

CRUSTACEA FROM THE NORTHERN COAST OF YUCATAN, THE HARBOR
OF VERA CRUZ, THE WEST COAST OF FLORIDA AND
THE BERMUDA ISLANDS.

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The Crustacea treated of in this paper were collected for the greater part on the northern coast of Yucatan and in the harbor of Vera Cruz, during the early months of 1890 by the Expedition in charge of Professor Angelo Heilprin, sent by the Academy of Natural Sciences of Philadelphia to investigate the Natural History of Yucatan and Mexico. The writer, who was a member of the Expedition, is indebted to Professor Heilprin for the opportunity of working up this portion of the collection.

The paper also includes a list of the Crustacea collected upon the west coast of Florida in the spring of 1886 by Professor Heilprin and Mr. Joseph Willcox under the auspices of the Wagner Free Institute of Science of Philadelphia,¹ and the description of a new Isopod, collected by the Academy's Expedition to the Bermuda Islands in 1888.

It is remarkable that the shores of Yucatan and Mexico, portions of the American Continent among the first to be discovered by Europeans, should be among the last to have their zoology investigated. Nothing whatever, with one or two isolated exceptions, has been known hitherto of the fauna of the shores of Yucatan, and very little of that of the eastern coast of Mexico.

The material collected by the Expedition has added considerably to the knowledge of this region. The carcinological results may be briefly summarized as follows.

Five new species and one new variety are described and figured: a species described by Say from the coast of New Jersey and two described by Dana from Rio Janeiro, and not referred to since their original description, have been redescribed and one of them figured: other little known and unfigured species have been figured; and some interesting conclusions have been arrived at in regard to the synonymy of some of the species, and the geographical distribution of the crustacea of the Caribbean region.

¹ See Professor Heilprin's Report "Explorations on the west coast of Florida and in the Okeechobee Wilderness," Trans. Wagner Free Institute of Science, vol. 1, 1887.

In reference to the character of the coasts upon which the specimens were collected in Yucatan and Mexico, the following paragraphs are quoted from the author's report upon the Echinoderms collected by the Expedition.¹

"The northern coast of Yucatan possesses a sandy beach largely made up of shell fragments. The water, off the coast, is very shallow, the 10 fathom line being 20 miles from the shore, and the 100 fathom line about 150 miles. Three miles off the shore, in the neighborhood of Progreso, the bottom is of a sandy character, although a few small corals were brought up in the dredge. Along the shore to the westward of Progreso is a small Serpuloid reef. Large quantities of sea-weed and sponges are thrown upon the beach and lie decomposing in the sun. These and numerous water-worn specimens of *Orbicella annularis* and a large Escharine species of Bryozoan, with some specimens of *Xiphogorgia anceps*, indicate the existence of a region rich in animal and vegetable life not very far from the shore."

The harbor of Vera Cruz is an area of luxuriant coral growth, madrepores and brain corals being especially abundant.

The specimens from the west coast of Florida were collected in the shallow waters of that region from Cedar Keys to the Caloosahatchie River. The shore line consists of sandy or shelly beaches and mud flats. The 10 and 100 fathom lines are about the same distance from the coast as in the case of northern Yucatan.

While engaged in working upon the Brachyura discussed in the following pages, the author came to the conclusion that it would be advantageous to carcinologists to have a special term for the four posterior pairs of appendages of crabs, now known as the "ambulatory legs." The term *cruriped*,² a word of similar construction to *cheliped*, has therefore been introduced. It was found that confusion often arose in the use of the term legs, it being used indiscriminately either for the four posterior pairs of appendages alone, or for all five pairs. The term "ambulatory leg" used by Mr. Miers and others is cumbersome, and may be well replaced by *cruriped*. In the following pages, therefore, the term *chelipeds* is used for the anterior pair of appendages of Brachyura, *cruripeds* for the four posterior pairs of appendages and *legs* when speaking of all five pairs.

¹ Proc. Acad. Nat. Sci. Phila., 1890, pp. 317, 318.

² *Crur* leg, *ped* foot.

The species enumerated and described below are arranged under the localities in which they were collected. The systematic portion of the paper is followed by some considerations in regard to their geographical distribution and a chronological list of the general literature of the higher crustacea of the West Indian region which it is believed will be of use to future students of these shores.

YUCATAN.

DECAPODA.

Pericera trispinosa.

Pisa trispinosa, Latreille, Encyclopédie t. x, p. 142.

Pericera trispinosa, A. Milne-Edwards, Crust. Mis. Sci. Mex. p. 52, pl. 15, fig. 2.

A single specimen, dredged in shallow water off Progreso. The postero-lateral spines are much broader than in Guerin's¹ figure of this species. The specimen closely resembles the figure given by A. Milne-Edwards. Specimens in the collection of this Academy from Cuba and the Tortugas closely resemble the specimen collected. The living crab was of a bright scarlet color.

Microphrys bicornutus.

Pisa bicornutus, Latreille, Encyclopédie. t. x, p. 141.

Microphrys bicornutus, A. Milne-Edwards, Crust. Miss. Sci. Mex. p. 61, pl. xiv, figs. 2-4.

A young individual, dredged in 20 ft. of water off Progreso.

Libinia dubia.

Milne-Edwards, Hist. nat. Crust. Vol. I, p. 300, pl. xiv *bis.*, fig. 2.

A dead specimen collected upon the beach at the Port of Silam.

Panopeus Herbstii.

Milne-Edwards, Hist. nat. Crust. t. I, p. 403.

A. Milne-Edwards, Crust. Miss. Sci. Mex. p. 308, pl. LVII, fig. 2.

Two young males from the Port of Silam.

Pilumnus aculeatus.

Say, Jour. Acad. Nat. Sci. Phila (1) Vol. I, p. 449.

A. Milne-Edwards, Crust. Miss. Sci. Mex. p. 282, pl. L, fig. 1.

Three specimens dredged in 20 feet of water off Progreso.

Menippe mercenaria.

Say, Jour. Acad. Nat. Sci. Phila. (1) Vol. I, p. 448.

A young specimen from the Port of Silam.

¹ Iconographie du Règne animal de G. Cuvier, Crust. pl. 8, fig. 3.

Eucratopsis crassimanus.

Dana, U. S. Explor. Exped. Vol. XIII, Crust. p. 311, pl. 19, fig. 2a-d.
S. I. Smith Trans. Conn. Acad. Vol. II, p. 35.

A female of this interesting species was obtained at the Port of Silam. Professor Dana described the species from a specimen obtained by the Wilkes Exploring Expedition, probably at Rio Janeiro. It has not since been recorded from any locality and its re-discovery upon the coast of Yucatan is of much interest. A broad distribution is thus indicated.

Ocypoda arenaria.

Ocypode arenarius Say, Journ. Acad. Nat. Sci. Phila. (1), Vol. I, p. 69.
Ocypoda rhombea Dana, U. S. Explor. Exped. Crust. p. 322, pl. XIX, fig. 8.

A dried specimen collected upon the beach at Progreso.

Gelasimus speciosus, n. sp. Pl. V, figs. 6 and 7.

Four fiddler-crabs were collected at the Port of Silam which apparently represent an undescribed species.

They consist of three males and one female, and agree well in their character.

The species may be described as follows.

Rostrum broad between the orbits. Male abdomen seven-jointed. Carapace smooth, moderately elevated; posterior edge, between the posterior pair of cruripeds, three-fifths of the length of the anterior edge; antero-posterior diameter about two-thirds of the length of the anterior edge. Margin of the meros of the larger cheliped minutely denticulate, inner flat surface smooth, outer convex surface with scattered transverse rows of minute tubercles. Carpus, inner surface smooth, outer surface minutely tubercled. Manus long and slender. In a specimen fifteen mm. wide between the antero-lateral angles of the carapace, the manus is thirty-one mm. long to the tip of the dactylus, and nine mm. wide across the broadest portion of the palm. The length of the palm is rather less than two-fifths, and its breadth rather less than three-tenths, of the entire length of the hand. The fingers are long and slender, the pollex is perfectly straight, and the dactylus is narrow at its base between the superior and prehensile borders, rather longer than the pollex, little arcuate and gently curved toward the tip. Palm minutely granulated on the outer surface, on the inner surface with a row of tubercles running upwards and backwards from the lower margin to the carpal groove, and continued upwards and forwards from the carpal groove towards the upper margin. Proximal portion of

the palm behind this groove minutely granulated, distal portion smooth. Pollex and dactylus smooth, with three rows of minute tubercles upon their prehensile margins, tubercles of the outer and inner rows very minute and closely approximated, those of the middle row slightly larger, of irregular size and not closely approximated, the five at the base of the dactylus being most prominent and increasing in size from the base outwards; one or more tubercles nearly as prominent as these latter, in each of the fingers near their middle. The inner row of the tubercles upon the pollex continued upwards and slightly backwards upon the palm nearly to its upper margin. A slight ridge of tubercles in front of it at the base of the dactylus. The ridge forming the upper border of the carpal groove minutely denticulated and its anterior end not continued downwards and forwards upon the palm.

This form is closely allied to *Gelasimus vocator* as characterized by Professor Kingsley.¹ It differs from it principally in the length and shape of the larger cheliped. In *Gelasimus speciosus*, the larger cheliped is about twice the length of that of *Gelasimus vocator*. The fingers are longer and more slender, the dactylus is less arcuate, the granulation upon the outer surface of the palm is finer and the ridge forming the upper border of the carpal groove is not continued forwards and downwards upon the palm but is terminated by a slight groove separating it from the upward and forward extension of the tubercular ridge of the lower portion of the inner surface of the palm. The sides of the carapace are also rounded and less angular than in *Gelasimus vocator*. In the long and slender character of the fingers it approximates *Gelasimus stenodactylus*, but is distinguished from this species by the fact that the fourth, fifth and sixth segments are distinct from each other and not ankylosed into one piece.

The following species have been described since the monograph of the genus by Professor Kingsley.²

G. Thomsoni, Kirk. Trans. New Zealand Inst. vol. XIII, p. 236, 1880, Wellington, New Zealand.

G. Huttoni, Filhol, Mission de l'Ile Campbell, Rec. Vénus, III, pt. 2, (Crustacea).

G. Cimatodus, Rochebrune, Bull. Soc. Philomat., Paris; (7) t. VII, p. 171, 1882-1883, Senegambia.

¹ Proc. Acad. Nat. Sci., Phila., 1880, p. 147, pl. X, fig. 20.

² Loc ut. pp. 135-155.

Pachygrapsus gracilis.

De Saussure, Mem. Soc. Hist. Nat. Genève, t. XIV, p. 443, pl. II, figs. 15 and 15a, c.

A male collected at the Port of Silam.

Sesarma cinerea.

Grapsus cinereus, Bosc. Hist. Nat. Crust. vol. I, p. 258, pl. V, fig. 1; Say, Jour. Acad. Nat. Sci., Phila., (1) vol. I, p. 442; (non *Grapsus cinereus*, op. cit. p. 99.)

Two males and two females, collected at the Port of Silam.

Hippa emerita.

Cancer emeritus, L., Syst. Nat., ed. 12, p. 1055, (pars).

Hippa emerita, Miers, Jour. Linn Soc., vol. XIV, p. 323, pl. V, fig. 9.

Hippa analoga, Stimpson, Jour. Bost. Soc. Nat. Hist., vol. VI, p. 485; Miers, op. cit., p. 324, pl. 5, fig. 10.

Hippa talpoidea, Verrill, Report of U. S. Commissioner of Fish and Fisheries, 1871 and 1872, p. 548, pl. II, fig. 5.

Numerous specimens of this widely distributed species were obtained at Progreso and the Port of Silam. It is used by the fishermen as bait, and large numbers are dug from the sand.

Specimens of *Hippa* are in the collection of the Academy from the eastern and western coasts of the Americas; from California, Guatemala, Panama, and Chili, and from Massachusetts, New Jersey, Florida, Brazil and La Plata. A careful examination of the abundant material leads me to the conclusion that the forms on the Pacific and Atlantic sides of the continent represent but a single species. The supposed distinctive characters enumerated by Stimpson and Miers, such as the shape, width and rugosity of the carapace, the shape of the frontal lobes, of the antennal spines, of the lobe of the third joint of the outer maxillipeds, and of the last abdominal segment, do not appear to be constant. Variation in these characters exists in forms from both the Pacific and Atlantic waters, and I have not found it possible to fix upon any character by which to distinguish the forms from the two areas. All the characters mentioned above are more or less variable, in the specimens from either side. The carapace may be broader or narrower, more or less rugose, the shape of the frontal lobes, and of the lobe of the third joint of the outer maxillipeds, varies, and the antennal spines vary in their length and may be directed slightly inwards or outwards. The specimens from any one locality, however resemble each other, and the tendency towards variation expresses itself in local varieties. The specimens from the west coast appear

to be usually more rugose than those from the east coast, but it is by no means a constant character.

No good typical figure of this species exists. That given by Professor Verrill is the best, but the carapace is usually narrower at its anterior extremity than is shown in his figure. The figure given by H. Milne-Edwards in the "Règne Animal"¹ under the name of *Hippa emerita*, Fabr., is much narrower than any specimen of this species which I have seen, and its general aspect excites a suspicion that it represents a specimen of *Hippa asiatica*,² and not of *Hippa emerita*.

Clibanarius formosus, n. sp. Plate V, figs. 1 and 2.

Three hermit crabs were collected upon the beach at the Port of Silam which apparently belong to an undescribed species of the prolific genus *Clibanarius*. For them I propose the foregoing name. The species may be characterized as follows:—

Carapace with the anterior margin angular; possessing a small acute median tooth; about four-fifths as broad as long. Eye peduncles slender, about as long as the anterior margin of the carapace, their basal scales small with three or four teeth on the anterior margin. External antennæ with the last joint of the peduncle nearly three times as long as the penultimate and with the basal scale of moderate size; its acute extremity reaching the distal edge of the penultimate joint. Chelipeds small, of equal size; manus oblong-oval, covered with numerous tubercles from which arise tufts of short hairs; meros joint with a small black-tipped spine at its anterodorsal extremity. Cruripeds somewhat compressed; tarsus of the first and second pairs slightly longer than the penultimate joint; with several longitudinal series of small pits into which are inserted tufts of short hairs. Color in alcohol a dull orange, the cruripeds with four broad longitudinal stripes of reddish-brown upon the tarsal and penultimate joints; the stripes situated upon the dorsal lateral and ventral surfaces respectively. The preceding or fourth joint with two broad stripes upon its outer surface, and one upon its dorsal surface.

Length of the carapace, 25 mm.

In general characters this species resembles very closely the common form of the southern coast of the Eastern United States,

¹ Crustacés, pl. 42, fig. 2.

² H. Milne-Edwards, Hist. Nat. Crust. ii, page 209.

Clibanarius vittatus Bosc,¹ but differs from it in its smaller chelipeds, and in its color pattern. The external antennæ are also apparently about one-fifth shorter than in *C. vittatus*.

The following species of *Clibanarius* may be added to those enumerated by Stimpson in his Prodrômus.² The greater number have been described since the publication of his list. They are arranged in chronological order and without regard to the question of synonymy.

C. tubularis L., Syst. Nat., Ed. 12, 1767, p. 1050; Risso, Crust. de Nice, p. 56, 1816. Mediterranean.

■ *C. misanthrops* Risso, Hist. nat. de l'Eur. mér., t. V, p. 40, 1826; Roux, Crust. de la Médit. pl. 14, fig. 1. Mediterranean.

C. ornatus Roux, Crust. de la Médit., 1830, pl. 43. Marseilles.

C. strigimanus White, Proc. Zool. Soc. 1847, p. 122. Van Dieman's Land.

C. Cubensis de Sausure, Mem. Soc. Hist. Nat. Genève, Vol. XIV, p. 455, 1857. Cuba.

C. turgidus Stimpson, Bost. Jour. Nat. Hist. 1857, p. 484, pl. XXI, fig. 1. Puget Sound.

C. carnifex Heller, Sitzungsber. Akad. Wissensch. Wien Vol. XLIV, pt. I, p. 259, 1861. Red Sea.

C. signatus Heller, id, p. 252. Red Sea.

C. Rouxi Heller, Crust. südl. Europa, Wien, 1863, p. 279. Gibraltar.

C. barbatus Heller, Reise der Oesterreichischen Fregatte Novara, Crust. p. 90, Taf VII, fig. 5, 1868. Auckland.

C. infraspinatus Hilgendorf, Crustaceen von Ost Afrika, 1869, p. 97.

C. cayennensis Miers, Proc. Zool. Soc. 1877, p. 657. Cayenne.

C. carnescens Miers, id, p. 658. Cayenne.

C. speciosus Miers, loc. cit. Brazil.

C. Lordi Miers, loc. cit. Vancouver Island, B. C.

C. Mediterraneus Kossmann, Archiv. für Naturg., vol. XLIV, p. 257, 1878. Mediterranean.

C. eurysternus Hilgendorf, M. B. Akad. Wissensch. Berlin, 1878, p. 822, pl. III, figs. 9 and 10. Mozambique.

C. Padarensis De Man, Journ. Linn. Soc. Vol. XXII, p. 242, Pl. XVI, fig. 1. King Island, Mergui Archipelago.

C. arethusa De Man, id. p. 252, King Island, Mergui Archipelago.

Alpheus heterochelis.

Alpheus heterochelis, Say, Journ. Acad. Nat. Sci. Phila., (1) Vol. I, p. 243,

Alpheus lutarius, de Sausure, Mem. Soc. Hist. Nat. Genève, t. XIV, p. 461, Pl. III, fig. 24.

A male and female, obtained at the Port of Silam.

Palæmonella Yucatanica, n. sp. Pl. V, fig. 8.

A small female prawn with eggs attached was dredged in twenty feet of water off Progreso. It is allied to *Palæmonella tenuipes* of Dana (1852, p. 582, pl. 38, fig. 3) and appears to be an undescribed species. I have named it *Palæmonella Yucatanica*. It may be characterized as follows.

¹ Histoire Naturelle des Crustacés, Vol. I, p. 327, Vol. II, pl. XII.

² Proc. Acad. Nat. Sci. Phila. 1858, p. 225.

Rostrum straight, from its origin to its apex about as long as the carapace, projects beyond the anterior edge of the carapace about as far as two-thirds of the length of the basal scale of the outer antennæ, arises about midway between the anterior and posterior edges of the dorsal surface of the carapace, its origin marked by a tooth, between this and the apical tooth of the rostrum there are six other teeth equally spaced, the posterior one being directly above the base of the outer antenna, two teeth on the under surface near the apex. Peduncle of inner antennæ as long as the basal scale of the outer antennæ. Antennal tooth directly above the base of the outer antenna; hepatic tooth in a line drawn midway between the first and second teeth of the rostrum, counting from its base, and a little below the antennal tooth. Second pair of pereiopods with meros about as long as from the posterior edge of the dorsal surface of the carapace to the basal tooth of the rostrum; its distal end not spined, carpus about as long as the meros, its distal end with a very minute spine, manus about as long as from the second tooth of the rostrum to its apex; fingers about half the length of the hand.

It may be distinguished from *Palæmonella tenuipes* by the shorter hand of the second pair of pereiopods, not longer than from the first tooth of the rostrum to its apex; by the lack of spines upon the distal end of the meros and the presence of only a rudimentary spine upon the distal end of the carpus; also by the position of the first tooth of the rostrum, midway between the anterior and posterior edges of the dorsal surface of the carapace, the greater length of the peduncle of the inner antennæ and the basal scale of the first antennæ, which are as long as the manus, and the less anterior position of the hepatic tooth which is one-quarter to one-third of the length of the carapace removed from the anterior edge.

STOMATOPODA.

Squilla prasinolineata.

Squilla prasinolineata Dana, Crust. U. S. Explor. Exped. p. 630, Pl. XII, fig. 3.

Squilla Dufresnii (Leach) Miers, Ann. Mag. Nat. Hist. (5), Vol. V, p. 18, Pl. II, figs. 8 and 9.

A small female squilla, about $2\frac{1}{2}$ inches in length, was collected at the Port of Silam. It agrees well with Dana's description of *Squilla prasinolineata*. It also resembles the figure of *Squilla Dufresnii*, given by Mr. Miers in his Monograph of the Squillidæ, and I am therefore led to regard this latter species as a synonym of

Squilla prasinolineata. The squilla in the collection of the British Museum, described and figured by Mr. Miers under the name of *Squilla Dufresnii*, had had the name attached to it in manuscript by Leach but had never been previously described. White in his "List of the specimens of Crustacea in the collection of the British Museum," 1847, p. 83, recorded Leach's manuscript name but gave no description. Dana published his description of *S. prasinolineata* in 1852, and if as I have assumed, these two species are synonymous, then Dana's name must be used, as no description was attached to the publication of Leach's name in 1847. The specimen in the collection of the British Museum which Mr. Miers doubtfully refers to *Squilla prasinolineata*, appears to me in all probability not to belong to it. He says that the median carinules of the exposed thoracic and first to sixth post-abdominal segments are obsolete, whereas Dana says only "in part obsolete." Dana says that the lateral margins of the three exposed segments of the thorax are entire, whereas the figure given by Mr. Miers shows that the two posterior segments have a small anterior lobe. Mr. Miers also says that the median longitudinal carina of the carapace is indistinctly furcate only in its anterior portion, whereas Dana states that it is not distinctly furcate near the front, but towards the posterior margin opens for a short distance. Mr. Miers also states that in his specimen the terminal post-abdominal segment is proportionally narrower and more elongated than in *Squilla Dufresnii*, but I fail to see any difference in this respect between Mr. Miers' figure of this latter species and Dana's figure of *Squilla prasinolineata*.

Mr. Miers' figure shows that the specimen he is describing has a well developed lateral process to the first exposed thoracic segment, whereas the specimen collected in Yucatan only has a small insignificant lateral process such as is shown in his figure of the thoracic segments of *Squilla Dufresnii*. Dana's species was described from Rio Janeiro. *Squilla Dufresnii* of Miers has no locality. The species has not since been recorded from any new locality and the finding of it on the coast of Yucatan is therefore very interesting.

ISOPODA.

Ligia Baudiana. Pl. VI, fig. 2.

Milne-Edwards, Hist. nat. crust., t. III, p. 155.

Three small specimens of this species were collected at the Port of Silam. It was originally described by Milne-Edwards from San Juan d'Ulloa, the fortress of the harbor of Vera Cruz. Mr. E. J.

Miers (1877) has described specimens from Cayenne, and also states that there are specimens of it in the British Museum from Rio Janeiro. De Saussure has also recorded it from Cuba. The small slender appendage of the inner ramus of the uropoda that Mr. Miers speaks of I did not find in the Yucatan specimens, but as he suggests they may have been lost. The specimen figured has been enlarged two diameters.

Cirolana mayana, n. sp. Pl. VI, figs. 3-10.

Three small specimens of a *Cirolana* were obtained at the Port of Silam which do not correspond to any described species. They are distinguished from all other species by the form of the antennæ, and represent a new species which may be characterized as follows.

Body narrow, about three and one-third times as long as broad, with the sides nearly straight and parallel, smooth and polished with few punctations.

Head sub-hexagonal, about one and three quarter times as broad as long, antennulæ rather longer than the breadth of the head, antennæ as long as from the interior margin of the head to the posterior margin of the third thoracic segment; sigmoid in shape, at its origin bending backwards, then bending forwards and then backwards; segments of the flagellum forming the anterior concavity armed anteriorly each with two bundles of numerous bristles one on the upper and other on the lower edge, thus forming a brush shaped structure.

First thoracic segment nearly twice as long on the median line as the second; second, third and fourth segments equal; fifth and sixth segments rather longer and seventh segment half the length of the sixth. The epimera of the fourth, fifth, sixth and seventh segments are produced posteriorly into an angle, and those of the second and third segments are subquadrate, all have an impressed line running antero-inferiorly.

Spines and bristles upon the legs are not numerous. A small portion of the first abdominal segment exposed. The lateral angles of the abdominal segments acute not rounded. The telson about two-thirds as long as broad, minutely crenulate on its posterior border, with very short spines inserted in the notches.

The largest of the three specimens from which this description has been drawn is about 9 mm. in length. In the smaller specimens the series of bristles upon the antennæ are not so well developed.

The most characteristic features of this species are the brush-like arrangement of bristles upon the antennæ and the crenulate posterior border of the telson.

As no list of the species of this genus has been published since the "Histoire Naturelle des Crustacés" I append the following list of species described to the present day:—

- C. (Eurydice) pulchra* Leach, Trans. Linn. Soc., vol. XI, p. 370, 1815; Milne-Edwards, Hist. Nat. Crust., t. III, p. 238. England.
- C. cranchis* Leach, Dict. Sci. Nat. t. XII, p. 347; Bate and Westwood, Brit. Sess. Crust., p. 296, with figure. England.
- C. (Nelocira) Swainsonii* Leach, loc. cit.; Milne-Edwards, Règne Animal, pl. 67, fig. 4. Sicily.
- C. hirtipes* Milne-Edwards, Hist. Nat. Crust. t. III, p. 236, pl. 31, fig. 25, 1840; Règne Animal, pl. 67, fig. 6. Cape of Good Hope.
- C. elongata* Milne-Edwards, loc. cit. Mouth of Ganges.
- C. sculpta* Milne-Edwards, op. cit. p. 237. Malabar.
- C. Rossii* White, List of the Specimens of Crustacea in the Collection of the British Museum, 1847, p. 106. No description given. He refers to the Zoology of the Erebus and Terror, t. 5, fig. 9, but I have been unable to find this figure among the monographs of this expedition. Auckland Islands.
- C. borealis* Lilljeborg, Ofversigt, Kongl. Vetensk. Akad. Förhandl, arg. 8, 1851, No. 1, p. 23. Norway.
- C. armata* Dana, U. S. Explor. Exped. vol. XIII, pl. II, Crust., p. 771, pl. 51, fig. 5, 1852. Rio Janeiro.
- C. latisylis* Dana, op. cit., p. 772, pl. 51, fig. 6. Borneo.
- C. (Eurydice) orientalis* Dana, op. cit., p. 773, Pl. 51, fig. 7. Sooloo Sea.
- C. multidigitata. Aega multidigitata* Dana, op. cit., p. 768, Pl. 51, fig. 3. Borneo.
- C. polita* Stimpson, Marine Invert. Grand Menan. Smithsn. Contrib., vol. VI, p. 41, 1853. Grand Menan.
- C. concharum* Stimpson, loc. cit. Charleston, S. C.
- C. Solæ* Hesse, Ann. Sci. Nat. (5) t. V, p. 259, 1866. Brittany.
- C. Raia* Hesse, op. cit. p. 260. Brittany.
- C. molvæ* Hesse, op. cit. p. 261. Brittany.
- C. elongata* Hesse, op. cit. p. 262. Brittany.
- C. merlangi* Hesse, op. cit. p. 264. Brittany.
- C. spinipes* Bate and Westwood, Brit. Sess. Crust. p. 299 with figure, 1867; Harger, Bull. Mus. Comp. Zool. vol. XI, p. 91, pl. I, fig. 2, pl. II, fig. 1. England and North America.
- C. rugicauda* Heller, Reise der Fregatte Novara, vol. II, pt. 3, p. 142, t. XII, fig. 13, 1868. St. Paul.
- C. truncata* Norman, Ann. Mag. Nat. Hist. (4), vol. II, p. 421, pl. 23, figs. 12, 13, 1868. Shetland Isles.
- C. Rossi* Miers, Ann. Mag. Nat. Hist. (4) vol. XVII, p. 218, 1876; Cat. Crust. New Zealand, p. 109, pl. III, fig. 3. New Zealand and Auckland Islands.
- C. Arabica* Kossmann, Reise in die Küstengebiete des Rothen Meeres, p. 114, t. VIII, figs. 7-12, t. IX, figs. 1-4. Red Sea.
- C. microphthalma* Hoek. Nederlând. Arch. Zool., suppl. I, Lief. 3, taf. II, figs. 13-17, 1882. Arctic Sea.
- C. lata* Haswell, Proc. Linn. Soc. New South Wales, vol. VI, p. 192, pl. IV, fig. 1, 1882. Port Stephens, N. S. W.
- C. lata* var. *integra* Miers, Zool. Coll. H. M. S. 'Alert,' p. 304, 1884. Albany Island.
- C. longicornis* Studer, Abh. Akad. Berlin, 1882, II, p. 28, pl. II, fig. 15. Table Bay; South Africa.

C. lævis Studer, Abh. Akad. Berlin, 1883, p. 21, pl. II, fig. 8. Queensland.

C. impressa Harger, Bull. Mus. Comp. Zool. vol. XI, p. 93, pl. I, fig. 3, pl. II, fig. 3, 1883-1885. North Atlantic.

C. Schiödtei Miers, Zool. Coll. H. M. S. 'Alert,' p. 302, pl. XXXIII, fig. A, 1884. Arafura Sea, Torres Straits.

C. tenuistylis Miers, op. cit. p. 303, pl. XXXIII, fig. B. Prince of Wales Channel.

C. Cookii Filhol, Mission de l'Ile Campbell, Recueil de Mémoires relatifs à l'observation de Passage de Vénus sur le Soleil. Paris, p. 455. Campbell Island.

Cymodocea caudata.

Næsa caudata Say, Jour. Acad. Nat. Sci. Phila. (1), vol. I, p. 482.

A single specimen of this interesting species was collected in twenty feet of water, off Progreso. The species does not appear to have been recorded from any locality since its original description by Say, from Egg Harbor, New Jersey. On plate III (figs. 11-14), will be found dorsal and lateral views, a view of the fourth leg on the right side, and of the male sexual organs. The species has been well described by Say. The male genital organs upon the middle of the ventral surface of the seventh thoracic segment consist of two spine-like appendages, with a broad groove upon the posterior surface.

This form does not come properly within the genus *Næsa*, either as defined by Leach,¹ Milne-Edwards,² or Gerstæcker.³ I have placed it provisionally under *Cymodocea*, believing with Mr. Beddard (1886, p. 145) that the genera *Dynamene*, *Næsa* and *Cilicæa* probably represent variations of form of this type, sexual or otherwise, of no primary importance.

M. Hesse⁴ has worked out the sexual dimorphism of several related species inhabiting the coasts of France. The figure given on pl. VI, (figs. 11-14) was drawn from a male specimen from the Bermuda Islands collected by the Academy's Expedition to that locality in 1888 under the charge of Professor Angelo Heilprin. Six specimens all males were collected. There appears to be a tendency in the four spines within the sinus of the posterior abdominal segment to become double. The three tubercles upon the first exposed abdominal segment may also be double. The largest specimen from Bermuda is 10 mm. in length.

Associated with these were six specimens of a related form, in which the exterior uropoda are short and lamellate. I supposed at

¹Dictionnaire des Sciences Naturelles, t. XII, p. 341.

²Histoire Naturelle des Crustacés, t. III, p. 216.

³Bronn's Thier-Reichs, Bd. V, p. 223.

⁴Ann. Sci. Nat. (5), t. XVII, p. 1-35, Pls. 1-3.

first that these were the females of *Cymodocea caudata*, but further examination showed the presence of well developed male appendages in one of the specimens, and I am therefore compelled to regard them as a distinct species, which I have described as *Cymodocea Bermudensis* (see p. 194).

CIRRIPEDIA.

Chelonobia testudinaria.

Lepas testudinaria Linn. Syst. Nat. Ed. X., p. 668.

Chelonobia testudinaria Darwin, Monograph of the Cirripedia, p. 392, pl. 14, figs. 1a-1d, fig. 5; pl. 15, fig. 1.

A single specimen was collected at Progreso. Large numbers of the Green turtle (*Chelonia mydas*) are taken at this locality, and this species of barnacle is probably found upon them.

XIPHOSURA.

Limulus polyphemus.

Monoculus polyphemus Linn. Syst. Nat. Ed. X, p. 634.

Polyphemus occidentalis DeKay, Natural History of New York, Crust., p. 55, pl. XI, figs. 50, 51.

The King Crab is very abundant upon the beach at the Port of Silam. It has already been recorded from Laguna de Terminos, at the southern extremity of the Gulf of Mexico, by Professor H. Milne-Edwards (1880 (1), foot note, p. 4). Professor Benjamin Sharp informs me that it breeds in the harbor of Nantucket, and to Professor Kingsley I am indebted for the information that it breeds in great abundance at Cape Ann, Massachusetts. The species is thus seen to have a very extensive north and south range.

VERA CRUZ.

DECAPODA.

Mithraculus sculptus.

Maia sculpta Lamarck, Hist. Nat. Anim. sans Vert., t. V, p. 242.

Mithraculus sculptus A. Milne-Edwards, Crust. Miss. Sci. Mex., p. 105, pl. XX, fig. 2.

Four specimens of this species were collected at Vera Cruz. Three of them in which the carapace is less than 10 mm. broad, have no teeth either upon the pollex or dactylus. The fourth specimen, in which the carapace is about 20 mm. broad, has teeth of the ordinary type upon both fingers.

Liomera longimana.

A. Milne-Edwards, *Nouv. Arch. Mus.* (1) t. I, p. 221, pl. XII, figs. 7, 7a, 7b.

A young specimen apparently of this species was found in a cavity of a coral, *Madrepora palmata*, collected at Vera Cruz.

Neptunus Sayi.

Lupa Sayi Gibbes, *Proc. Amer. Assoc.* 1850, p. 178.

Neptunus Sayi A. Milne-Edwards, *Arch. Mus.* (1) t. X, p. 317.

There are three young specimens of this species in the collection of the Academy labelled Vera Cruz. One of them was donated by Dr. T. B. Wilson. The other two do not bear the name of the donor.

Neptunus cribrarius.

Portunus cribrarius Lamarck, *Hist. Anim. sans Vert.* t. V, p. 259.

Lupa cribraria Milne-Edwards, *Hist. Nat. Crust.* t. I, p. 452, pl. XVII, fig. 1.

A female was obtained at Vera Cruz.

Ocypoda arenaria.

Loc. cit.

Several specimens were collected at Vera Cruz.

Grapsus grapsus.

Cancer grapsus L., *Syst. Nat.*, ed. X, pl. 30.

Grapsus pictus A. Milne-Edwards, *Crust. Règne Animal*, Cuvier, pl. 22.

A male was obtained at Vera Cruz.

I have used the specific name given to this species by Linnæus, in 1758, and not the designation of *maculatus* applied to it by Catesby¹ in 1743. Most authors have used Catesby's name, but as this antedates the tenth edition of the *Systema Naturæ*, it should be abandoned in favor of Linnæus' name. Lamarck² in 1801 erected a new genus for the reception of this species with an allied form, and gave to the new genus, the name of the Linnean species. This he renamed *Grapsus pictus*. I am of opinion, however, that Linnæus' specific name should not be abandoned, on account of its use generically, and I therefore retain it.³

Penæus Brasiliensis, var. *Aztecus*, n. var.

A number of shrimps were obtained at Vera Cruz, which belong to this species, but differ from the typical form in the very long flagellum of the outer antennæ. The flagellum is from seven to ten

¹ *Nat. Hist. of the Carolinas*, vol. II, p. 36, pl. XXXVI, fig. 1.

² *Système des Animaux sans Vertèbres*, p. 150.

³ Report of Committee on Zoological Nomenclature, *Proc. Amer. Assoc. Adv. Sci.* 1877, pp. 50, 51, LXVIII.

times the length of the carapace, from its anterior to its posterior edge, not including the rostrum. On account of the remarkable length of the flagella they appear to me to constitute a new variety which I have named *Aztecus*.

The species itself closely resembles *Penæus canaliculatus* of Oliver (see Spence Bate, 1888, p. 243, pl. XXXII) which inhabits the Indo-Pacific region. It may be distinguished from it by the presence of a spine upon the second and third joints of the first pairs of pereopods instead of one upon the second joint only, and by the presence of two teeth instead of one upon the ventral surface of the rostrum.

I have examined Latreille's original description,¹ but have identified the specimens collected by means of Milne-Edwards' characterization of the species in the *Histoire Naturelle des Crustacés*, t. II, p. 414. Mr. Spence Bate² has also discussed this species.

WEST COAST OF FLORIDA.

DECAPODA.

Libinia dubia.

Loc. cit.

Five specimens collected in Anclote Bay. Two of these are young individuals, in which the median row of spines of the carapace and the rostral spines are relatively much more developed than in the adult.

Panopeus Texanus.

Panopeus Texanus Stimpson, Ann Lyc. Nat. Hist., New York; vol. VII, p. 55. A. Milne-Edwards, Crust. Miss. Sci. Mex., p. 312, pl. LVIII, fig. 4.

Numerous specimens collected at Point Pinellas, Tampa Bay, and in Anclote Bay.

They differ slightly from the figure given by M. Milne-Edwards. The postero-lateral border of the carapace is rather shorter, and the antero-lateral spines are less closely approximated.

Panopeus Herbstii.

Loc. cit.

A single specimen, dredged in 9-12 feet of water, off Manatee River, Tampa Bay, probably belongs to this species. It differs, however, from the typical form in the broad leaf-shaped character of the antero-lateral teeth of the carapace. (See Pl. V, fig. 7.)

¹ Nouv. Dict. Hist. Nat. t. XXV, p. 175.

² Ann. Mag. Nat. Hist. (5) vol. VIII, p. 175.

Menippe mercenaria.*Loc. cit.*

Specimens were obtained at Anclote Bay, Sarasota Bay and in 9-12 feet of water off the Manatee River, Tampa Bay.

Achelous spinimanus.*Portunus spinimanus* Latreille, Encycl. Mèth., t. X, p. 188,*Achelous spinimanus* A. Milne-Edwards, Arch. Mus., t. X, p. 341, pl. XXXII.

Specimens were obtained off the Manatee River, Tampa Bay, at Sarasota Bay and at Boca Noga, Little Gasparilla Inlet.

They exhibit a considerable amount of variation, specimens agreeing in all other characters, differ in the shape of the abdominal segments, the number of spines upon the anterior border of the arm or the size of the posterior antero-lateral spine.

Gelasimus pugilator.*Ocyroda pugilator* Bosc, Hist. Nat. Crust., t. I, p. 250.*Gelasimus pugilator* H. Milne-Edwards, Ann. Sci. Nat. (3), t. XVIII, p. 149, pl. IV, fig. 14.*Gelasimus vocans* Dekay, Nat. Hist. of New York, Crust., p. 14, pl. VI, fig. 9.

Numerous specimens obtained at Perico Island, Sarasota Bay.

Calappa flammea.*Cancer flammea* Herbst, Krabben und Krebse, vol. II, p. 161, pl. XI., fig. 2.*Calappa flammea* Miers, "Challenger" Brachyura., p. 284, pl. XXIII, fig. 1.

A male was collected in Little Gasparilla Inlet.

The specimen resembles Herbst's figure, but lacks the clearly marked reticulations of the dorsal surface of the carapace, which is very faintly mottled with reddish brown.

Persephona punctata.*Cancer punctatus* L., Syst. Nat. ed. XII, p. 1045.*Persephona punctata* Miers, "Challenger" Brachyura, p. 312, pl. XXV, fig. 5.

Two males were obtained, one from 9-12 feet of water off Manatee River, and the other in Sarasota Bay.

Polyonyx macrocheles.*Porcellana macrocheles* Gibbes, Proc. Am. Assoc., vol. III, p. 191; Proc. Elliott Soc. Charleston, S. C., vol. I, p. 6, pl. I, fig. 5.*Polyonyx macrocheles* Faxon, Bull. Mus. Comp. Zool., vol. V, p. 256, pl. III, fig. 11.

A male and female were obtained in 9-12 ft. of water off Manatee River.

As Professor Kingsley (1879, p. 408) has already pointed out, the carapace is much broader in the female than in the male.

Clibenarius vittatus.

Pagurus vittatus Bosc, Hist. Nat. Crust. t, I, p. 327; t. II, pl. 12, fig. 1.

A number of specimens obtained at Little Gasparilla Inlet.

This species has only been figured by Bosc, and as his representation of it is very unsatisfactory, I have refigured it. (Pl. V, figs. 3 and 4). The outline drawing represents one of the medium-sized specimens collected at Little Gasparilla Inlet. The right anterior cruriped has been given in detail to show the color markings and the tufts of hair. In alcohol, the carapace is yellowish with a reddish tinge; the dorsal surface of the chelipeds reddish-brown mottled with yellow, ventral surface yellowish; the tarsal and penultimate joints of the cruripeds reddish-brown with eight narrow longitudinal yellow bands. Two of these bands are upon the dorsal surface, two upon the ventral and two upon each of the lateral surfaces. The two dorsal bands are closer together than the others. The ventral surface of the cruripeds is much lighter than the dorsal and lateral surfaces.

Eupagurus pollicaris.

Pagurus pollicaris Say, Jour. Acad. Nat. Sci. Phila. (i), vol. I, p. 162.

De Kay, Natural History of New York, Crust., p. 19, pl. VIII, fig. 21.

Three specimens, one male and two females, collected in 9-12 feet of water, off Manatee River, in Tampa Bay.

Eupagurus annulipes.

Stimpson, Ann. Lyc. Nat. Hist. New York, vol. VII, p. 243.

A single specimen of this small species collected at Anclote Bay.

The species so far as I am aware has not been recorded since it was first described by Dr. Stimpson, from Beaufort Harbor, N. C.

Hippolyte Wurdemanni.

Gibbes, Proc. Amer. Assoc., vol. 3, 1850, p. 197.

Three specimens obtained at Point Pinellas, Tampa Bay.

This species has not been recorded since it was originally described by Professor Gibbes from Key West and Charleston Harbor. Professor Gibbes' description is very good. The carpus of the second pereopod is multiarticulate; synnhipods and psalistomata are absent; the flagellum of external antenna is about four times as long as the carapace, measuring from the tip of the rostrum to its posterior edge; the longer flagellum of the internal antenna is about three and a half times as long as the carapace, and the shorter flagellum is about three times as long.

As the species has not yet been figured, I have figured one of the specimens collected. (Pl. VI, fig. 1). It is enlarged two diameters.

Palæmontes exilipes.

Stimpson, Ann. Lyc. Nat. Hist. New York, vol. X, p. 130.

S. I. Smith, U. S. Comm. Fish and Fisheries, Rept. of Commissioner for 1872 and 1873, p. 640, pl. I, fig. 1.

Specimens of this fresh water species were collected in the Caloosahatchie River, in the canal connecting Lake Hikpochee and Lake Okeechobee, and in Lake Okeechobee.

Penæus Brasiliensis.

Latreille, Nouv. Dict. Hist. Nat., t. XXV, p. 256.

Spence Bate, Ann. Mag. Nat. Hist. (5) vol. VIII, p. 175.

Specimens collected at Anclote Bay; Sand Key, Clearwater Bay and at Boca Noga, Little Gasparilla Inlet.

BERMUDA.

Cymodocea Bermudensis, n. sp. Pl. VI, figs. 15, 16.

Six small specimens were found associated with specimens of *Cymodocea caudata*, from the Bermuda Islands, which appears to be a new species.

This species may be characterized as follows. Head short, about twice as broad as long. First segment of the thorax longer than any of the following, about as long as the head, three times as broad as long; the remaining thoracic segments about equal in length, half as long as the first thoracic segment.

Two abdominal segments exposed to view; first segment about twice as long as the preceding thoracic segment, its posterior border nearly straight; terminal segment large, about one third of the length of the whole body; subtriangular in shape; posterior angle truncated; elevated in the center and descending steeply to its lateral and posterior margins; three tubercles arranged transversely upon its elevated portion.

Uropoda, short, lamellate, inner and posterior borders straight, outer border slightly convex.

Anterior and posterior antennæ of about equal length. Peduncles of anterior antennæ three-jointed, with first joint stout compressed, second very short compressed, the third long and slender; flagellum multiarticulate. Peduncle of second antennæ, four-jointed, first joint slender, very short, second joint longer, third and fourth joints longer, of about equal length, slender, flagellum multiarticulate. Legs terminating in a well-developed claw with a smaller

claw at its base, similar to that of *Cymodocea caudata*. (See Pl. VI, figs. 15, 16.)

The longest specimen 6 mm. in length.

GEOGRAPHICAL DISTRIBUTION.

In the chronological list at the end of this paper will be found the titles of all important monographs dealing with the higher crustacean fauna of the West Indian region. As this list represents a summary of our knowledge of the region, I will merely mention here briefly the most important contributions to the subject.

In 1817, THOMAS SAY, who might aptly be termed the Father of American Invertebrate Zoology, published in the first volume of the Journal of this Academy a series of papers entitled, "An Account of the Crustacea of the United States." These papers contain descriptions of a number of new species principally from the Southern coasts of the Eastern United States. The species are nearly all characteristic forms of Florida or the West Indies, and his papers may therefore be regarded as the first contribution to our knowledge of this fauna. In 1850, GIBBES, in a paper on the carcinological collections of the United States, described a number of new forms, the greater part of them being from the same region as those described by Mr. Say. In 1852, DANA published his historical monograph on the Crustacea collected by the United States Exploring Expedition, in which the species collected at Rio Janeiro are enumerated, and many new ones from that locality described. In 1858, H. DE SAUSSURE described a number of new species from the coast of Mexico and the West Indies, and in the following year DR. STIMPSON published the first of three papers, continued in the years 1860 and 1871, in the Annals of the Lyceum of Natural History, of New York, in which he described many new species from the region opened up by Say and Gibbes. M. A. SCHRAM, in 1876, published a manuscript by Dr. Isis Desbonne, enumerating the Crustacea of Guadeloupe, and describing some new species. In the following year HELLER, in his report upon the Crustacea, collected by the Novara Expedition, gave a list of species obtained at Rio Janeiro, with descriptions of some new species. In 1869, Professor S. I. SMITH published a notice of the Crustacea collected by Professor C. F. Hartt, on the Coast of Brazil, 1867, which contains a list of species collected and descriptions of new species, and also a list of all the species of Crustacea known upon that coast at that

date. In the same year Dr. ED. V. MARTENS published a description of some fresh and brackish water Crustacea from Southern Brazil, collected by Dr. Reintz-Hensel. In 1870, Dr. STIMPSON published his preliminary report upon the Crustacea, dredged in the Straits of Florida by L. F. de Pourtalés, of the United States Coast Survey. In 1872 appeared a paper by Dr. ED. V. MARTENS on the Crustacea of Cuba. Five years later, Mr. E. J. MIERS described several new species from Cayenne, and in 1879, Professor KINGSLEY published his list of Decapod Crustacea, found at Fort Macon, N. C. In the same year he also published a paper upon a collection of Crustacea from Virginia, North Carolina and Florida.

During the years 1873-1880 appeared the report of Prof. A. MILNE-EDWARDS upon the Crustacea collected by the Mission Scientifique au Mexique. Professor Milne-Edwards originally intended to make his report a complete monograph of the Carcinological fauna of both sides of Central America, but owing to the destruction of nearly the entire collection of the Commission during the bombardment of Paris, he was unable to do this. The report although imperfect as a complete monograph is an excellent work. The greater part of the Brachyurous Crustacea of these waters are described, and illustrated by very fine figures.

In 1881, Prof. MILNE-EDWARDS published his Preliminary report upon the decapod Crustacea dredged in the Gulf of Mexico and the Caribbean Sea by the United States coast survey steamer "Blake" during the years 1877, 1878 and 1879. In this report many interesting deep sea types are described.

In 1887, Prof. C. L. HERRICK published an extensive paper entitled "Contributions to the Fauna of the Gulf of Mexico and the South." The subject of the paper is a collection of Crustacea made in Mobile Bay. A number of new and little known species are described and figured. The paper on account of its comprehensiveness and numerous illustrations, should be a very valuable addition to the literature of the subject. I am sorry to state, however, that although I have had occasion to make very little use of it, my slight acquaintance with it, has not left a very favorable impression upon my mind. In the figure of *Palæmonetes vulgaris*, Pl. V, fig. 7, there has been drawn one thoracic leg too many, six legs instead of five, and in the figure of *Penæus setiferus* on the same plate, fig. 6, there are three instead of two teeth upon the frontal and hepatic regions. In the latter case the third tooth that has

been drawn does not exist in any member of the genus. As the species figured is a common one, there can be no doubt that the figure is intended to represent this species, but if it were correct, the existence of a third spine would probably be sufficient to make a new genus of it.

In addition to the papers that have been enumerated, should be mentioned the several monographs on the different groups of Crustacea collected by the Challenger Expedition, including species from the Bermudas, St. Thomas, and Bahia.

It will be apparent from the preceding resumé of the literature of the Crustacea of the West Indian region that although much is known of the subject, our knowledge is as yet by no means complete. Much remains to be learned of the Crustacean fauna of the Eastern coast of South America. Several collections of Crustacea have been made at Rio Janeiro, but we do not know with certainty how far south of this point the Caribbean Crustacea extend.

North of Rio Janeiro Professor Hartt collected at the Abrolhos Reefs, and at a few points on the East coast of Brazil. Of the fauna of the Northeastern coast of Brazil, and of the Northern coast of South America and the Eastern coast of Central America we have only very scattered knowledge. Even of the Gulf of Mexico itself our information is very limited. Northward from Florida to Cape Hatteras the coast is much better known. From Cape Hatteras to New Jersey is still nearly a terra incognita. The only contribution to our knowledge of this latter portion of the coast is a scanty list of Crustacea collected by Mr. P. R. Uhler in Chesapeake Bay.

Of the Crustacea of the West Indian Islands much remains to be known. We have a fair knowledge of the fauna of Cuba and Guadeloupe, and a very limited knowledge of that of Hayti, St. Thomas and St. Martin. The Crustacea of the Bermuda Islands are known from the Academy's Expedition to these Islands in 1888. Dr. Isis Desbonne has described many species peculiar to Guadeloupe and we may reasonably look for species peculiar to some of the other unstudied West Indian Islands.

The lists of Crustacea collected in various regions are usually of much less value than they might be, from the fact that they do not give any particulars in regard to the specimens collected. It should always be stated in such lists whether the specimens occur in abundance or are rare. In some cases also, young specimens are found

during the summer which have developed from larvæ brought to these shores by warm currents, and which perish during the winter. Such species certainly cannot be regarded as normally inhabiting these shores. This occurs on the coasts of Southern New Jersey, where during the summer numerous specimens of *Ocypoda arenaria* both in the Megalops stage and in the very young adult stage can be collected on the beach. No large adult specimens are found. *Neptunus cribrarius* is also occasionally obtained on the coast, but this species on account of the rarity of its occurrence, can only be regarded as an occasional visitor and not as an inhabitant. It is probably brought north by the warm currents from the south. Mr. S. I. Smith has treated of this subject, and records the occurrence of young specimens of five southern species of Decapods upon the shores of Long Island and of Vineyard Sound. Besides these he records two southern species brought in on whalers, and three pelagic species characteristic of the Gulf stream, which have been stranded upon the Northern coasts. These facts should therefore be carefully considered and when an area of distribution is defined for a given species it should only include those localities in which the species is constantly found in greater or less abundance. Mr. S. I. Smith, in the Crustacea of the Atlantic Coast of North America north of Cape Cod, has exemplified this method and his paper is consequently of great value. Besides entering carefully into the range of the species, he has also given the depth of water which they inhabit.

The following list represents the species collected by the Academy's Expedition to Mexico, together with their general distribution:—

YUCATAN.

- Pericera bispinosa*. West Indies, Yucatan, Bahia.
- Microphrys bicornutus*. Florida to Desterro, West Indies.
- Libinia dubia*. Cape Cod to Yucatan, West Indies, West Coast of Africa.
- Panopeus Herbstii*. Carolina, Florida, Yucatan, Aspinwall, Bahamas.
- Pilumnus aculeatus*. Fort Macon to Yucatan, Guadeloupe.
- Menippe mercenaria*. Beaufort, N. C., to Florida, Yucatan, Bahamas.
- Eucratopsis crassimanus*. Rio Janeiro, Yucatan.
- Ocypoda arenaria*. Fort Macon to Rio Janeiro, West Indies.
- Gelasimus speciosus*. Yucatan.
- Pachygrapsus gracilis*. Florida, Yucatan, West Indies.
- Sesarma cinerea*. Virginia to Florida, Yucatan, West Indies.
- Hippa emerita*. Massachusetts to LaPlata, West Indies, California to Chili.
- Clibanarius formosus*. Yucatan.

Alpheus heterochelis. Fort Macon to Abrolhos Reefs (Brazil), West Indies, Panama and Nicaragua.

Palæmonella Yucatanica. Yucatan.

Squilla prasinolineata. Yucatan, Rio Janeiro.

Ligia Baudiniana. Yucatan, Vera Cruz, Cuba, Cayenne, Rio Janeiro.

Cirolana Mayana. Yucatan.

Cymodocea caudata. Egg Harbor, New Jersey (visitor?), Bermuda, Yucatan.

Chelonobia testudinaria. Circumtropical.

Limulus polyphemus. Massachusetts to Gulf of Mexico.

VERA CRUZ.

Mithraculus sculptus. West Indies, Vera Cruz, Fernando Noronha.

Neptunus Sayi. Gulf Stream.

Neptunus cribrarius. Ft. Macon to Vera Cruz, Guadeloupe, Rio Janeiro.

Liomera longimana. West Indies, Vera Cruz.

Ocypoda arenaria. Fort Macon to Rio Janeiro, West Indies.

Grapsus grapsus, Circumtropical. West Indies to Pernambuco.

Penæus Brasiliensis, var. *Aztecus*. Vera Cruz.

Penæus Brasiliensis. New Jersey to Bahia, West Indies, Nicaragua, Whydah (W. Africa).

FLORIDA.

Libinia dubia. Cape Cod to Yucatan, West Indies, West Coast of Africa.

Panopeus Texanus. Cape Cod to Florida and Texas.

Panopeus Herbstii. Carolina, Florida, Aspinwall, Bahamas.

Menippe mercenaria. Beaufort, North Carolina to Florida, Yucatan, Cuba, Bahamas.

Achelous spinimanus. South Carolina, Florida, Brazil, Martinique, Chili.

Gelasimus pugilator. Cape Cod to Florida.

Calappa flammea. North Carolina to Florida, West Indies.

Persephona punctata. Beaufort, North Carolina, Florida, Guadeloupe, Cuba.

Polyonyx macrocheles. Beaufort, North Carolina to Florida.

Clibanarius vittatus. Florida, West Indies, Brazil.

Eupagurus pollicaris. Massachusetts to Florida.

Eupagurus annulipes. Beaufort, N. C., Florida.

Hippolyte Wurdemanni. Charleston Harbor, Key West, Fla.

Palæmonetes exilipes. (Fresh Water.) Florida, South Carolina, Lake Erie, Lake Michigan.

Penæus Brasiliensis. New Jersey to Bahia, West Indies, Nicaragua, Whydah (W. Africa).

The comparative ranges of these species may be graphically illustrated by the following table. The horizontal line opposite the name of a species represents its longitudinal distribution along the Eastern coast of the American continent. Where species have been recorded as occurring at distant points, such as Yucatan and Rio Janeiro, these localities have been connected by a line passing through the intervening regions, although the species may not as yet have been recorded from these regions, as it is probable in all the cases in which this has been done that the species occur there.

The preceding table suggests the division of the Caribbean province into two sub-provinces, which may be termed respectively the Caribbean and the Brazilian. The Caribbean, extending southwards from Cape Hatteras to Central America, including the West Indian Islands, and the Brazilian extending from Central America to Rio Janeiro. A consideration of what is known of the distribution of the Crustacea of the entire Caribbean province has also led me to adopt this view. By far the greater number of the species enumerated by Rathbun from Brazil are peculiar to that coast and the same can be said of the species enumerated by Kingsley from the Carolinian and Floridian shores. The fauna of the latter region is undoubtedly very closely related to the West Indian proper, of which indeed it may be regarded as a part.

Professor Dana, as early as the year 1852, in his monograph of the Crustacea collected by the United States Exploring Expedition, discussed the question of the geographical distribution of the Crustacea in a way that has laid all future marine zoologists under a debt of gratitude to him. He showed very clearly the important part that the temperature of the water plays in the distribution of marine littoral species. The chart of the world prepared by him, showing the isocrymes or lines of greatest cold, affords the key to many a perplexing problem. He divides the region which I have termed the Caribbean into four Provinces, the Caribbean, including the West Indian Islands, the Eastern coast of Central America and the Northern and Northeastern coast of South America, from the region of the Mississippi River to beyond Bahia; the Floridian Province, including Key West and the Southern extremity of Florida, together with the Bermudas; the Brazilian Province, including Rio Janeiro, and extending north nearly to Bahia; and the Carolinian Province, including Northern Florida, Georgia and the Carolinas as far north as Cape Hatteras. It appears to me, however, that these four provinces should be merged into a single province, the Caribbean, which may be subdivided into two sub-provinces, the Caribbean and Brazilian, as outlined above. It is, I think, impossible to separate the Carolinian, Floridian and Caribbean provinces of Dana. Our knowledge of the species inhabiting these regions has increased greatly since the publication of his work, and the range of the species is known to be greater than he supposed. The extension of the Floridian fauna northwards to Cape Hatteras is probably owing to the fact that the shores of Flor-

ida, Georgia and the Carolinas, as far north as Cape Hatteras are bathed by an overflow of the warm waters of the Gulf Stream. The Arctic Labrador current coming from the North, along the Eastern coast of the United States, according to Commander Bartlett¹ does not extend south of Cape Hatteras, but at that point goes under the Gulf Stream eastwards. North of Cape Hatteras the Gulf Stream is deflected northeastwards, and is more or less separated from the coast by the cold Labrador current.

On the Northern coast of Yucatan, as evidenced by the collection of the Mexican Expedition, the Brazilian and Caribbean sub-provinces to a certain extent overlap.

There appears therefore to be two centres of distribution in the Caribbean region, a Floridian and a Brazilian, giving rise to the two provinces which overlap in Central America.

Professor Dana in his classical work enumerates eight species common to the warm waters of both sides of the American Continent, and Professor Kingsley in his paper upon the genus *Alpheus*, mentions 15 additional species. Professor Dana also pointed out the fact that the genera of the east and west coasts are largely characteristic of the region embraced by these two coasts, and that a large proportion are common to both shores. He distinguished the region represented by these coasts as the Occidental Kingdom. He was unable, however, to account for this relationship of the eastern and western coasts, as at that time there did not appear to be any evidence of the recent submersion of any part of Central America. It is now well known, however, that during the Tertiary period a connection must have existed between the waters of the Atlantic and the Pacific. This connection will explain the existence of species common to both shores. The Cretaceous rocks of Mexico, and the Tertiary deposits of Yucatan discovered by the Academy's Mexican Expedition² together with the recognized Cretaceous and Tertiary deposits of northern South America,³ further point to a time when there was a free intermingling of the waters of the Atlantic and of the Pacific. The close relationship of the two faunas, as evidenced by the large proportion of genera common to the eastern and

¹ Report of the U. S. Coast and Geodetic Survey, 1882, p. 37.

² See Professor Heilprin's report in the Proceedings of the Academy for 1890, pp. 445-469.

³ See Dr. Hermann Karsten "Géologie de l'ancienne Colombie, Bolivarienne, Vénézuéla, Nouvelle-Grenade et Ecuador" Berlin, 1886.

western shores of the continent, and their general similarity, is thus explained. The separation of North and South America also probably explains the well marked division of the continental portion of the West Indian region into a Brazilian and Caribbean sub-province.

The peculiar distribution of *Limulus polyphemus* is worthy of note. It breeds north of Cape Cod and extends at least as far south as Yucatan. It apparently does not extend as far south as Bahia, but it may be found to occur on the South American coast between that point and Yucatan. So far as is yet known it is characteristic of the Eastern coast of North America. The presence of closely related species in the Moluccas and on the coast of Japan, suggests, as pointed out by Prof. H. Milne-Edwards,¹ a former connection of the Atlantic and Pacific Oceans. This may have been that even of the Cretaceous, as the genus appears to have undergone little modification since an early geological period. The presence of members of this genus in the Triassic, Jurassic, Cretaceous and Oligocene beds of Europe and Syria, render it also possible that both the American and Asiatic species may have had as their original center of distribution the Mesozoic and Cenozoic seas of Europe, the one migrating westwards and the other eastwards, and that neither species has been derived from the other, but both from a common European ancestor.

The author having previously been engaged in working up the Echinoderms collected by the Academy's Expedition to Mexico,² a comparison of the distribution of the Echinoderms and Crustacea on the two sides of the continent, in the tropical and sub-tropical regions, naturally suggests itself to the mind. Among the Echinoderms no species are known, with absolute certainty, to be common to both coasts; if there are any, they are undoubtedly very few in number, while in the Crustacea, as stated above, there are supposed to be twenty-three species common to the two areas. Professor Verrill,³ however, has pointed out that notwithstanding the absence of identical species of Echinoderms, there is a very close relation between the faunas of the two coasts. A large proportion of the genera are represented on both sides. The fauna of the Pacific coast is also very distinct from the Indo-Pacific fauna. The absence of identical species of Echinoderms upon both coasts and their presence

¹ Crust. Miss. Sci. Mex, p. 4.

² Proc. Acad. Nat. Sci. Phila., 1890, pp. 317-340.

³ Trans. Conn. Acad. vol. I, pp. 339-351.

in the Crustacea may be explained upon the supposition that the comparatively recent connection of the oceans which allowed the passage of some of the Crustacea from one coast to the other, was not of sufficient magnitude, or did not extend through a period of time long enough to allow the less active Echinoderms to migrate, or their larvæ to be carried, from one region into the other. The general similarity, on the other hand, of the Echinoderms inhabiting both shores, points to an earlier period, as in the Crustacea, when there was uninterrupted communication between the two areas. The present distinct specific, and to a certain extent generic, character of the two faunas point to a subsequent complete separation of the two regions. This again must have been partially obliterated, allowing a slight intermingling of the active forms of the two areas.

As stated above, from the geological researches conducted by the Mexican Expedition, and other explorations in Central and South America, it is now known that Mexico and more or less of Central and northern South America were submerged during the Cretaceous period, and it is probable that there existed during this period a tropical and sub-tropical American littoral fauna, undifferentiated into Eastern and Western regions. During the succeeding Tertiary period Central America were elevated, forming a complete barrier between the two oceans, during this period the differentiation of the two faunas took place. At a still later period there was probably a partial subsidence of Central America, allowing the passage of a few forms of the one region into the other.

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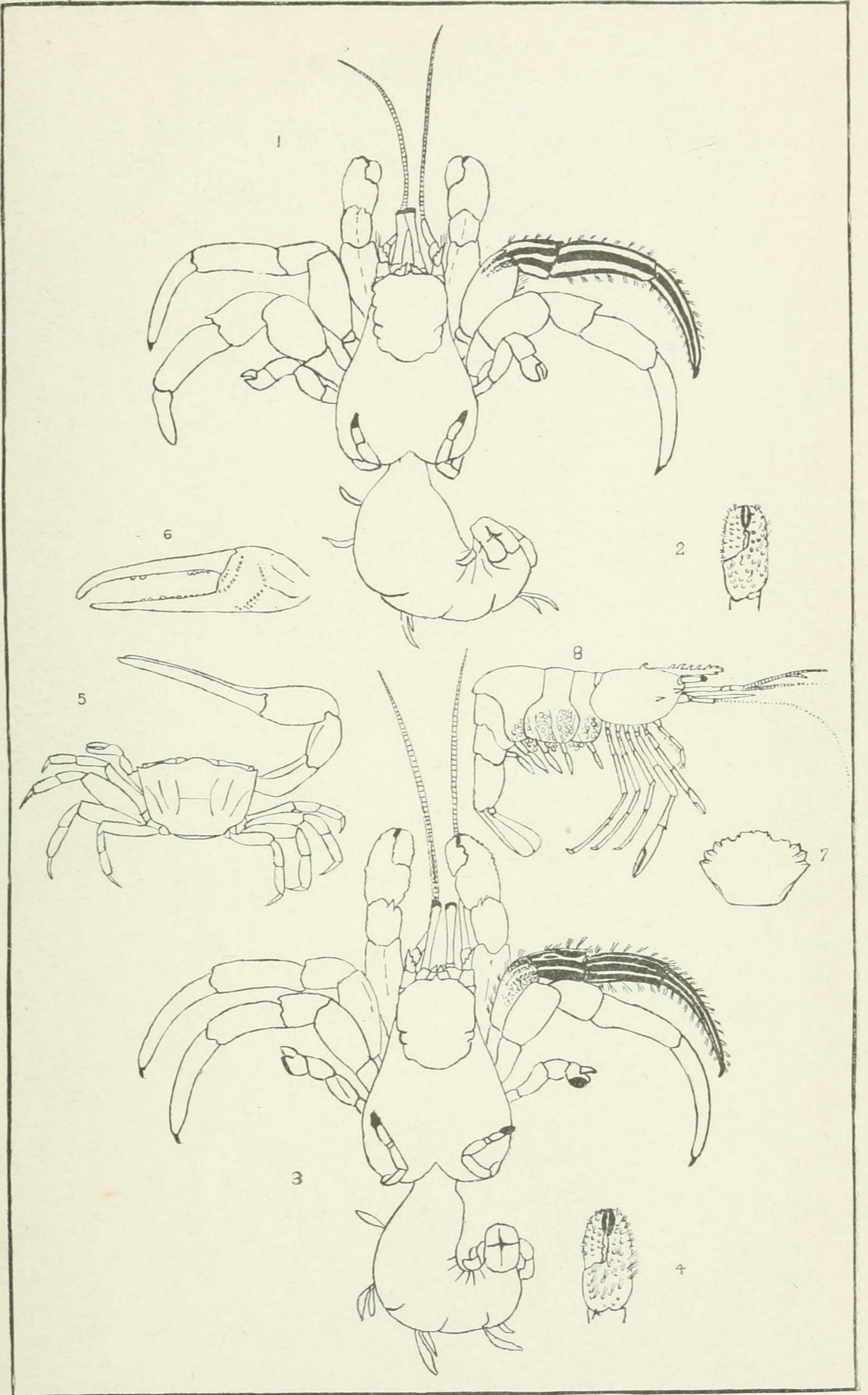
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EXPLANATION OF PLATE V.

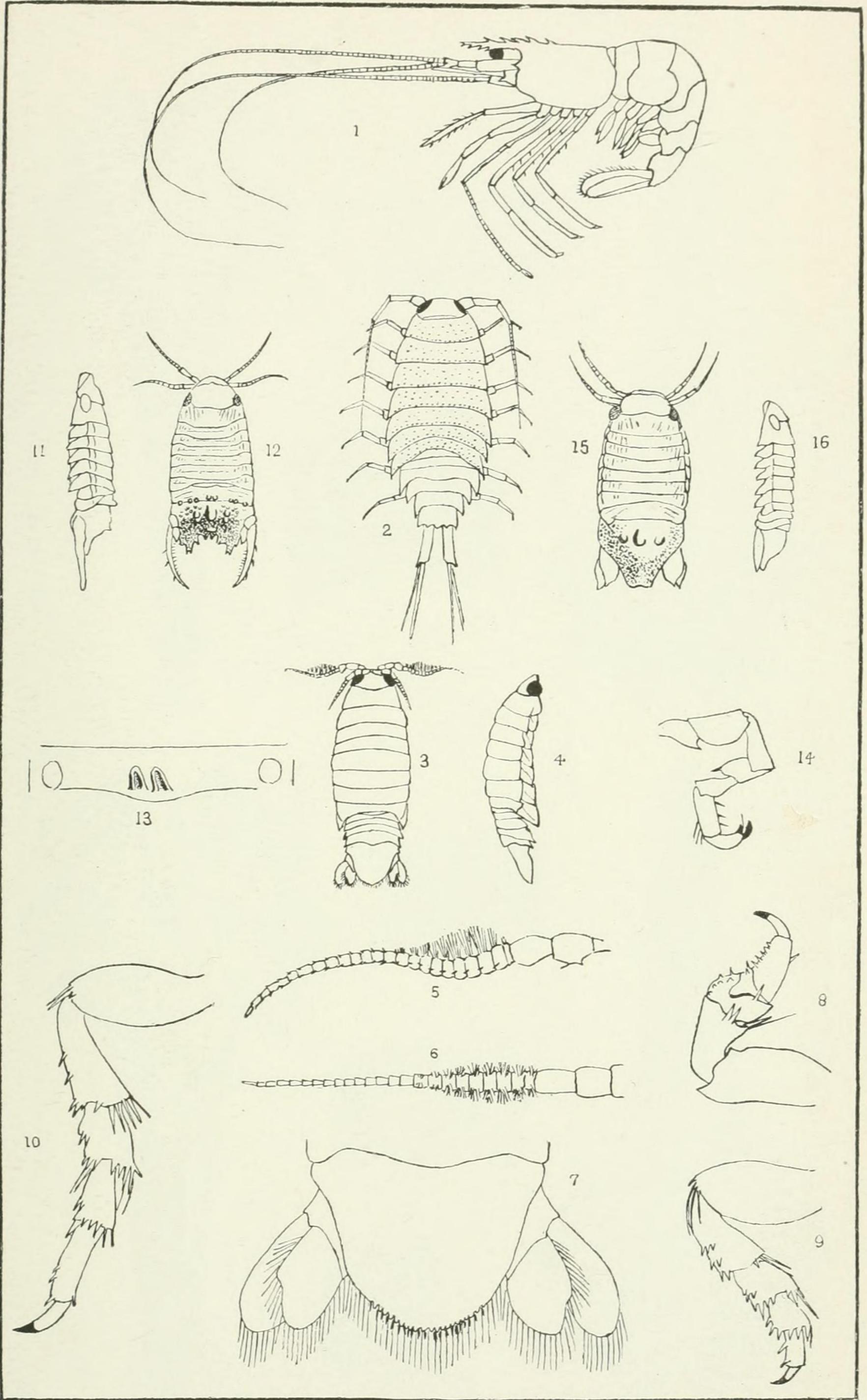
- Fig. 1. *Clibanarius formosus*, natural size.
Fig. 2. Dorsal surface of the right hand.
Fig. 3. *Clibanarius vittatus*, natural size.
Fig. 4. Dorsal surface of the right hand.
Fig. 5. *Gelasimus speciosus*, natural size.
Fig. 6. Inner surface of the hand.
Fig. 7. *Panopæus Herbstii*. Dorsal surface of the carapace, showing the leaf-like antero-lateral teeth.
Fig. 8. *Palæmonella Yucatanica*, enlarged two diameters.

EXPLANATION OF PLATE VI.

- Fig. 1. *Hippolyte Wurdemanni*. Enlarged two diameters.
Fig. 2. *Ligia Baudiniana*. Enlarged two diameters.
Fig. 3. *Cirolana Mayana*. Enlarged three diameters.
Fig. 4. Right side, enlarged three diameters.
Fig. 5. Dorsal view of right anterior antenna much enlarged.
Fig. 6. Anterior view of same.
Fig. 7. Last abdominal segment with appendages much enlarged.
Figs. 8, 9, 10. First, fourth and seventh legs of the right side.
Fig. 11. *Cymodocea caudata*, view of left side enlarged three diameters.
Fig. 12. Dorsal view, enlarged three diameters.
Fig. 13. Seventh thoracic segment, with the male appendages, much enlarged.
Fig. 14. Fourth leg of the right side, much enlarged.
Fig. 15. *Cymodocea Bermudensis*, enlarged three diameters.
Fig. 16. Left side, enlarged three diameters.



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