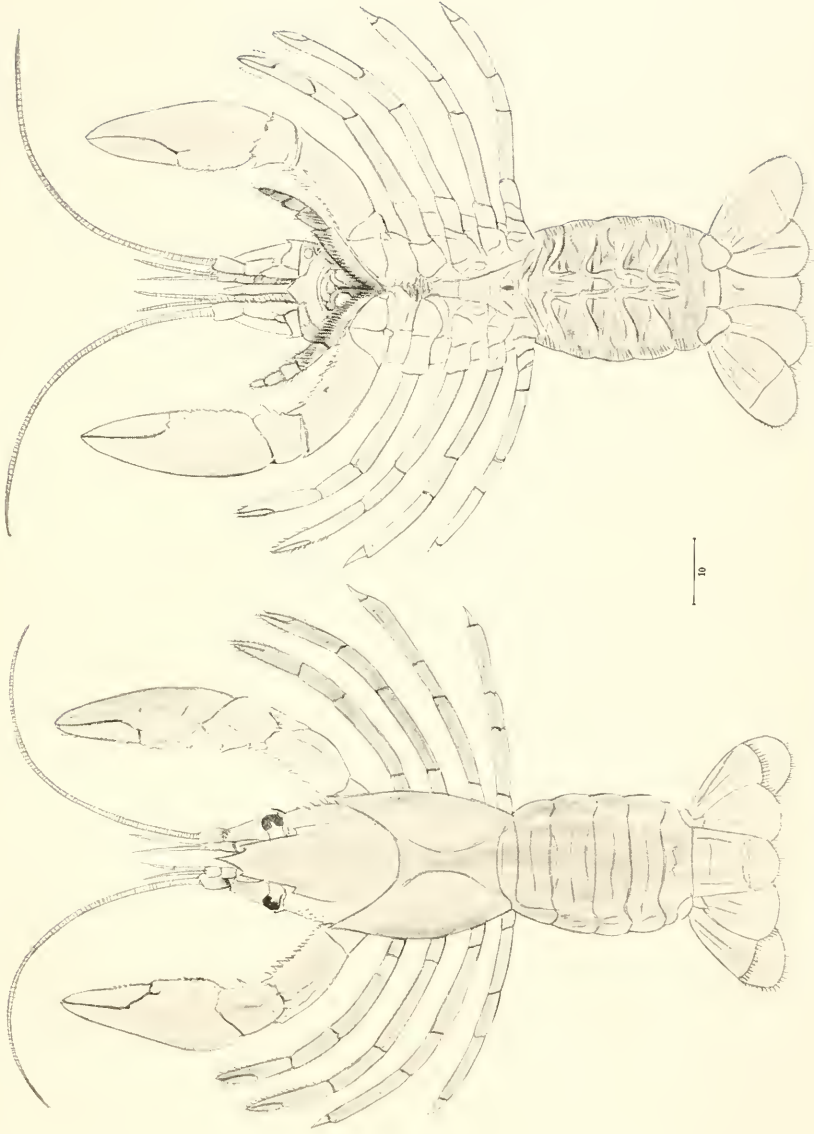
RIVER CRAWFISH. *Cambarus limosus* (Rafinesque). (Male.)



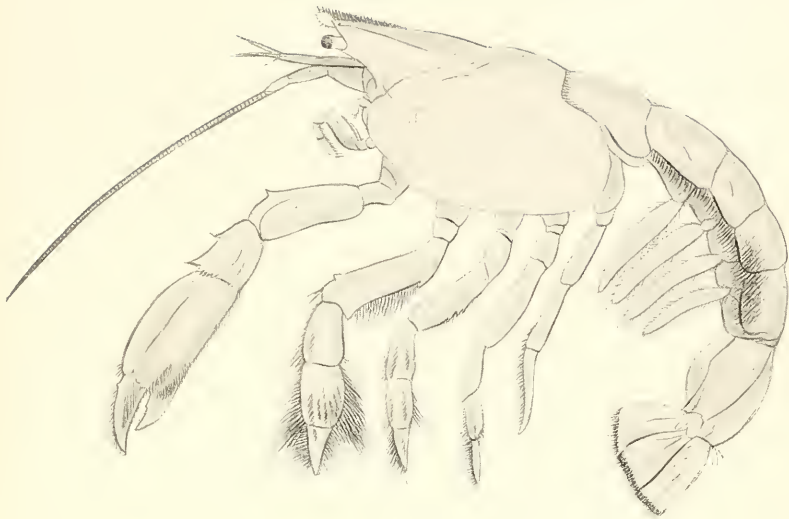
RIVER CRAWFISH. *Cambarus limosus* (Rafinesque). (Female.)



BLANDING'S CRAWFISH. *Cambarus blandinii* (Harlan). (Male.)



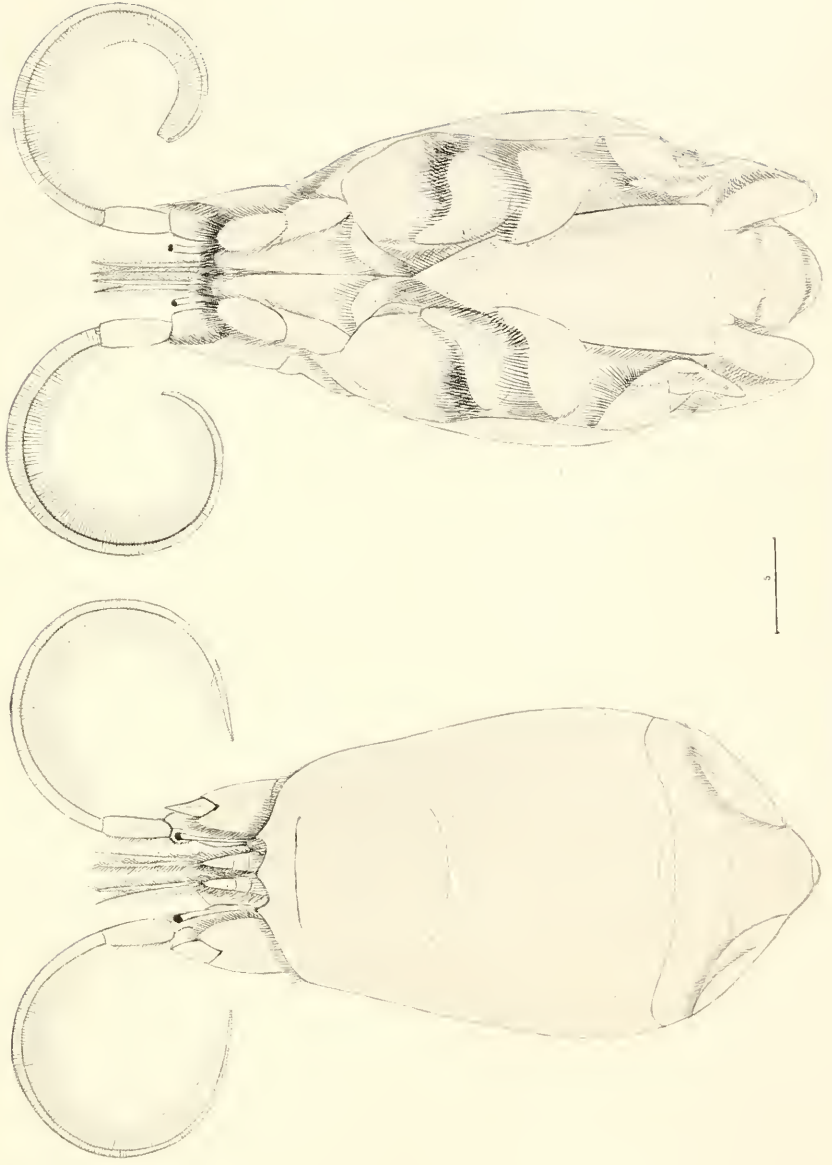
BLANDING'S CRAWFISH. *Cambarus blandinii* (Harlan). (Female.)



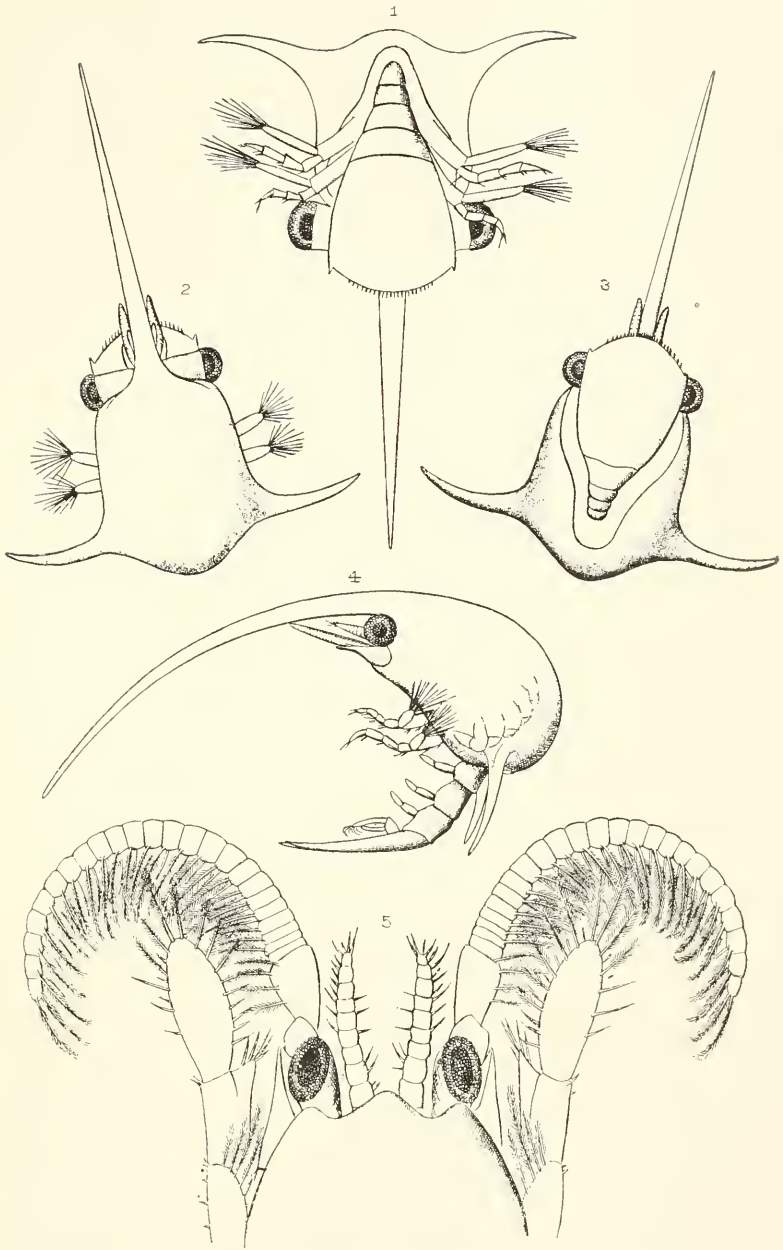
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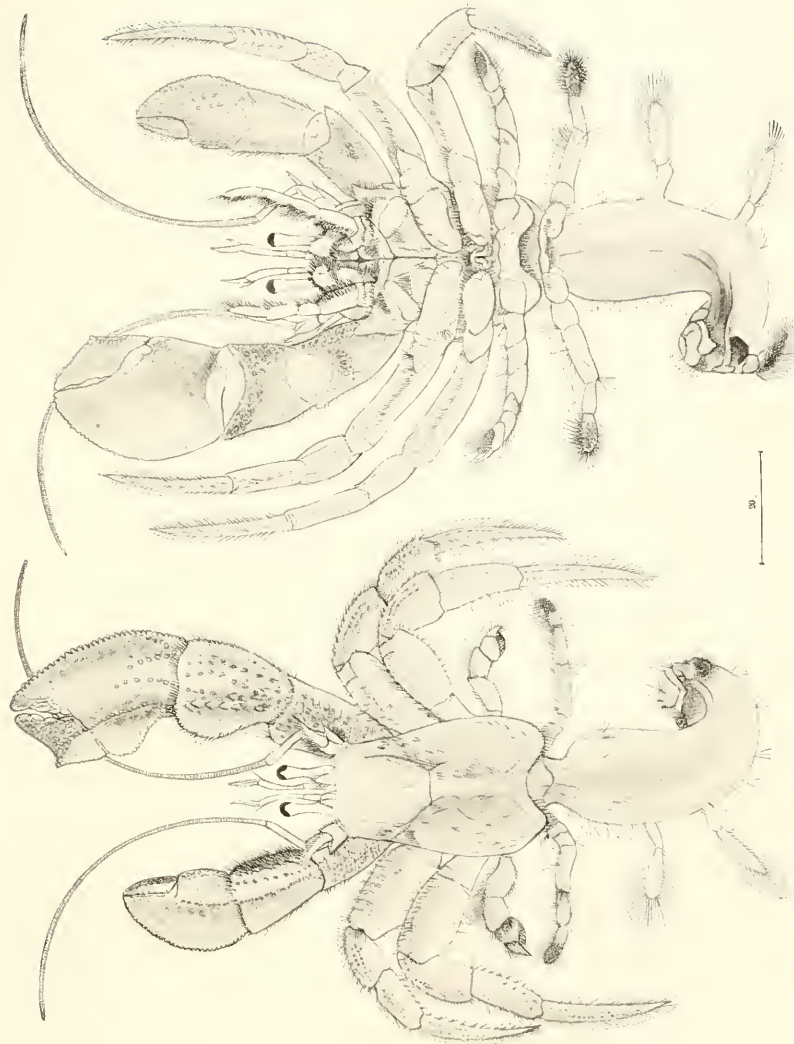
Upogebia affinis (Say).
(Upper figure, male; lower, female.)



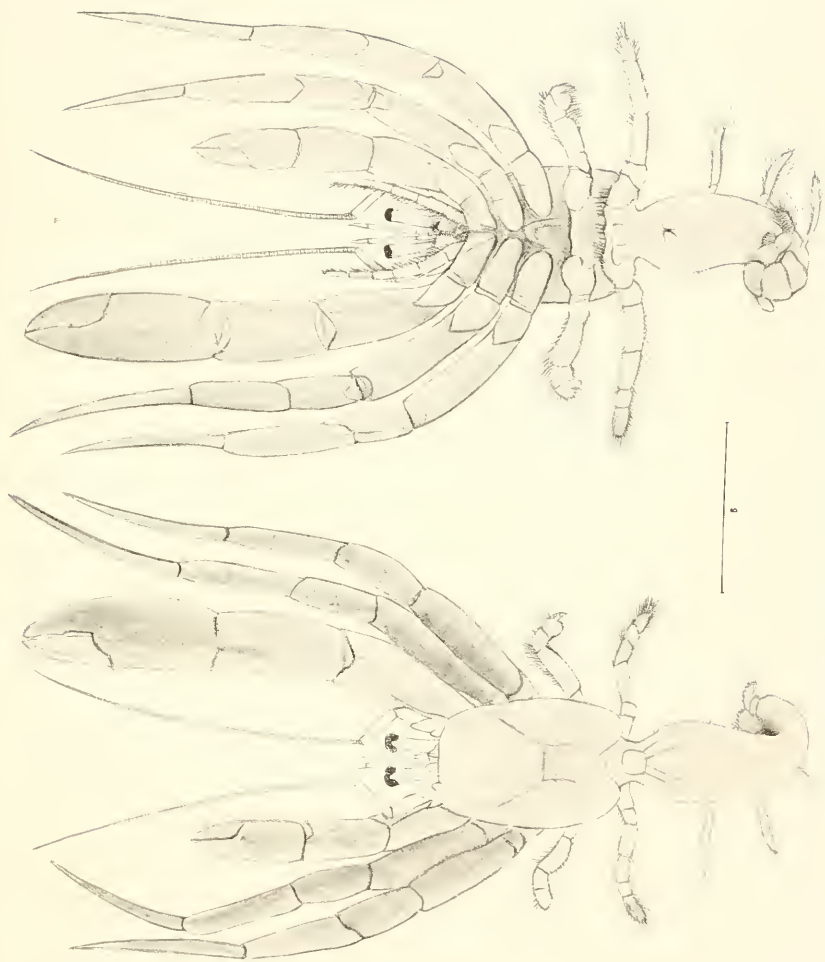
SAND BUGS. *Emerita talpoida* (Say).



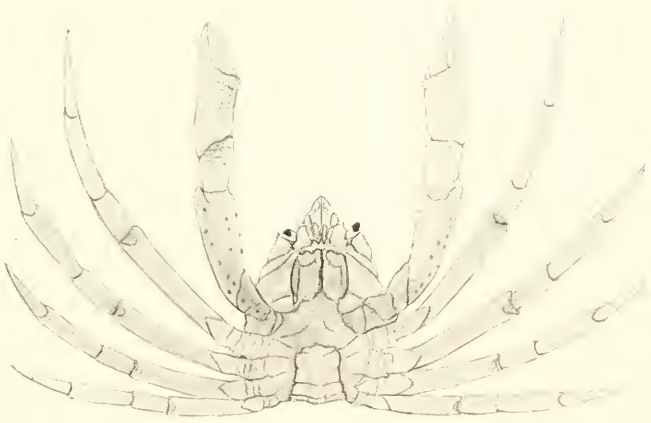
SAND BUGS. *Emerita talpoida* (Say). (Young.)



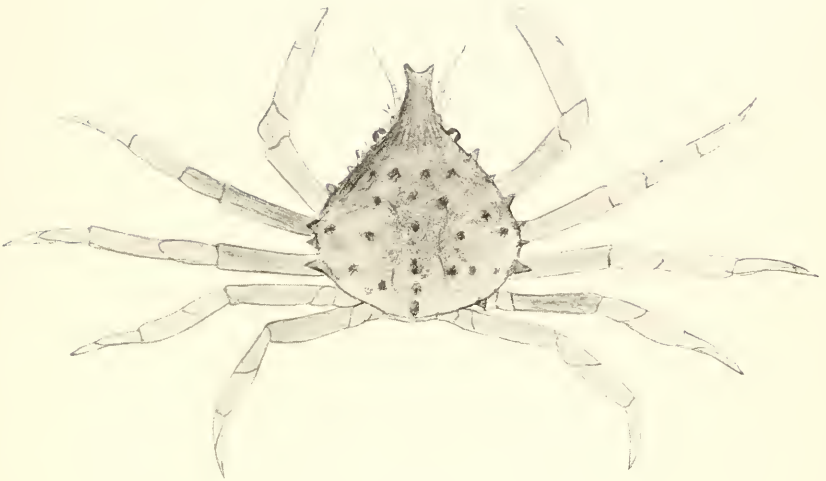
HERMIT CRAB. *Pagurus pollicaris* Say.



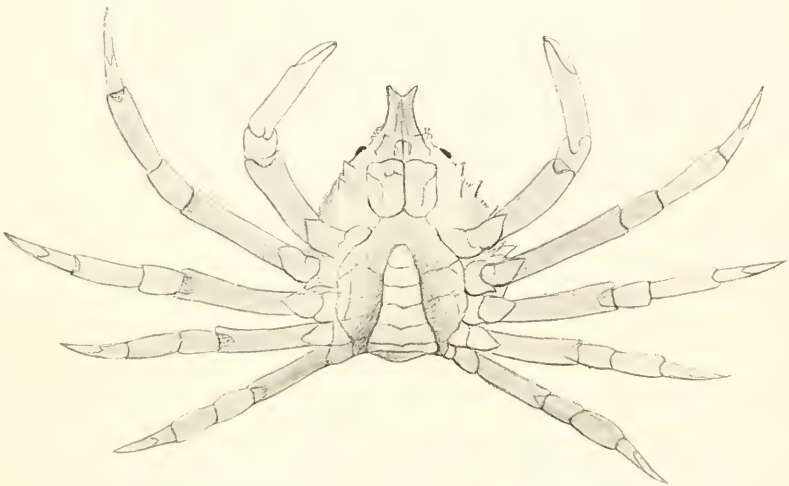
LONG-ARMED HERMIT CRAB. *Pagurus longicarpus* Say.



TOAD CRAB. *Hyas coarctatus* Leach.



— 30 —



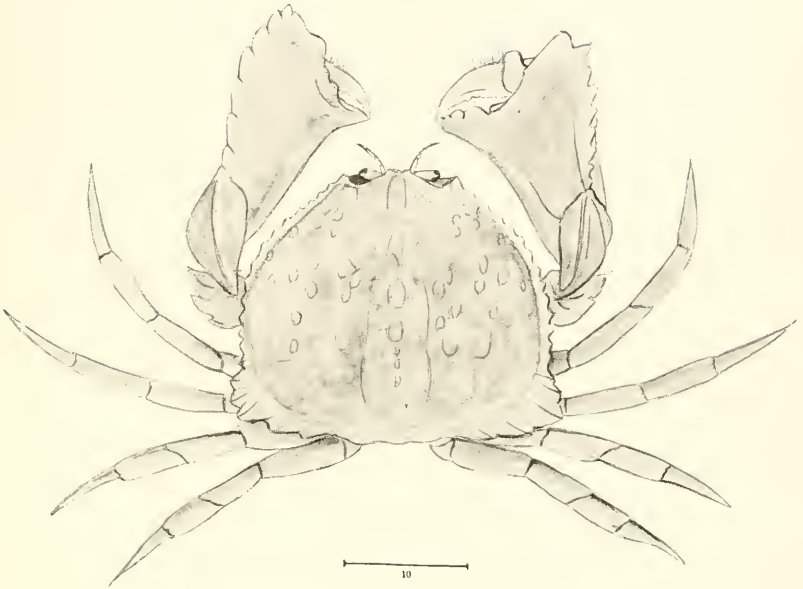
SPIDER CRAB. *Libinia dubia* Milne-Edwards.



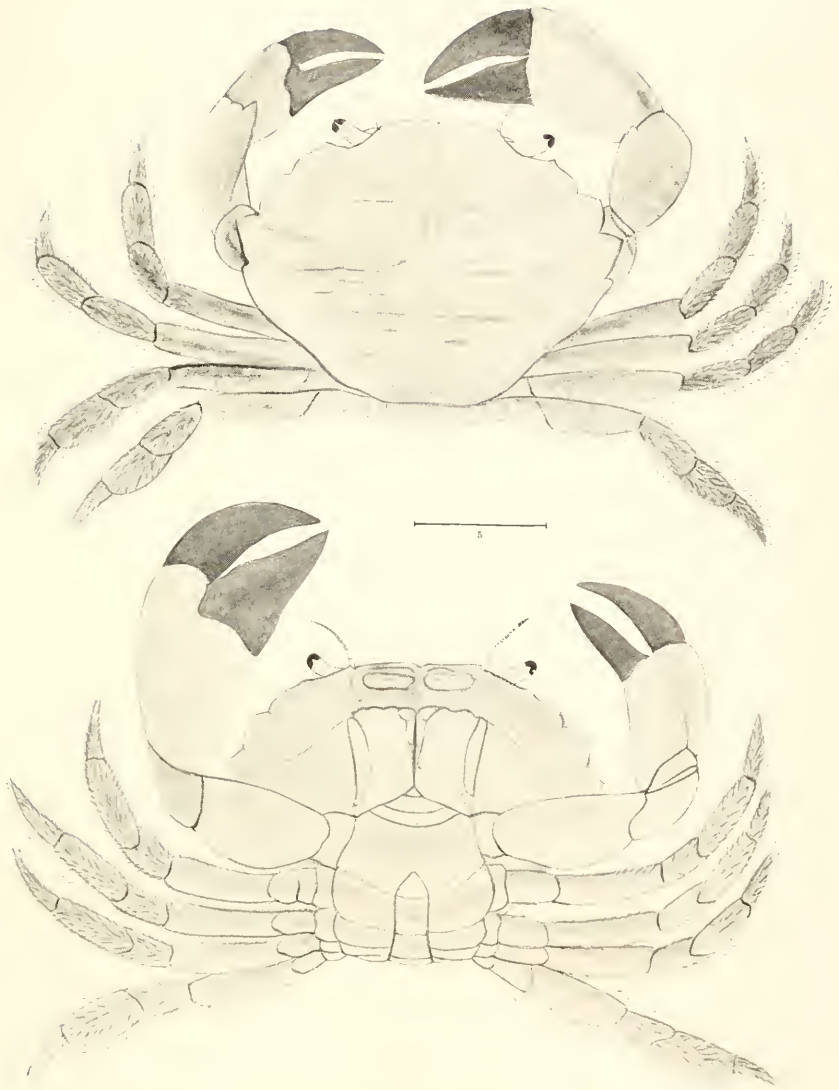
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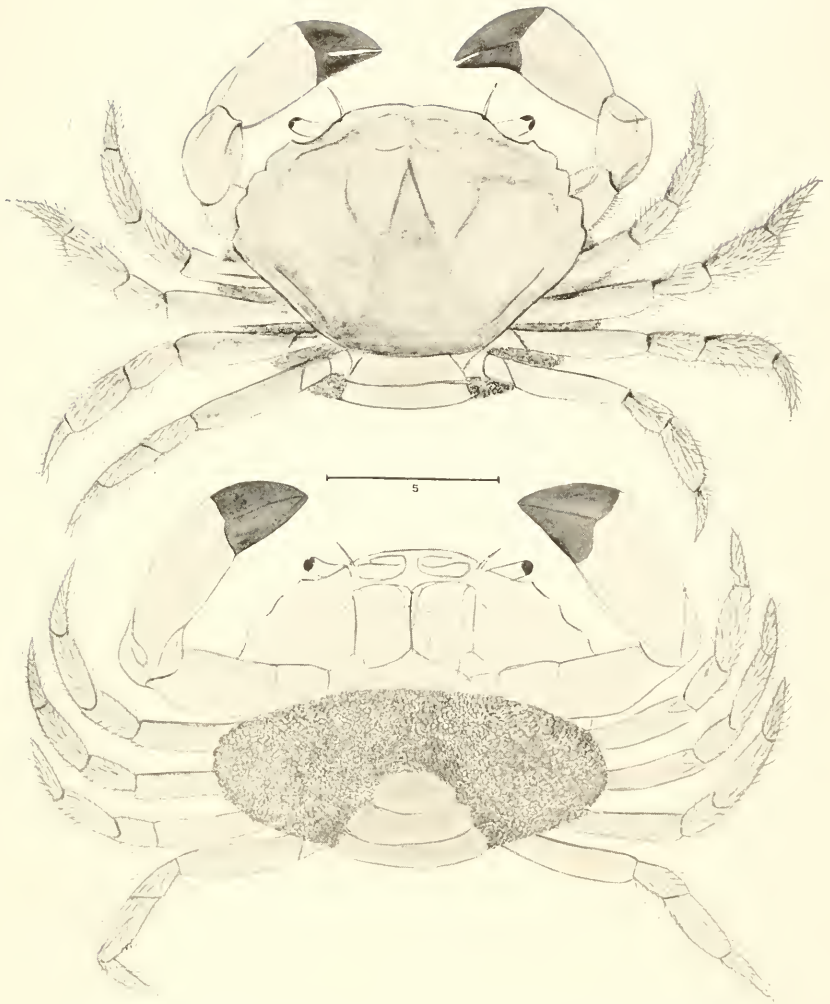
SPIDER CRAB. *Libinia emarginata* Leach.



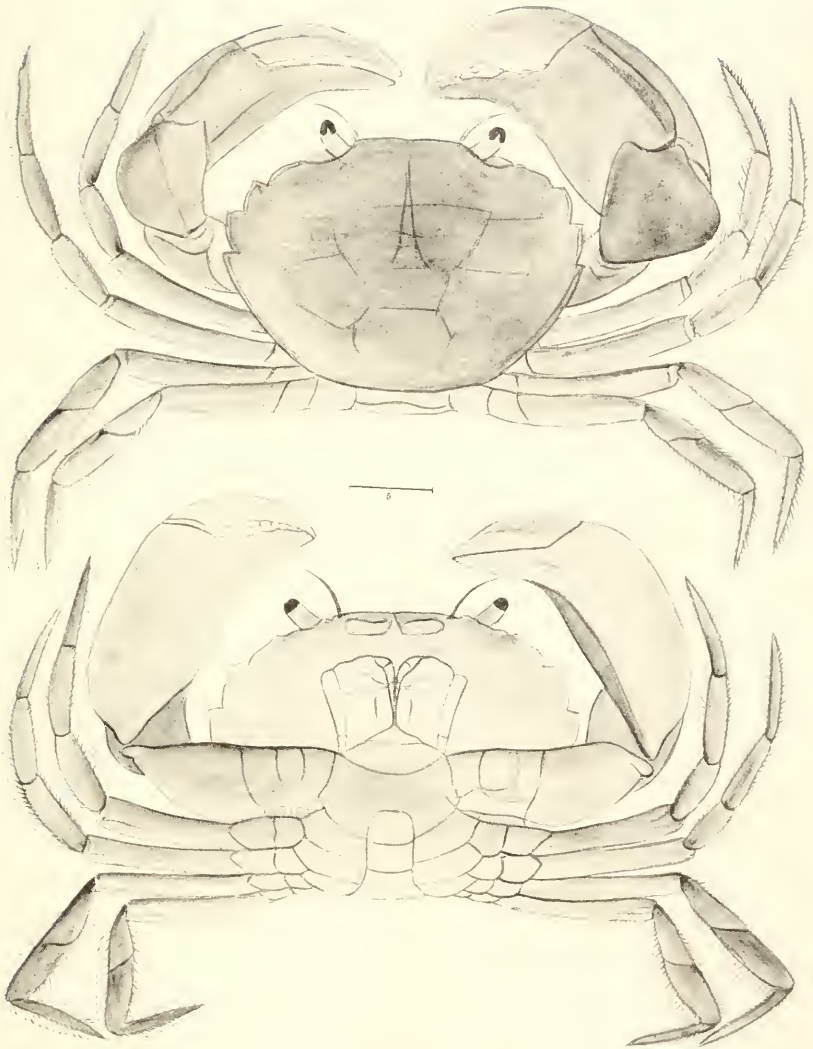
BOX CRAB. *Calappa flammea* (Herbst).



MUD CRAB. *Eurypanopeus depressus* (S. I. Smith). (Male.)



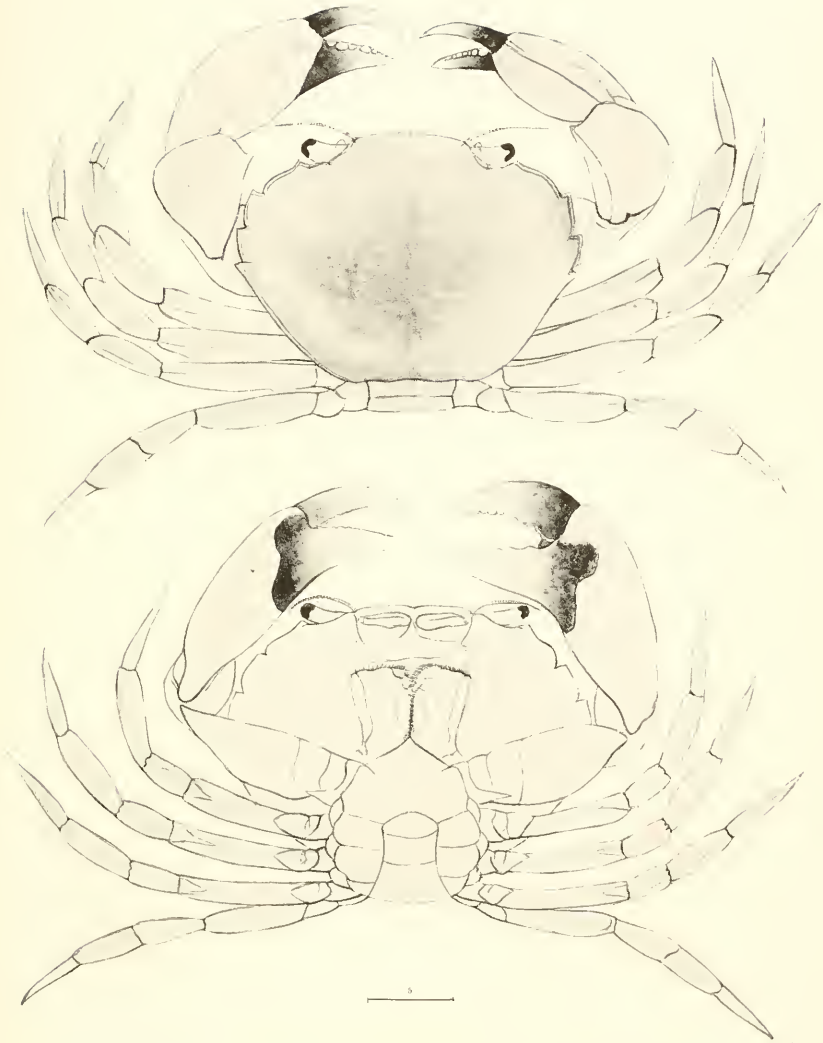
MUD CRAB. *Eurypanopeus depressus* (S. I. Smith). (Female.)



HARRIS'S CRAB. *Rhithropanopeus harrisi* (Gould). (Male.)



HARRIS'S CRAB. *Rhithropanopeus harrisi* (Gould). (Female.)



SAY'S CRAB. *Neopanope texana sayi* (S. I. Smith). (Male.)



HERBST'S CRAB. *Epanopeus herbstii* (Milne-Edwards). (Male.)



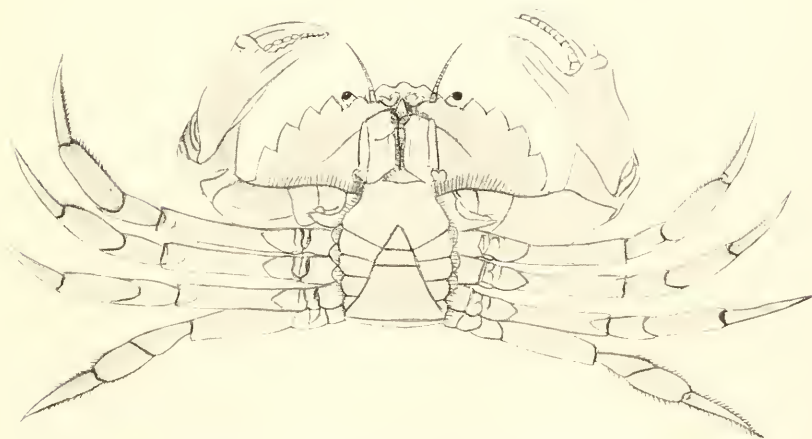
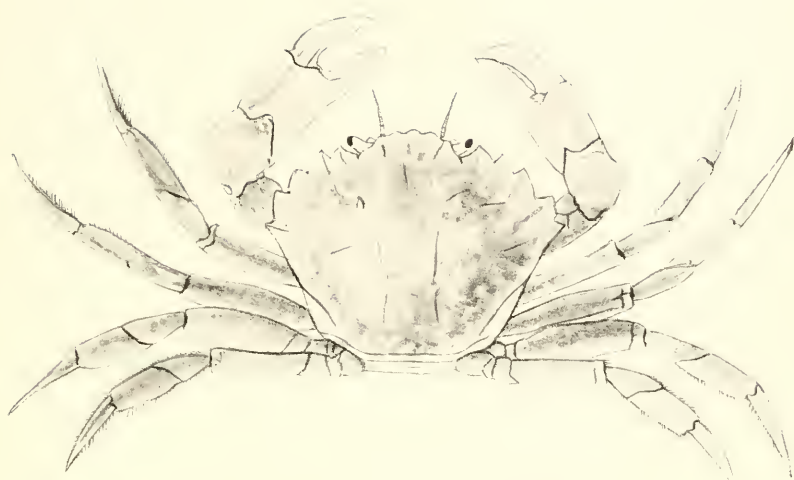
HERBST'S CRAB. *Eupanopeus herbstii* (Milne-Edwards). (Female.)



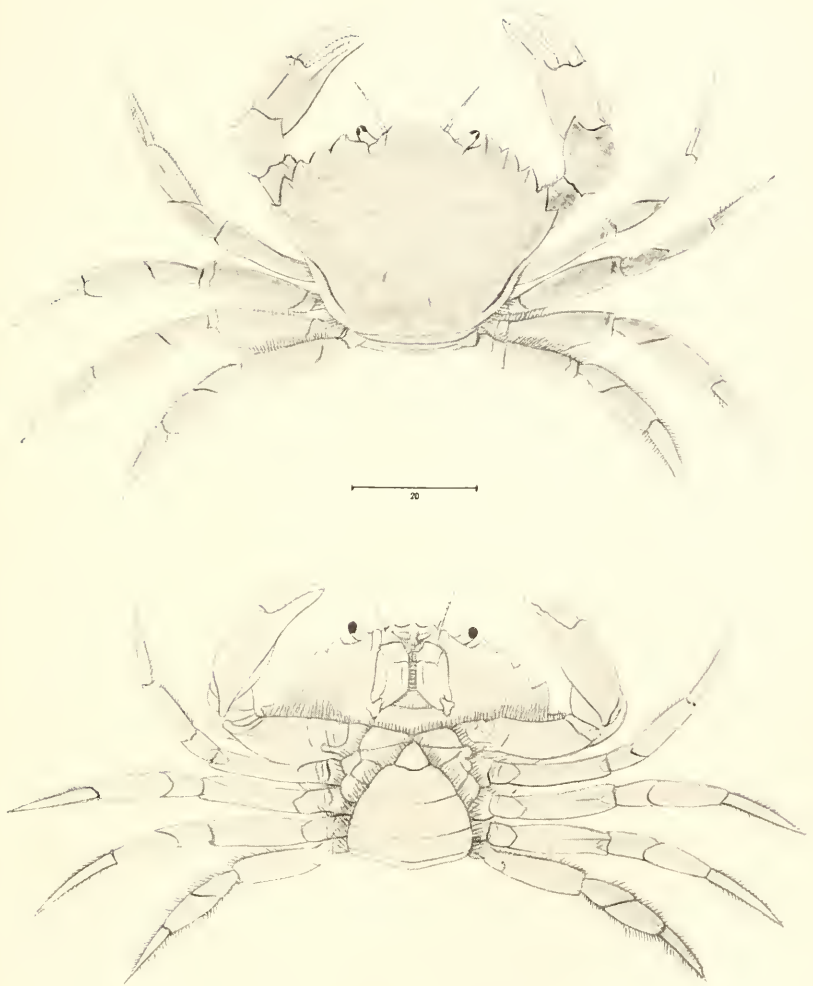
— 10 —



Eurytium limosum (Say). (Male.)



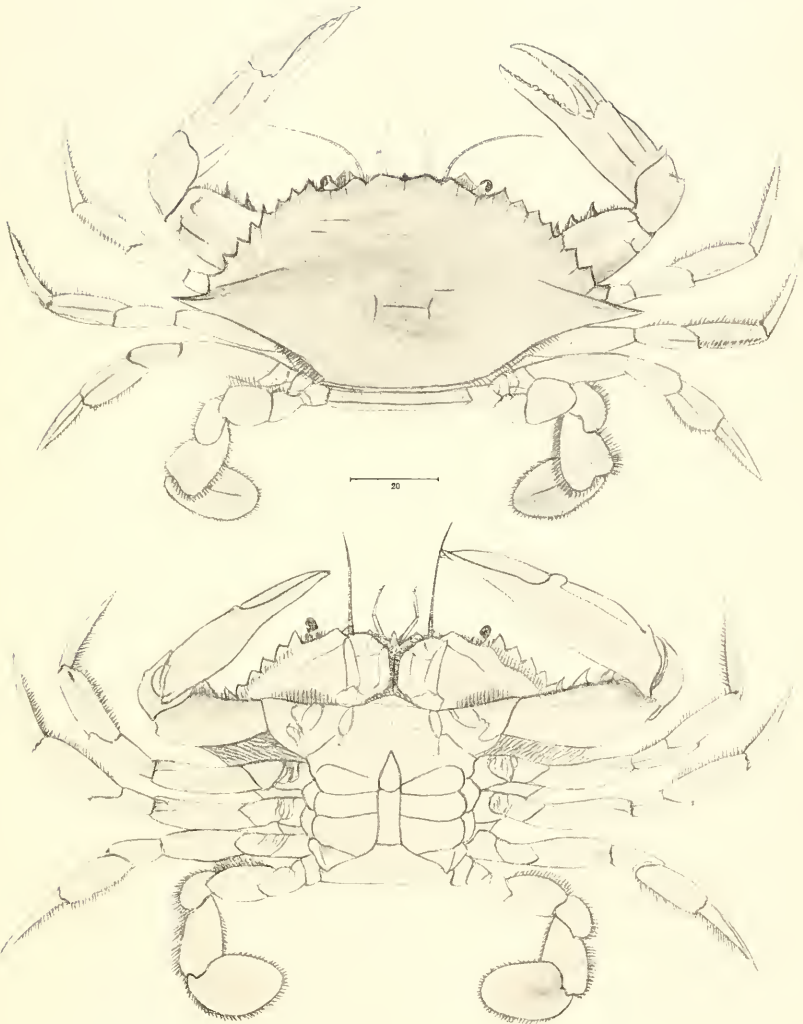
GREEN CRAB. *Carcinides mænas* (Linnæus). (Male.)



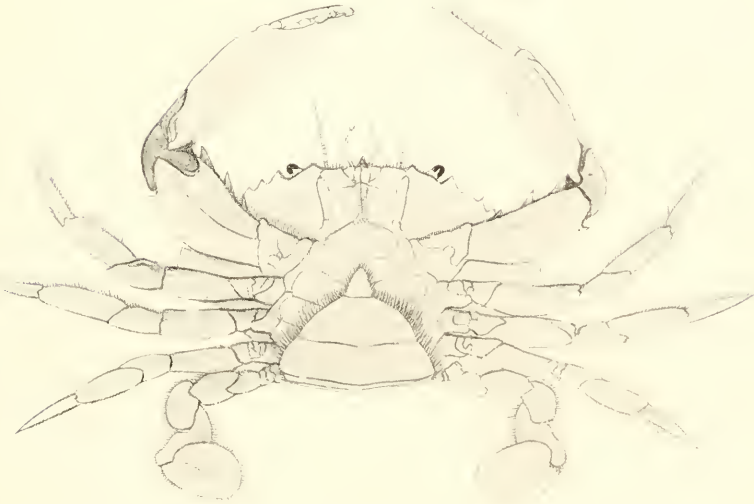
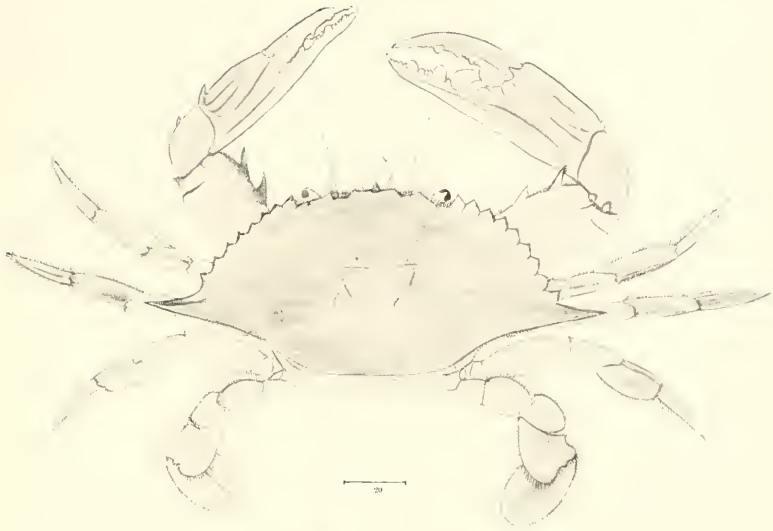
GREEN CRAB. *Carcinides mænas* (Linnæus). (Female.)



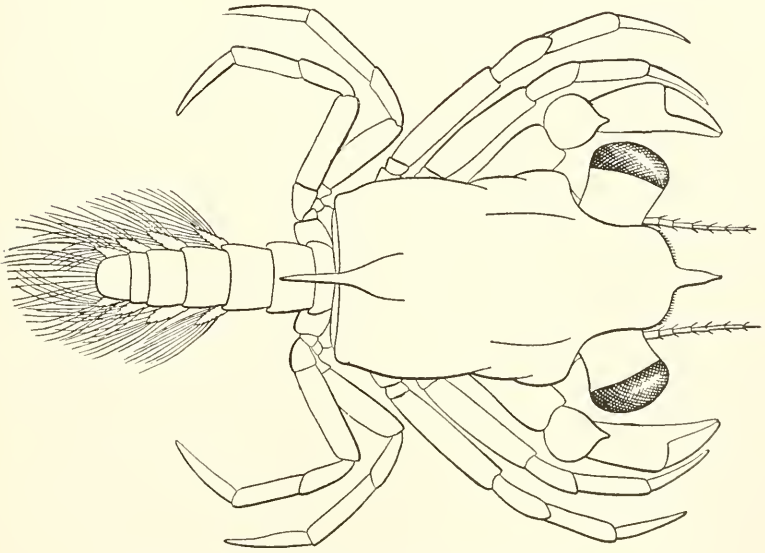
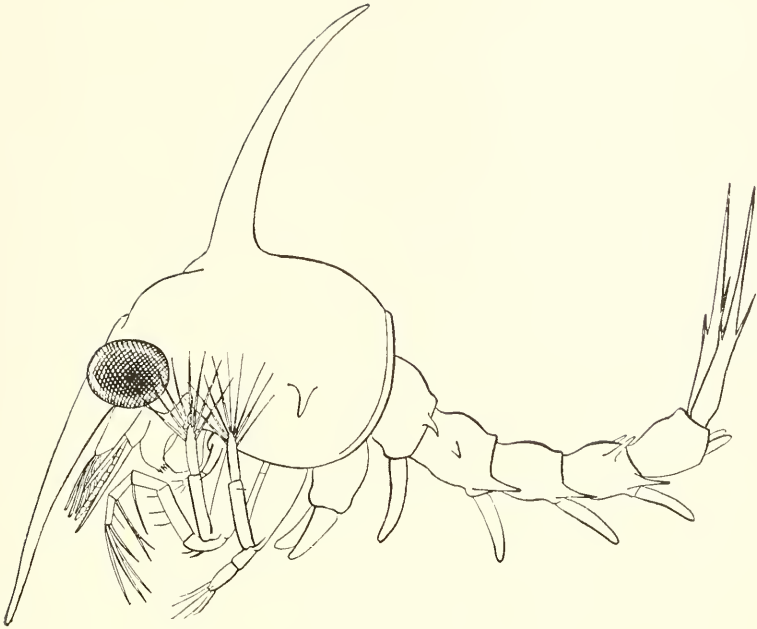
Arenarius cribrarius (Lamarck). (Male.)



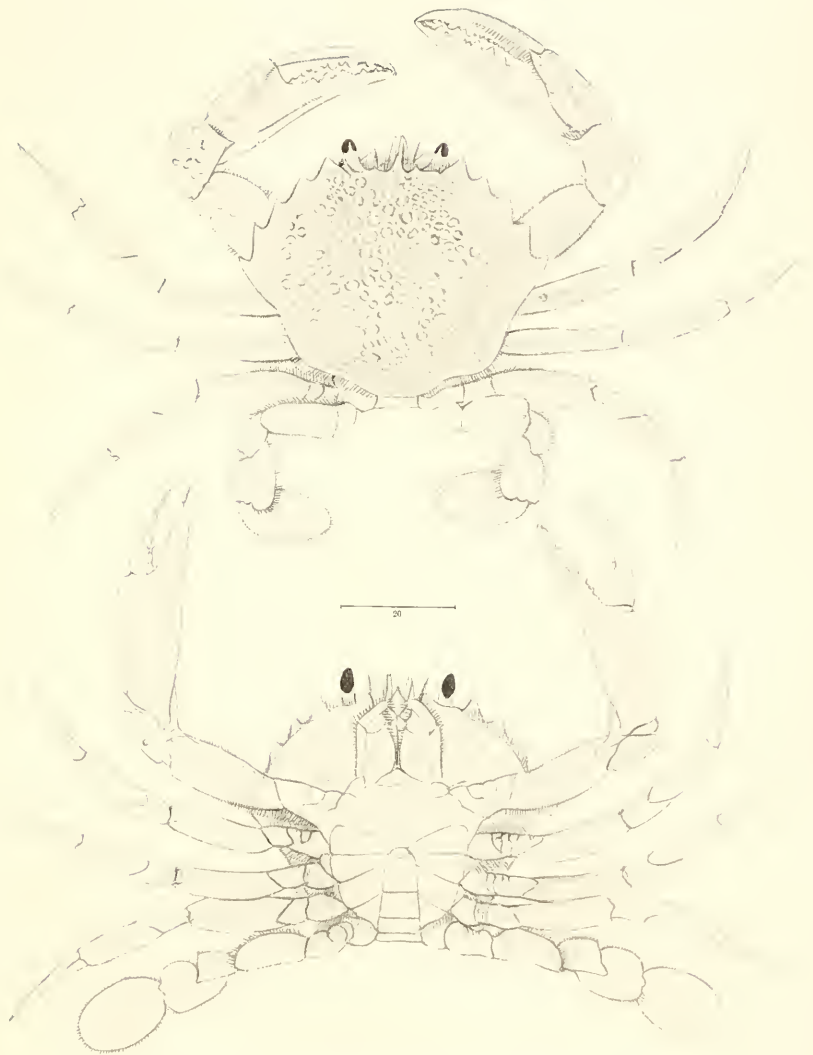
BLUE CRAB. *Callinectes sapidus* M. J. Rathbun. (Male.)



BLUE CRAB. *Callinectes sapidus* M. J. Rathbun. (Female.)



BLUE CRAB. *Callinectes sapidus* M. J. Rathbun.
(Zoea upper figure, megalops lower figure.)



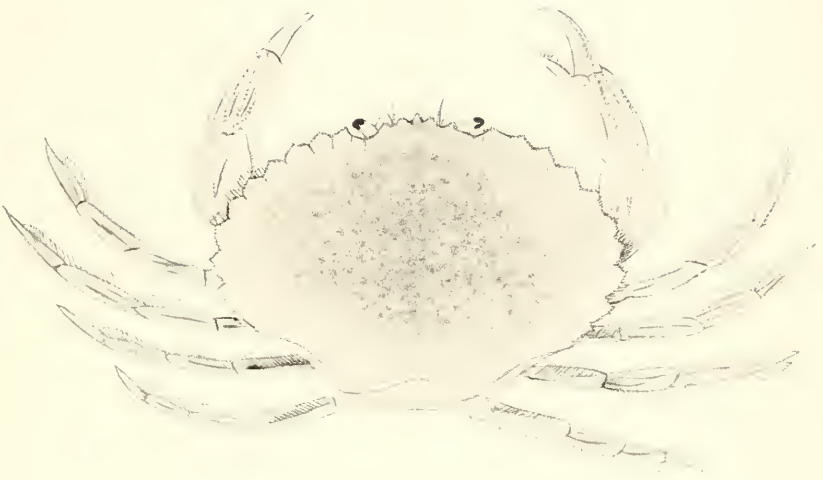
LADY CRAB. *Ovalipes ocellatus* (Herbst). (Male.)



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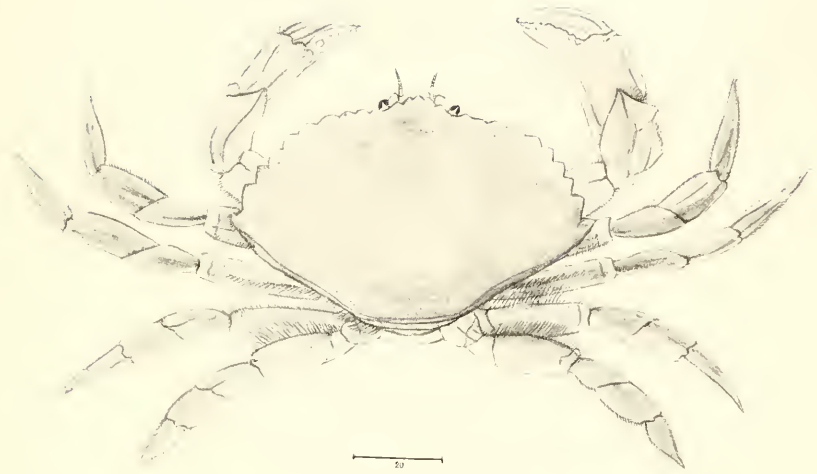
LADY CRAB. *Ovalipes ocellatus* (Herbst). (Female.)



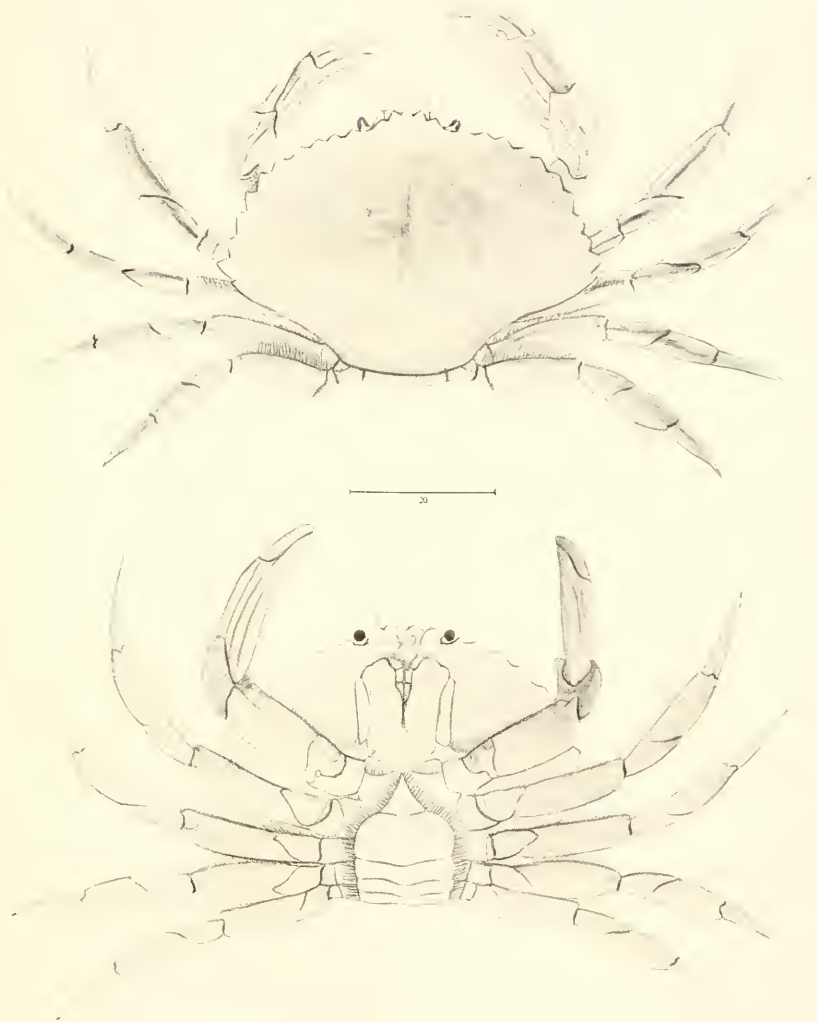
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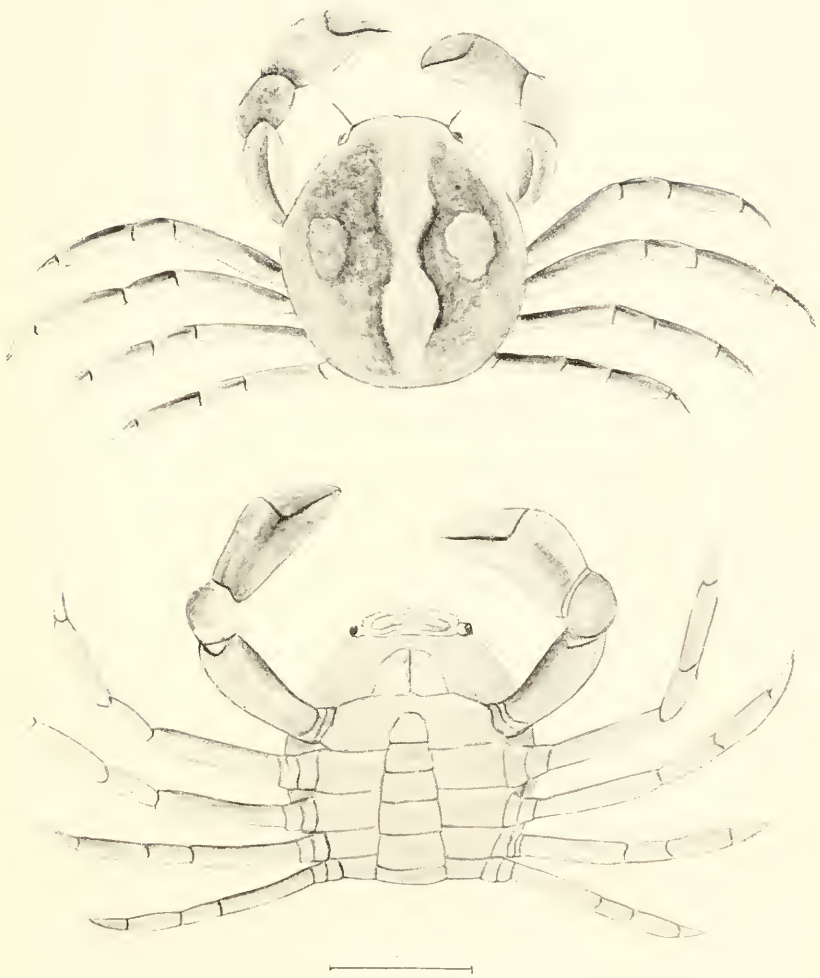
JONAH CRAB. *Cancer borealis* Stimpson. (Male.)



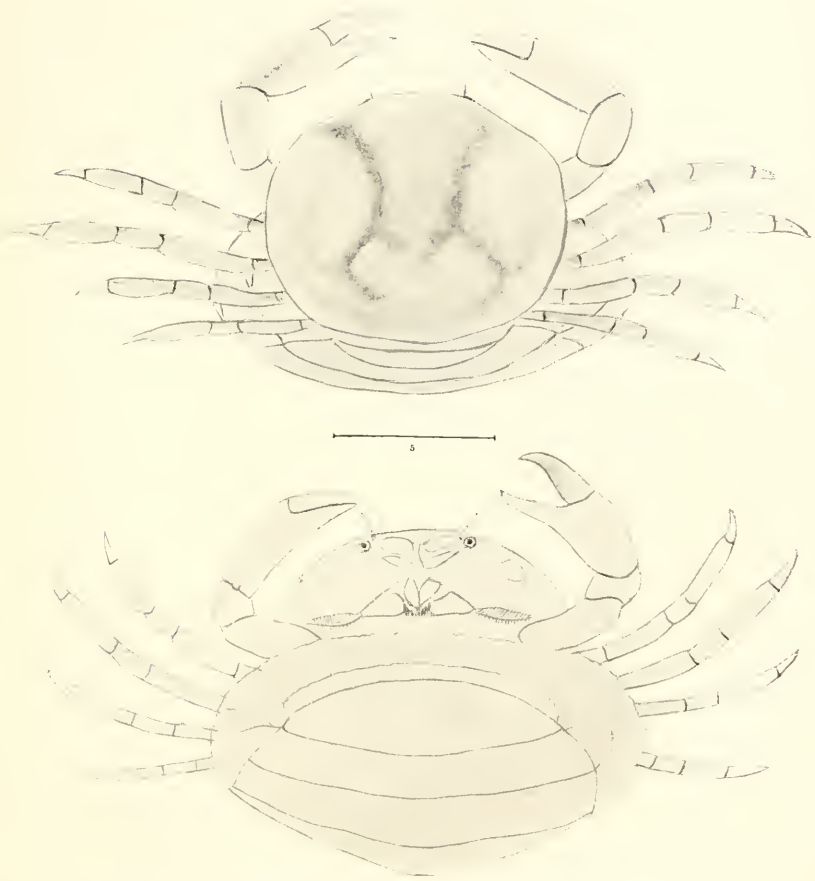
ROCK CRAB. *Cancer irroratus* Say. (Male.)



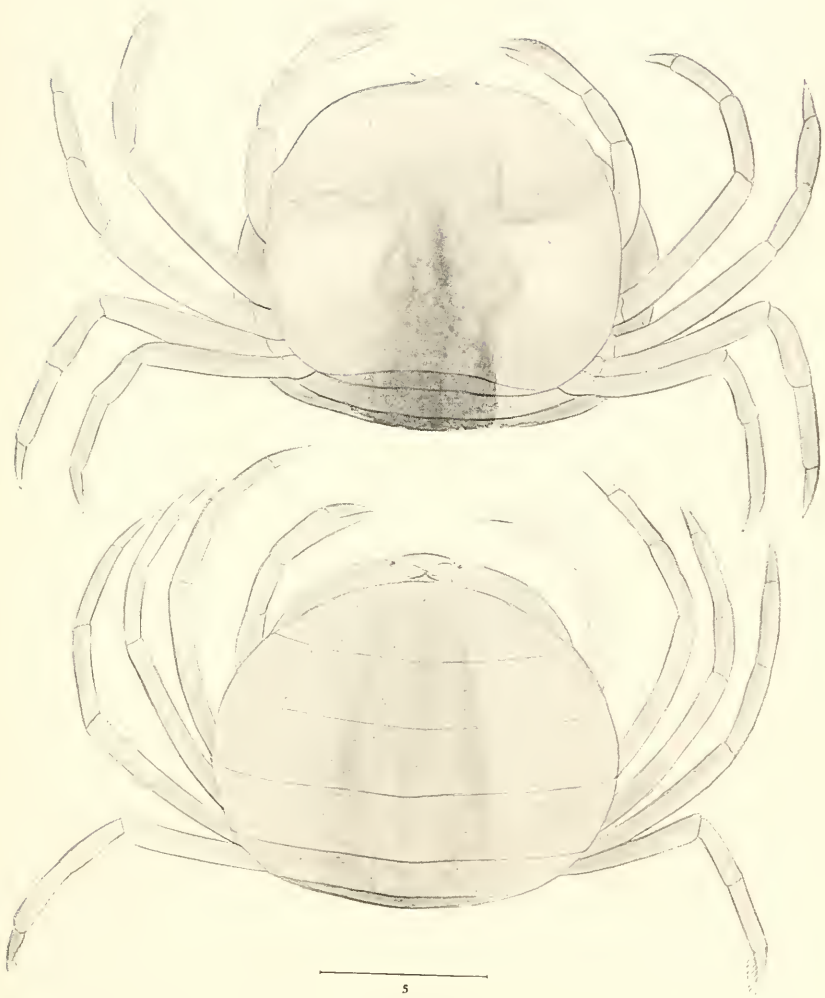
ROCK CRAB. *Cancer irroratus* Say. (Female.)



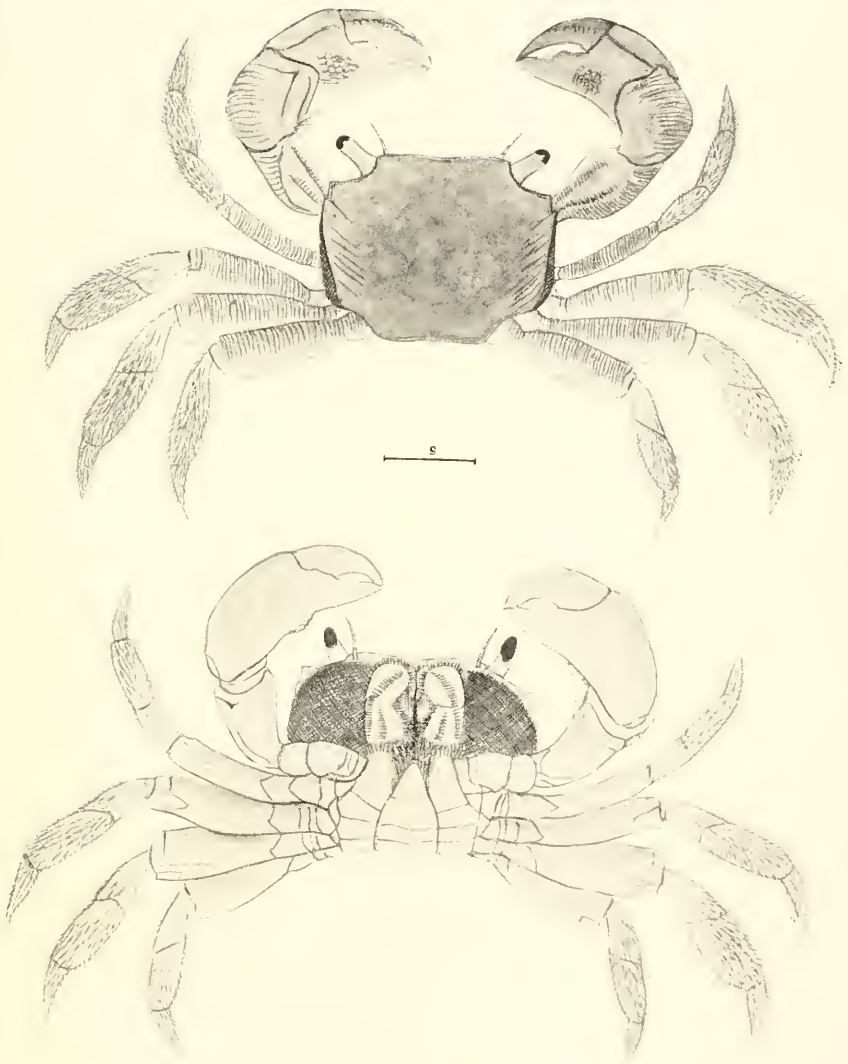
MUSSEL CRAB. *Pinnotheres macuiatus* Say. (Male.)



MUSSEL CRAB. *Pinnotheres maculatus* Say. (Female.)



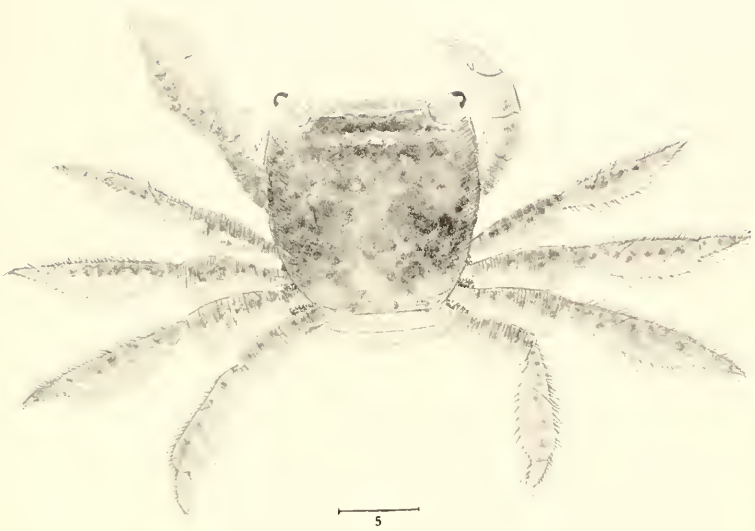
OYSTER CRAB. *Pinnotheres ostreum* Say. (Female.)



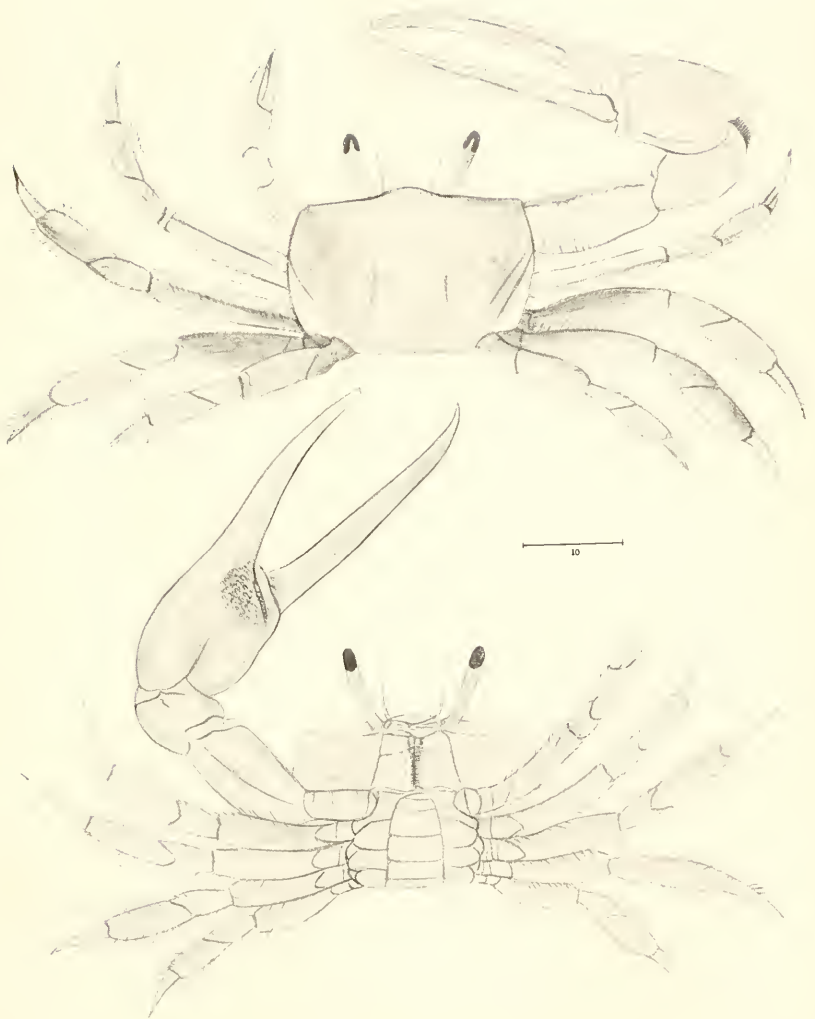
Sesarma reticulatum (Say). (Male.)



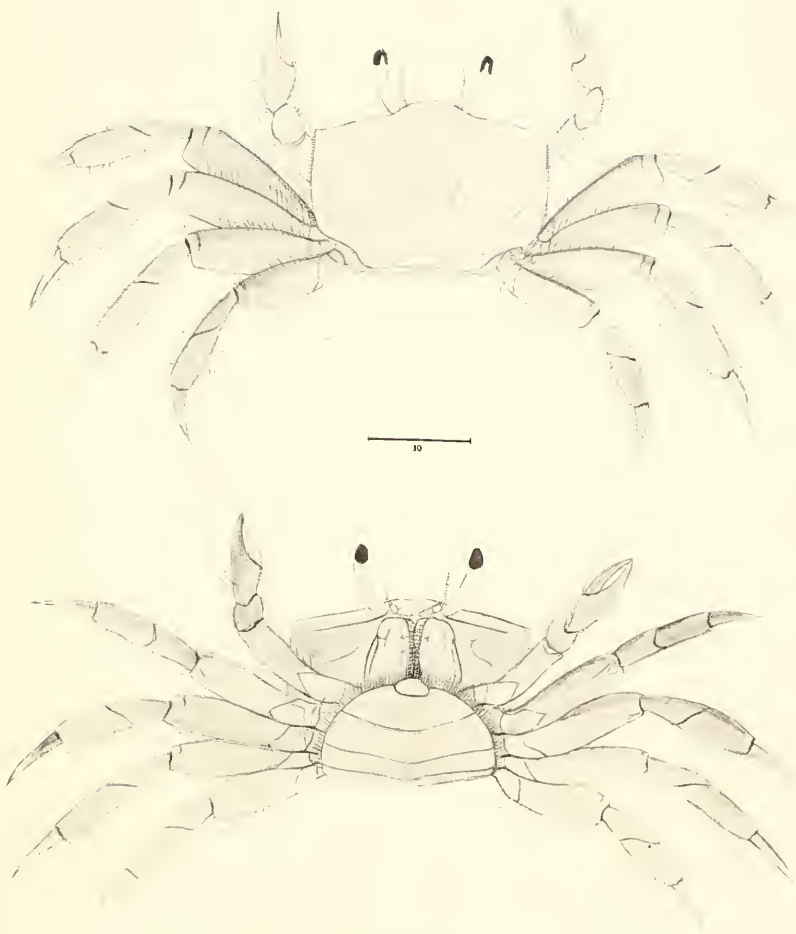
GULF-WEED CRAB. *Planes minutus* (Linnæus). (Male.)



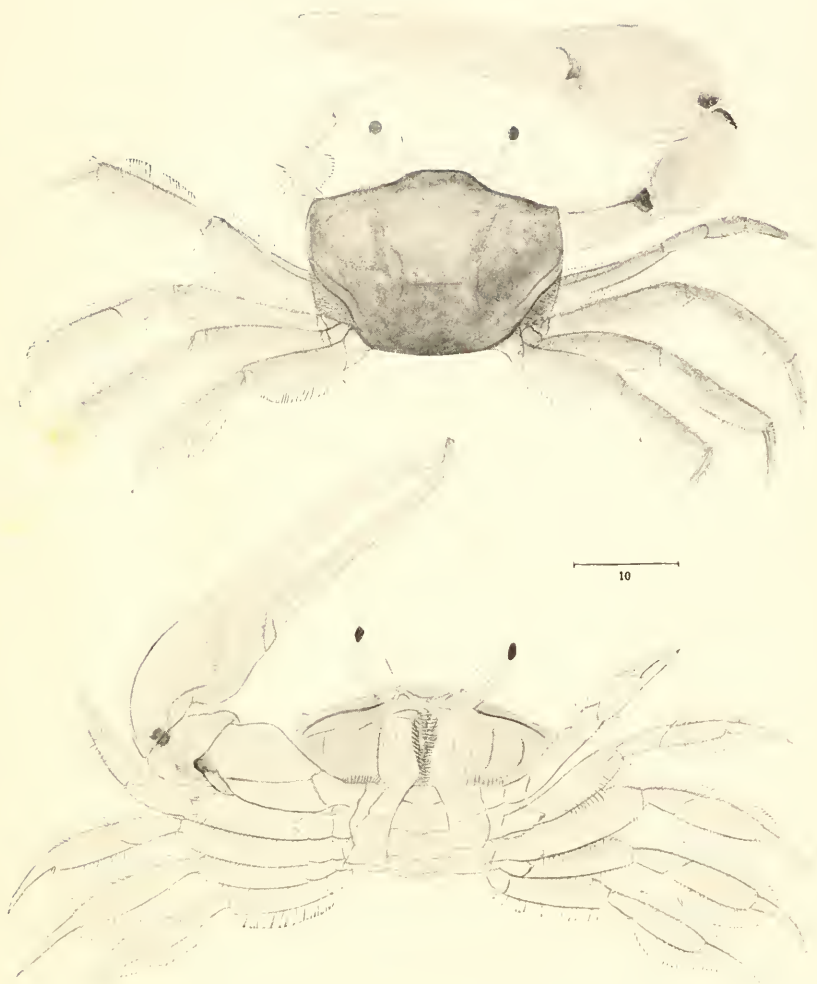
GULF-WEED CRAB. *Planes minutus* (Linnæus). (Female.)



FIDDLER CRAB. *Uca pugilator* (Bosc). (Male.)



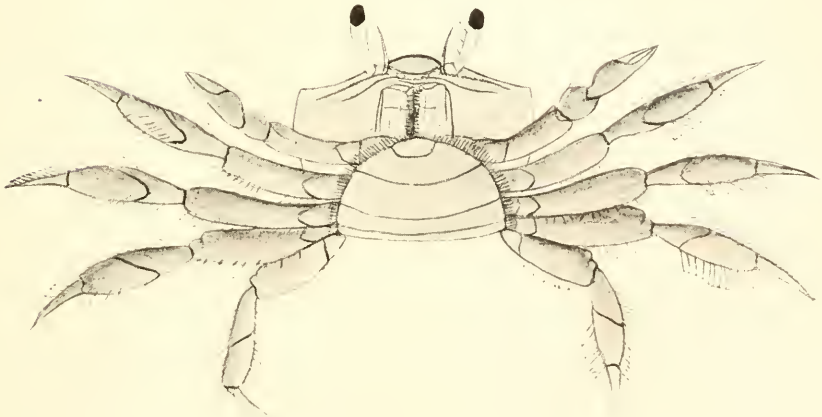
FIDDLER CRAB. *Uca pugilator* (Bosc). (Female.)



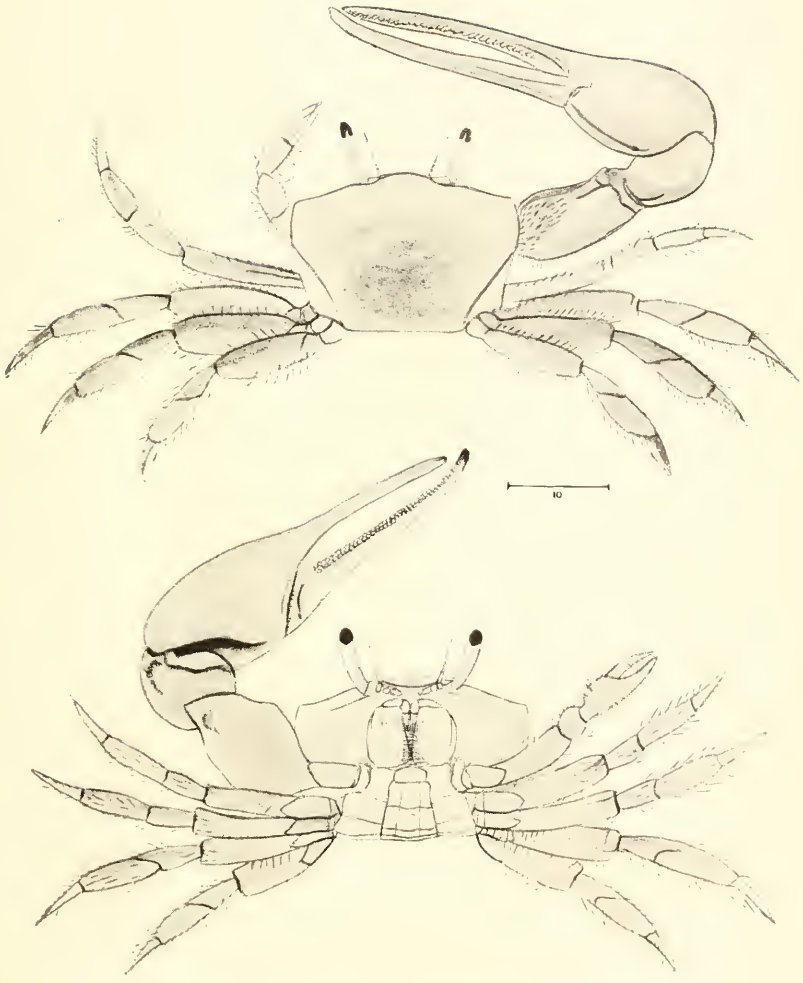
FIDDLER CRAB. *Uca minax* (Le Conte). (Male.)



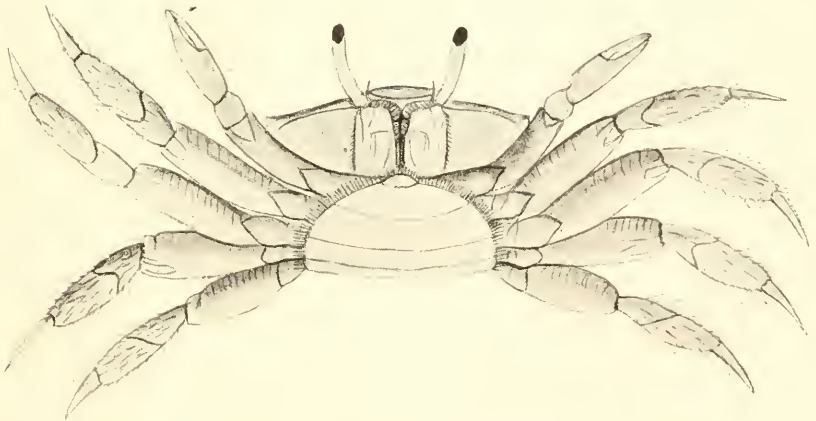
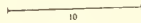
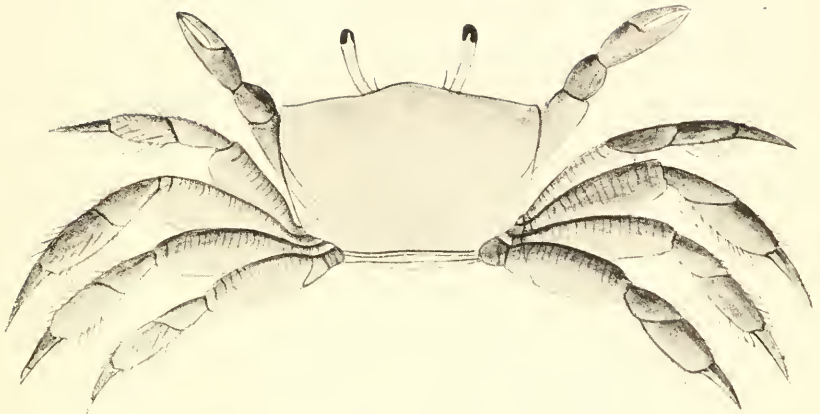
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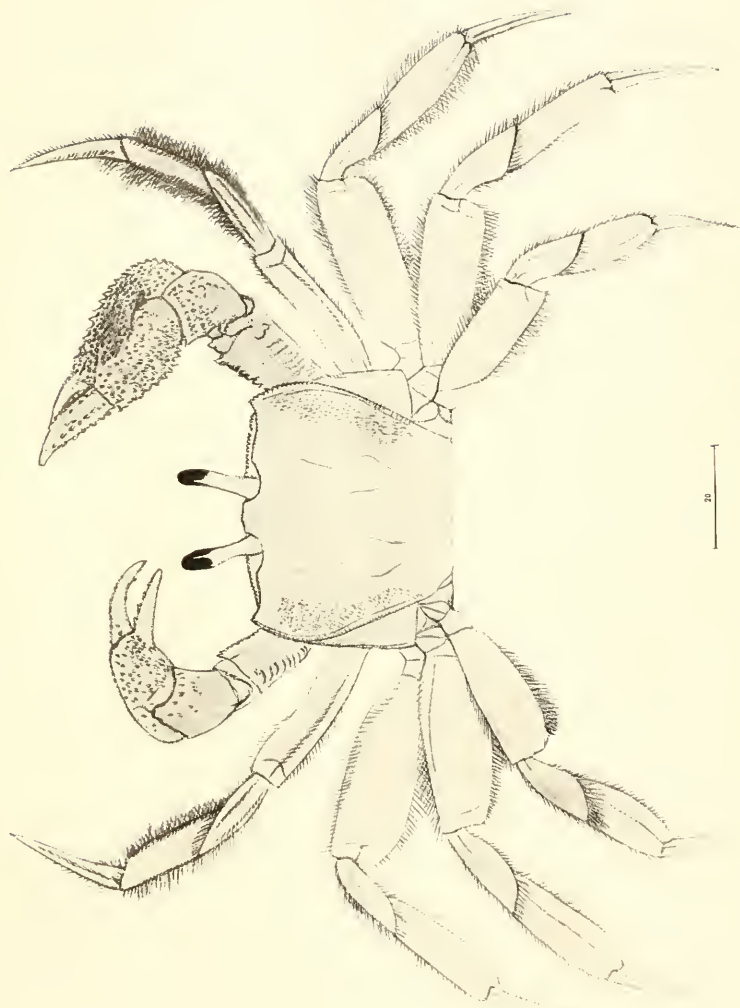
FIDDLER CRAB. *Uca minax* (Le Conte). (Female.)



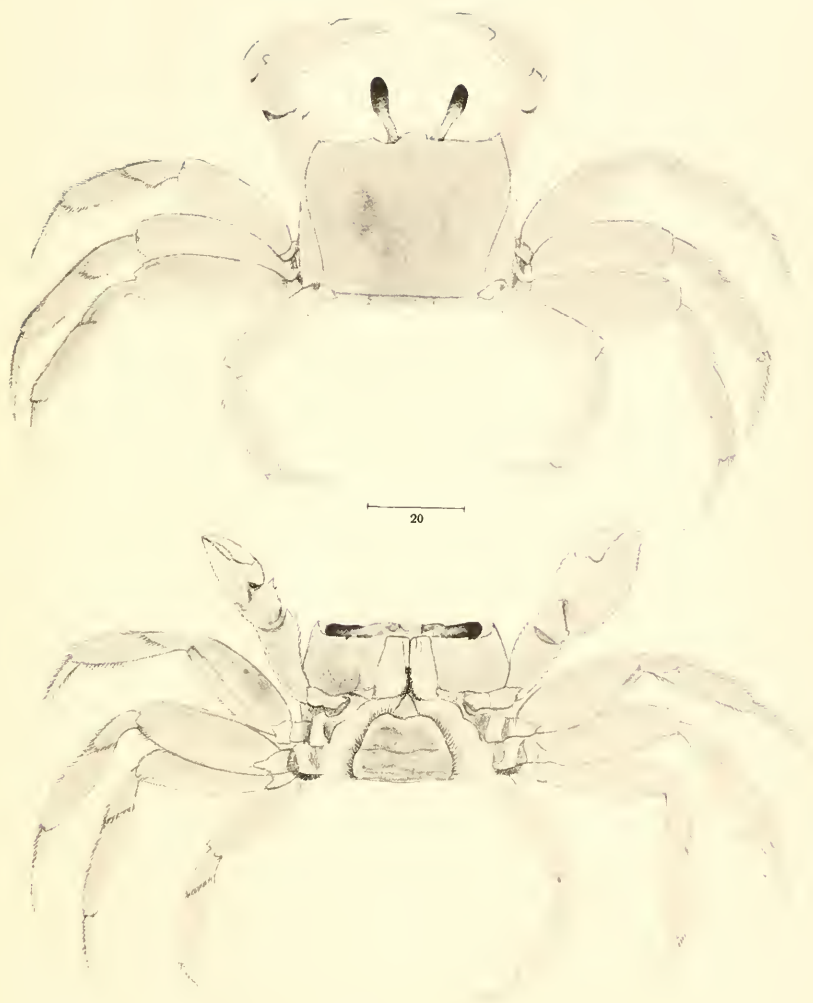
FIDDLER CRAB. *Uca pugnax* (S. I. Smith). (Male.)



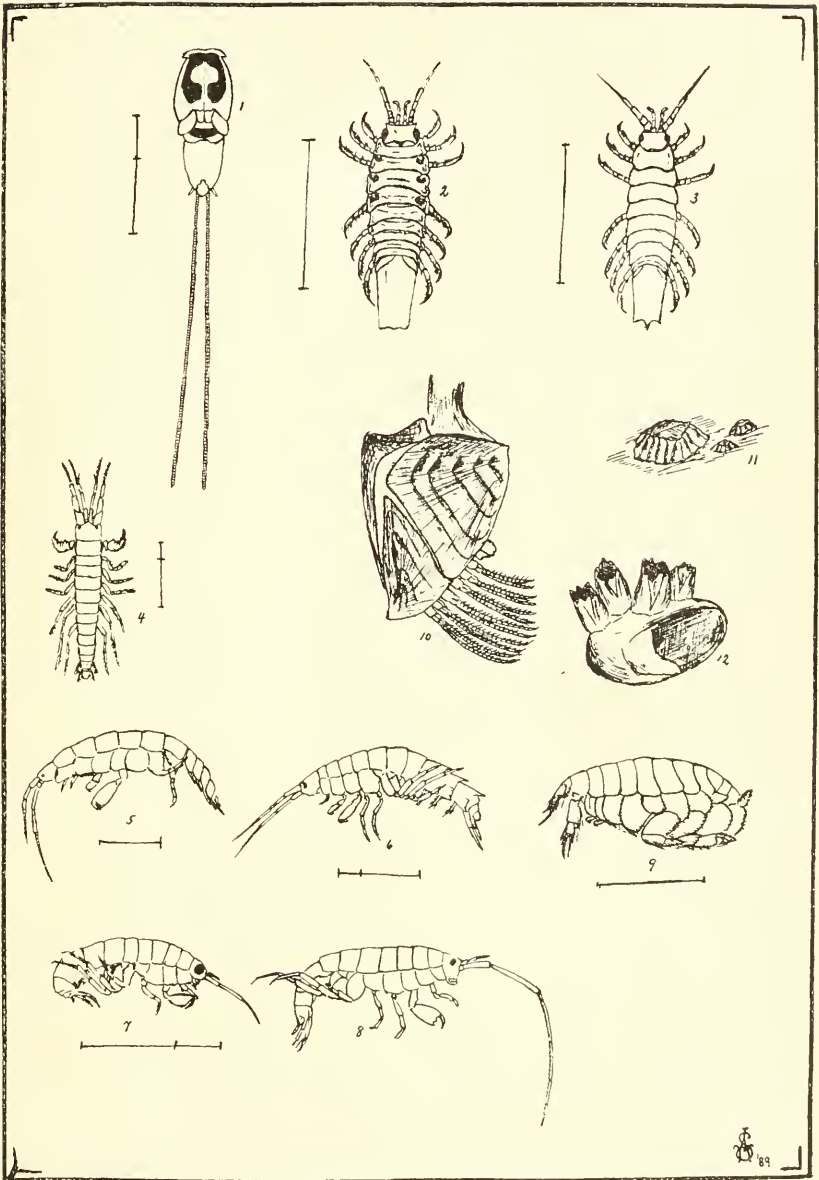
FIDDLER CRAB. *Uca pugnax* (S. I. Smith). (Female.)



GHOST CRAB. *Ocypode albicans* (Bosc). (Malc.)



GHOST CRAB. *Ocypode albicans* (Bosc.) (Female.)



- | | |
|--|---|
| 1. <i>Pandarus sinuatus</i> Say. | 7. <i>Talitrus megalophthalmus</i> (Bate). |
| 2. <i>Idotea metallica</i> Bosc. | 8. <i>Talitrus longicornis</i> Say. |
| 3. <i>Unciola balthica</i> (Pallas). | 9. <i>Haustorius arenarius</i> (Slabber). |
| 4. <i>Unciola irrorata</i> Say. | 10. <i>Lepas fascicularis</i> Ellis and Solander. |
| 5. <i>Gammarus locusta</i> Linnæus. | 11. <i>Balanus balanoides</i> (Linnæus). |
| 6. <i>Carinogammarus mucronatus</i> (Say). | 12. <i>Balanus eburneus</i> Gould. |

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