

less evident. The large chela, in the specimen described (No. 3119), is 9.5<sup>mm</sup> long; 4<sup>mm</sup> high.

The color of the male, after being a short time in formalin, was pale buff on the upper side of the carapace and legs; chelæ yellowish or salmon on the palm, with a white patch preceded by a yellow one at the base of the claws, which were umber-brown.

The figure given by M.-Edwards, from which our fig. 20 was copied, is not very exact. The lateral teeth are too large and the two small post-ocular ones are omitted. The carapace, also, is more swollen laterally and wider posteriorly than in our specimens, so that the proportions are different.

Our two specimens are the only ones known from Bermuda. It occurs in the West Indies and as far south as the Abrolhos Reefs, Brazil (Edwards).

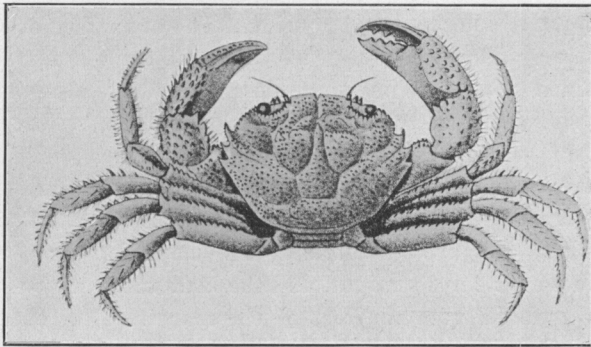


Figure 20.—*Pilumnus spinipes*, ♀, × 2½ times. After A. M.-Edw.

#### ***Eriphia gonagra* Edwards.**

*Cancer gonagra* Fabricius, Suppl. Ent. syst., p. 337, 1798.

*Eriphia gonagra* M.-Edwards, Hist. nat. Crust., i, p. 426, pl. xvi, figs. 16, 17, 1834; Ann. Sci. nat., 3, xvi, pl. 8, fig. 10, 1851. Gibbes, op. cit., p. 177. Dana, U. S. Expl. Exped. Crust., p. 250. Stimpson, Annals Lyc. Nat. Hist., New York, vol. vii, p. 217. Heller, Reise Fregatte Novara, p. 24, 1865. Smith, Crustacea of Brazil, these Trans., ii, p. 7, 1869 (measurements). Kingsley, Proc. Acad. Nat. Sci. Philad., for 1878, p. 397. A. M.-Edw., Miss. Sci. Mex., v, p. 238, pl. lvi, figs. 4-4b. Miers, Voy. Chall., xvii, p. 163. Rankin, op. cit., p. 527. M. J. Rathbun, Proc. Wash. Acad. Sci., ii, p. 141, 1900 (descr. colors); Brach. and Macr. Porto Rico, p. 42, 1901 (descr.).

#### PLATE XIV, FIGURE 3.

This species is easily recognized by the regularly and strongly tuberculated chelæ, while the central part of the back of the cara-

pace is nearly smooth, and in life is gayly colored, but the colors are variable. Some of our specimens were colored as follows: "Carapace mottled with green and pink on a gray ground color. Chelæ nearly white, with the round tubercles of the upper side dark green, becoming yellow; dactyl and end of thumb chocolate-brown; ambulatory legs yellow, conspicuously banded with reddish brown, each band formed by numerous minute, red-brown spots. Under surfaces white (C. S. V.). These gay colors appear to be protective when in its natural environment, among bright colored sponges, algæ, etc., on the reefs.

The ratio of length to breadth of the carapace varies from 1:4 to 1:5.

*Measurements of Bermuda specimens.*

No.	Sex	Carapace		Front between orbits	Chelæ	
		length	breadth		length	height
89a	♂	25	35	18	r. 28 l. 12.5	r. 15 l. 11
89b	♂	24.5	34	18	28	15
89c	♀ eggs	23	32	17	24	14
4009	♀ fig.	14	21	10.5	r. 19 l. 12	9 7
1903	?	18.5	26	14	r. 20.5	11.5

Nos. 89a-89c were collected in the autumn of 1905, at Nonesuch I., by the Field N. II. Mus. expedition. No. 89c carried a large mass of eggs. No. 4009 is the figured specimen.

It lives mostly under large loose stones and dead masses of corals, both on the reefs and on the rocky shores. Several good specimens were taken by our Yale parties, both in 1898 and 1901. It had previously been taken by Mr. Goode, Mr. J. M. Jones, and others. It was also in the 1903 collections of the Biological Station and of Prof. Kineaid.

Rankin reported two specimens with ova taken in the summer of 1897.

It has a wide range, from S. Carolina and the Florida Keys to Rio, Brazil (Smith); Abrolhos Reefs, Brazil (Smith). Bahamas (Rankin); Porto Rico (Rathbun); S. Carolina (Rankin); Indian Key, Fla. (Yale Mus.). Pernambuco and Maccio, Brazil (Rathbun); Rio Janeiro (Dana; Heller); Colon (Yale Mus.).

**Domecia hispida** Eyd. and Soul.

*Domecia hispida* Eydoux and Souleyet, Voy. Bonite, i, Crust., p. 325, 1842, Atlas, pl. ii, figs. 5-10. Dana, U. S. Expl. Exped., Crust., p. 251, 1852. Stimpson, Annals Lye. Nat. Hist. N. York, vii, p. 218 [90], 1860; Bull. Mus. Comp. Zool., ii, p. 145. A. M.-Edw., Miss. Sci. Mexico, Crust., p. 345, pl. Iviii, figs. 2-2*a*, 1880. M. J. Rathbun, Bull. Labr. Nat. Hist. Univ. Iowa, iv, p. 276, 1898; Branner-Agassiz Exped. Brazil, p. 141, 1900; Brach. and Anomura, Porto Rico, p. 43, 1901.

*Eupilumnus Websteri* Kingsley, Proc. Acad. Nat. Sci. Philad., for 1879, p. 383 (descr. of young, Florida, t. M. J. R.). Generic name was preoccupied.

FIGURE 21.

This is a very small species, covered above with pale hairs. Length of carapace about 6.6<sup>mm</sup>; breadth, 9.50. The color in life is light yellowish red, with the spines blackish; front darker.

It appears to be very rare in Bermuda. It lives between branches of corals and in holes in dead corals and stones. One small specimen, taken at Bermuda, was identified by Miss Rathbun.

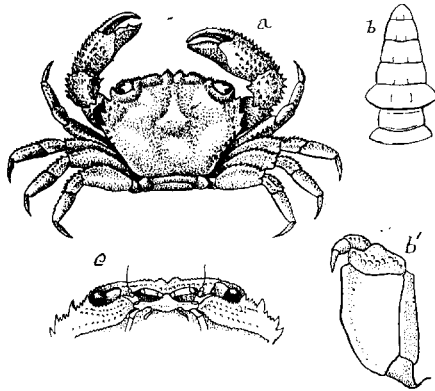


Figure 21.—*Domecia hispida*, male, enlarged; *b*, abdomen of male; *c*, front and antennal area; *b'*, outer maxilliped. After A. M.-Edwards.

It is very widely distributed in all tropical seas. Florida to Brazil; Hawaiian Is.; East Indies; Indian Ocean; Senegal; Cape Verde Is.; Maceio and Pernambuco, Brazil (Rathbun); Florida and Cuba (Stimpson). Gulf of California and Panama, between branches of *Pocillopora* (Yale Mus.).

Family, **PORTUNIDÆ** Leach, 1819. Swimming Crabs.

Of this extensive family, only twelve species have been collected hitherto at the Bermudas, and of these four\* have not been previ-

\* Namely: *Callinectes marginatus*, *C. Danae*, *Acheloüs Smithii*, and *Charybdella tumidula*.

ously recorded. No doubt others can be obtained by using small-meshed seines in the shallow bays, and by the use of trawl-nets in deeper water.

We should naturally expect to find there *Charybdella rubra*, *Arenæus cribrarius*, *Achelous spinicarpus*, and *Achelous sulcatus*, all of which are found at least as far north as the Georgia and Carolina coasts, and part of them as far north as Cape Hatteras.

*Analytical Table of the Bermuda Genera.*

- A.—Abdomen of male T-shaped; carapace wide, thick, and strong; marginal teeth 8, besides outer orbital, all except last subequal; 8th stout and sharp ..... *Callinectes*
- A'.—Abdomen of male not T-shaped; carapace weaker, less thick; chelæ slender, prismatic.
- B.—Marginal teeth 8, subequal, except last, which is generally longer or stouter; flagellum of antennæ included in the orbit, the antennal notch wide.
- C.—Carapace convex, nearly smooth, glossy; ambulatory legs remiform and fringed; swimming legs without longitudinal ribs and grooves on merus and carpus; merus of maxillipeds not prolonged ..... *Portunus*
- C'.—Carapace more depressed, usually with granulated transverse ridges, and covered with short scale-like hairs; ambulatory legs tapered, not evidently remiform; swimming legs flat, strengthened with longitudinal ribs and hairy grooves on most or all the segments except basal, which is transversely grooved; merus flat; merus of maxillipeds prolonged beyond insertion of flagellum ..... *Acheloüs*
- B'.—Marginal teeth 8, alternately larger and smaller; last one not much elongated; flagellum of antennæ wholly or partly excluded from orbit; antennal notch of orbit narrow ..... *Charybdella*

**Callinectes** Ordway, 1863.

This genus embraces a considerable number of species of large, very active, predaceous swimming crabs, most of which are American, but a few occur on the West coast of Africa. They occur on both coasts of America, in the temperate and tropical zones. Nearly all the species are valued as food.

The common "blue crab" or "edible crab" of the eastern coast of the United States (*C. sapidus*, formerly *C. diacanthus*) is the type. The species resemble each other pretty closely, and can best be distinguished, in doubtful cases, by the form and length of the male generative appendages, as was first pointed out by Ordway, in his monograph of the genus.

Four species have been taken at the Bermudas, but only one (*C. ornatus*) is common. Other species, especially *C. tumidus*, may be expected to occur, when the fauna becomes more fully known.



*Analytical Table of the Bermuda species of Callinectes.*

- A.—Frontal teeth four, not counting inner orbitals.  
 B.—Intramedial gastric area broad and short; ratio of length to breadth about 1:3; male appendages not very short; tips crossed.....*ornatus*  
 B'.—Intramedial area longer and less broad; length to breadth about 1:2.  
 C.—Male appendages very short, scarcely exceeding 3d abdominal segment.....*marginatus*  
 C'.—Male appendages much exceeding 3d abdominal segment; tips straight, not crossed.....*Danae*  
 A'.—Frontal teeth two, not counting the inner orbitals; male appendages very long, about reaching end of abdomen, tips divergent.....*sapidus*

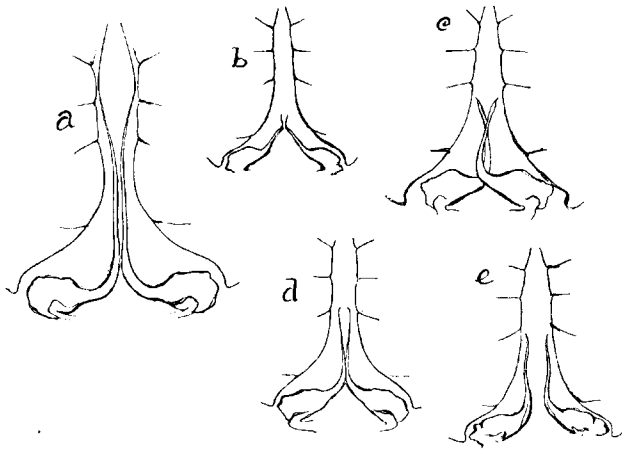


Figure 22.—Male generative appendages (verges) of *Callinectes*: a, of *E. sapidus*; b, of *C. marginatus*; c, of *C. ornatus*; d, of *C. Danae*; e, of *C. tumidus*. All these are West Indian species. After M. J. Rathbun.

***Callinectes ornatus* Ordway. Edible Crab.**

*Callinectes ornatus* Ordway, Boston Journ. Nat. Hist., vol. vii, p. 571, 1863. Smith, Crust. Brazil, these Trans., ii, p. 8, 1869 (descr.). A. M.-Edw., Miss. Sci. Mex., v, p. 225, 1879 (as var. of *diacanthus*). Smith, Annual Rep. U. S. Fish Comm., for 1885, p. 29, 1886. Rankin, Annals N. York Acad. Sci., xii, p. 529. Rathbun, The Genus *Callinectes*, Proc. U. S. Nat. Mus., xviii, p. 356, pl. xv (general); pl. xxiv, fig. 3, pl. xxv, fig. 2, pl. xxvi, fig. 2. pl. xxvii, fig. 2 (details), 1896; vol. xxi, p. 596; Braeh. and Macr. Porto Rico, p. 48, 1901 (descr.); Amer. Naturalist, xxxiv, p. 140.

FIGURES 22c, 23b. PLATE XVII, FIGURE 1. PLATE XXI, FIGURE 2.

This species can easily be distinguished from most of the others of this genus by the four prominent, frontal teeth; those of the antero-lateral margins are rather long, nearly straight and acute. The ambulatory legs are long and slender. The carapace is convex.

The colors of the adults, especially of the males, are often handsome, but are variable. Frequently the carapace is dull olive or olive-brown, usually with a large, ill-defined, roundish spot of orange or orange-red on each side posteriorly; the lateral spines and denticles light blue or whitish; eye-stalks purple. Chelipeds proximally similar to carapace, with the spines pale blue and joints red, with blue spots; inner surface of palm of chela with a large bright blue patch, bordered with purple; digits mostly purple, tipped with red. Ambulatory legs bright blue above, with a band of scarlet at each joint and a patch of paler blue or green on the posterior and lower side of each segment; tarsi red. Swimming legs similar in color, but with the red articular bands wider; a patch of yellow or orange on each segment; terminal segment bright scarlet on the distal half, separated from the blue proximal portion by a band of orange. Abdomen posteriorly light blue.

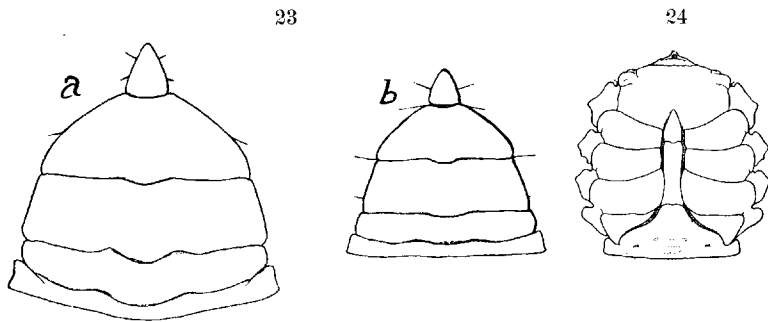


Figure 23.—Abdomens of female *Callinectes*; a, of *C. sapidus*; b, of *C. ornatus*.  
Figure 24.—Abdomen of a male *Callinectes sapidus*,  $\frac{2}{3}$  nat. size.

Many specimens are much less brilliantly colored. Some are mottled with lighter and darker olive on the carapace. The young are usually rather dull or plain olive-yellow; some are light olive or greenish above. Albino specimens often occur in which the entire carapace and legs are pale gray or nearly white, or in which white is the prevailing color.

One large dark male had the carapace, above, dull dark brown, the long postero-lateral spines, as well as the others, with white tips. Chelæ purplish brown, above; inner lateral and lower surfaces white, except inner surfaces of finger and thumb, which were deep purple. Ambulatory legs dark blue and brown both above and below, with whitish bands at the joints beneath. Swimming legs dark bluish brown, with a central yellowish white patch on outside of each segment, except the last, which is bright brownish red.

Measurements of Bermuda specimens.

No.	Sex	Carapace			Front bet. orbits	Chelæ		Central gastric area	
		l'gth	br'dth total	br'dth spines		l'gth	h'ght	l'gth	br'dth
4041	♀	39	73	63	13	r. 39	14	--	--
4039a	♂	50	101	85	17	{ r. 59 l. 52 }	{ 18 14 }	7.5	21
4039b	♂	47	99	83	17	r. 59	16	7	21
4039c	♂	42	92	75	15	{ r. 53 l. 55 }	{ 13.5 15 }	6	18.5
4039d	♂	35	75	59	13	r. 38.5	12	5	15
158 F	♂	14	31.5	23.5	6	13	4		

We found this species very common at Bermuda in the shallow water of inlets and bays, especially at Hungry Bay, in March and April, 1901. Also at Castle Harbor, Long Bird I., etc. It was contained in the earlier collections of J. M. Jones, G. B. Goode, and others. In the 1905 collection of the Field Nat. Hist. Museum, there are many fine specimens from St. Davids I., Hermit Bay, etc. One of the latter, only 13.5<sup>mm</sup> long, carried eggs.

Its range extends from Cape Hatteras to Brazil. Off C. Hatteras, 14 fath. Abrolhos Reefs and Caravellas, Brazil (Smith); S. Carolina (Ordway); St. Catharine, Brazil (M.-Edw.). Florida (Stimpson). Victoria, Brazil (Rathbun).

**Callinectes marginatus** (M.-Edw.), var. **larvatus** (Ord.). *Edible Crab.*

*Neptunus marginatus* A. Milne-Edw., Nouv Arch. Mus. Hist. Nat. Paris, x, p. 318, pl. xxx, fig. 2, 1861\* (t. M. J. Rathbun).

*Callinectes larvatus* Ordway, Jour. Boston Nat. Hist. Soc., vii, p. 573, 1863. Smith, these Trans., ii, p. 9, 1869 (Brazil). M. J. Rathbun, The Genus Callinectes, Proc. Nat. Mus., xviii, p. 358, pl. xvii, xxiv, f. 5, xxv, f. 4, xxvi, f. 4, xxvii, f. 4, 1895. Rankin, Crust. from Bahamas, Annals N. Y. Acad. Sci., xi, p. 232, 1898.

*Callinectes marginatus* M. J. Rathbun, Proc. Biol. Soc. Wash., xi, p. 149, 1897; Proc. Wash. Acad. Sci., ii, p. 142, 1900. Brach. and Macr. Porto Rico, p. 48, 1901.

FIGURE 22b. PLATE XVIII, FIGURE 1.

This is closely allied to *C. Danae*, of the West Indies and Brazil. The latter has straighter and more equilateral marginal teeth and the male generative appendages are longer and different in form.

It also closely resembles *C. ornatus* in most respects. It can best be distinguished by the longer and narrower intramedial gastric area of the carapace, which is only about twice as broad as long. The

\* This species was based on a small sterile female (figured as a male) from W. Africa. Prof. S. I. Smith first referred it to *Callinectes*, with some doubt, in 1869.

marginal teeth and frontal lobes are very similar to those of *C. ornatus*, but in this the two middle frontal lobes are a little more prominent. The basal appendages of the male abdomen are unusually short and small, and quite unlike those of the other species. (See fig. 22, *b*.) Its colors in life were not noted.

Measurements.

No.	Sex	Carapace			Front bet. orbits	Chelæ		Locality
		lgth	total breadth	—spines		length	height	
1735	♂	42	90	77	16	{ r. 58 l. 55	r. 20 l. 16	Key West, Fla.
1903 <i>b</i> fig.	♂	20	41	34	7	r. 21	6.5	Bermuda
1427	♂	47	99	84	28	{ r. 66 l. 64	23 18	Florida

On No. 1735, the intramedial gastric area is 7.5<sup>mm</sup> long in middle; 16<sup>mm</sup> broad anteriorly. In 1903*b*, it is 3.75<sup>mm</sup> by 8<sup>mm</sup>; in 1427, it is 8<sup>mm</sup> long, by 20 broad at widest part anteriorly.

A rather large specimen was in the collection of Mr. Goode (1876). Several young were obtained in the summer of 1903 by the Bermuda Biological Station. It ranges from Florida to Bahia, Brazil (Smith). It is common and used as food in some of the West Indies. Dominica I., common (A. H. Verrill, 1906). On the west coast of Africa, from Cape Verde Islands to St. Paul de Loanda (Rathbun). Pernambuco, Maccio, etc., Brazil (Rathbun). Ordway's types of *C. larvatus* were from Florida, Bahamas, and Hayti.

The type of *N. marginatus* (Edw.) was from West Africa. It was a barren or immature female with no very evident characters, as figured, to identify it with this species. This determination was made by Miss Rathbun.\*

\* I am not convinced of the correctness of this determination. The latter, as described and figured, has a broader carapace; ratio, as described, 1:2.17, as figured, 1:2.33, while in our *C. larvatus*, of similar size, it is 1:2.05; the merus of the maxillipeds has a decided notch at the insertion of the palpus, to which Edwards particularly refers: in *larvatus* the notch is not evident. The transverse granulated ridge of the carapace, from the anterior base of the lateral spines, curves much farther forward than in *C. larvatus*. It seems to me more probable that *marginatus* is a distinct but closely allied African species.

However Miss Rathbun has recorded additional specimens of *C. marginatus* from several localities on the W. African coast and Cape Verde Islands (op. cit., p. 291, 1900), but she has neither figured nor described the African specimens. Meantime, I prefer to retain *larvatus* as a name for the American form.

**Callinectes Danæ** Smith.

*Lupa diacantha* Dana, Crust. U. S. Expl. Exped. i, p. 272, 1852, Atlas, pl. xvi, fig. 7, 1855.

*Callinectes diacanthus* Ordway, op. cit., p. 575, 1863 (*non* Latr. sp.).

*Callinectes Danæ* Smith, these Trans., ii, p. 7, 1869 (measurements). M. J. Rathbun, The Genus *Callinectes*, Proc. U. S. Nat. Mus., xviii, p. 357, pl. xvi, pl. xxiv, fig. 4, xxv, fig. 3, xxvi, fig. 3, xxvii, fig. 3, 1895 (deser.); Bracl. and Macrura, Porto Rico, p. 4, 1901 (deser).

FIGURE 22, *d*.

The carapace of this species closely resembles that of *C. marginatus*, but the male is easily distinguished by the form of the male verges (see fig. 22, *d*). The female abdomen is narrower than in the other species. The carapace is rather strongly granulated. The five antero-marginal teeth, following the orbital, are all similar, broad at base, with sharp acuminate tips, their two edges nearly equal, and scarcely bent forward, granulated and hairy on the bases; the two succeeding teeth are still more acute and more squarrose; the last tooth is more than three times the length of the preceding. The front has four lobes, the two inner much smaller than the others, obtuse; the outer ones prominent, subacute; preorbital tooth about equal in size and more acute.

The length to breadth of the carapace varies from 1:2.08 to 1:2.26. Our Bermuda specimen has the carapace 32<sup>mm</sup> long; 66<sup>mm</sup> wide (total); 53<sup>mm</sup> wide without spines.

The only Bermuda specimen examined was a male collected long ago by J. M. Jones (coll. Yale Mus.). Its range is from Florida to Rio, Brazil. Pernambuco and Bahia, Brazil (Smith); Rio Janeiro (Dana). Porto Rico (Rathbun).

**Callinectes sapidus** Rathbun. *Blue Crab*; *Edible Crab* of the northern United States.

*Portunus hastatus* (*pars*) Fabr., Supl. Ent. Syst., p. 367.

*Portunus diacanthus* (*pars*) Latr., Encycl. Meth., x, p. 190, 1825.

*Lupa hastata* Say, Journ. Acad. Nat. Sci. Phila., i, p. 65, 1818. Desm. Consid. Gen. Crust., p. 98.

*Lupa diacantha* (*pars*) H. M.-Edw., Hist. nat. Crust. i, p. 451, 1835; Dekay Zoöl. N. York, Crust., p. 10, pl. iii, fig. 2 (*non* Dana).

*Neptunus diacanthus* (*pars*) A. M.-Edw., Nouv. Arch. Mus. N. Hist., x, p. 316, pl. xxx, fig. 1-1c, 1861.

*Callinectes diacanthus* (*pars*), var. *hastatus* A. M.-Edw., Miss. Sci. Mex., v, pp. 223, 224, 1879.

- Callinectes sapidus* M. J. Rathbun, The Genus *Callinectes*, Proc. U. S. Nat. Mus., xviii, p. 352, pl. xii, pl. xxiv, fig. 1, pl. xxv, fig. 1, pl. xxvi, fig. 1, pl. xvii, fig. 1 (details), pp. 368-373 (habits), 1896; Amer. Naturalist, xxxiv, p. 140, fig. 3, 1900.
- W. P. Hay, The Life History of the Blue Crab (*Callinectes sapidus*). Appendix to Annual Report of the Com. of Fisheries for 1904, pp. 397-413, 4 plates, 1905 (habits: moulting, breeding, etc.).
- Callinectes hastatus* Ordway, op. cit., p. 568. S. I. Smith, these Trans., vol. v, p. 33; Report Invert. Vineyard Sound, etc., p. 548. Verrill, Rep. Invert. Vineyard Sound, pp. 367, 468, 1873 (habits). R. Rathbun, Fisheries and Fishery Industries of the U. States, Crustacea, Part V, sec. i, pp. 775-778, pl. 267 (habits and statistics), 1884; sect. v, vol. ii, pp. 629-648, 1887.
- Paulmier, F. C., Higher Crustacea of New York City, New York State Museum, Bulletin 91, Zoölogy 12, p. 142, fig. 11, 1905.

FIGURES 22a, 23a, 24. PLATE XVII, FIGURE 2.

In this species the adult males are handsomely marked by bright blue on the chelipeds, legs, and margins of the carapace, the greater part of the dorsal surface of the carapace being green. In the adult female a dull red usually takes the place of the blue of the male.

According to observations first made on this crab by Professor Louis Agassiz, about 1860, it has interesting courting habits.\*

Probably the bright blue ornamentation of the male is due to sexual selection, for the male, during his courtship, stands on the tips of his legs, and "dances" or struts in front of the female, with his claws outspread to display his charms. The rival males, also, are belligerent at such times.

An account of the courting and pairing habits was quoted by Miss Rathbun (*The Genus Callinectes*, p. 369) from a long letter on the habits of this crab by Hon. John D. Mitchell, of Victoria, Texas, which agrees closely with the account by Agassiz.

He states that the sexually mature females are in their third summer. Meeting one of these, the adult male "will elevate himself on the tips of his legs, getting as high from the ground as possible, extend his claws to their widest extent, supporting himself with his paddles, and in this position he will strut slowly and pompously in front of her. Should another male appear, a battle ensues. The sexual act lasts from three to six hours."

\* Professor Agassiz then described in detail these phenomena and other habits of this crab to me and several of my classmates, his special students. He stated that they were new observations that he had just made on the south coast of New England, and in which he was then very much interested. I wrote out his observations in a diary that I kept at that time and preserved for many years. I am not aware that he ever published these observations.

According to Prof. W. P. Hay (op. cit., p. 405) the male takes possession of the young female, shortly before she is to moult into the adult condition, and carries her around with him until she is ready to moult, when he places her in a safe retreat and stands guard over her during the moulting. As soon as this is accomplished he immediately copulates with her and carries her away, remaining with her for "a day or two" or until her shell hardens.

That large numbers of males are taken in spring, each carrying a female with him (called "doublers" by the fishermen), is well known. But it is probable that only a part pair in this way, and that both accounts are correct.

Professor Hay thinks the females neither pair nor produce eggs but once, dying soon afterwards. This belief rests on very insufficient evidence. Most of the larger species of crabs are found carrying eggs at various stages of growth, and females of this crab, of at least two different sizes, are often found with eggs. In dissecting large numbers, during many years of instruction of students in my zoölogical laboratory, we have found large numbers of large size, and apparently more than three years old, containing fully developed ova, in early spring, indicating that the females breed at least twice, like the males. Perhaps these older females are the ones before whom the males perform their courtship dances. This matter needs much more careful investigation, under very favorable conditions, before it can be considered as settled.

This species and probably other allied crabs, can readily be put into a limp and helpless condition, apparently like the hypnotic state of man, by gently and continuously rubbing the carapace, over the region of the heart, in a particular way. I have often made the most pugnacious and active adult males perfectly docile in this way in a few minutes, and if the treatment be carried further, they soon become limp and helpless, as if dead, remaining where placed for some time. They soon spontaneously recover their activity, if left to themselves. I have often done this, as long ago as 1870.

This performance is generally a great surprise even to the fishermen who have handled crabs all their lives, for it does not seem to be generally known.

Our largest specimen (No. 1712, var. *acutidens* ♂) is from Nassau, N. P. Length of carapace, 185<sup>mm</sup>; total breadth, 204<sup>mm</sup>; less spines, 152<sup>mm</sup>; between orbits, 25<sup>mm</sup>; length of larger (left) chela, 116<sup>mm</sup>; its height, 32<sup>mm</sup>. The lateral teeth are very acute.

This species appears to be very rare, if not accidental, at Bermuda. It has been recorded by Miss Rathbun as in the Mus. Comp.

Zoölogy, from the collection of A. S. Bickmore, made about 1862. We were unable to find it or learn of its presence there, nor has it occurred in any of the other Bermuda collections that I have seen.\* It is the common edible crab of the Atlantic coast, abundant from Southern New England to Florida, Louisiana and Texas.

It ranges to Brazil.† Rio Grande (Miss Rathbun; also in Yale Mus.). It often ascends estuaries to points where the water is very brackish. Very abundant in Chesapeake Bay, where it is fished on a great scale.

**Portunus** Fabr. and **Achelous** De Haän, 1833.

Some of the distinctions between *Portunus* (Fabr., 1798, as now restricted) and *Achelous* (type *A. spinimanus*) are neither very definite nor constant. The species intergrade in some of the characters. In respect to the form of the carapace, which in typical *Portunus* is more broadly arched, "the center of the arc near the posterior end," the proportions change greatly with the growth. Young specimens of some species would thus fall in one group (*Achelous*) and the broader adults in the other. *A. anceps*, of the sizes usually taken, is nearly intermediate in form, if the long lateral spines be not reckoned in the measurements, but it lacks the flat remiform front legs of *Sayi*.

In *P. Sayi*, however, we see a distinctly remiform character of the anterior two pairs of ambulatory legs. They have the basal joint and merus smooth and nearly terete, while the three terminal segments are much flattened and strongly fringed with hairs on the edge, thus adapting them specially for swimming. This would seem to be a true generic character, for in the species of typical *Achelous* the distal segments of the legs are tapered and grooved, with the dactylus slender and sharp, and therefore adapted for walking.

To this may be added the character of the merus of the outer maxillipeds, which in *Achelous* is prolonged beyond the insertion of the palpus and is angular outwardly, while in *P. Sayi* it is not pro-

\* Mr. Witmer Stone, in Heilprin's "Bermuda Is.," p. 147, recorded two small males of "*Neptunus hastatus*." They may have been *Portunus Sayi* or *Callinectes ornatus*, but probably not this species.

Hurdis, Rough Notes and Mem., 1897, p. 361, gives *Lupa diacantha* as a Bermuda species in his brief list of Crustacea, but his names of the Crustacea are very unreliable. (See Bibliography, below.)

† Miss Rathbun (1896) established a variety or subspecies *acutideis* for a South American form, having sharper lateral teeth. This variety extends from the Bahamas to Rio Janeiro.



longed and is rounded distally. Hence I am disposed to consider the group including *P. Sayi* a distinct genus.

In these characters this species agrees with *P. pelagicus*, the type of the genus. I have compared it with a number of characteristic specimens of the latter from Japan. (Yale Mus., coll. E. S. Morse.)

**Charybdella** M. J. Rathbun, 1897 = *Cronius* Stimpson, 1860 (name preoccupied).

This genus was established for *C. rubra*, as the only species. The latter, which is a common West Indian and Florida species, differs from our species of *Acheloüs* in several important characters. Its outer maxillipeds have the merus short; the manus of the chelipeds bears three distal spines; the antero-marginal teeth are alternately larger and smaller; the antennal sinus of the orbit is much contracted; the inner orbital tooth is deeply bilobed. But the *Charybdella tumidula*, referred later to the same genus by Miss Rathbun, would seem to go about as well in *Acheloüs*, where it had previously been placed, for its characters are partly intermediate between the two genera. In most respects it is very closely related to *A. Gibbesii*, which it closely resembles in the strong areolation of the carapace; the frontal denticles; and bilobed interorbitals; the distal denticulation of the merus of the swimming feet, etc. But owing mainly to the alternation of large and small marginal teeth, I have left it in *Charybdella*. The characters of the antennal sinus and antennæ are intermediate.

*Some special diagnostic characters of the Bermuda species (and some others nearly allied) of Portunus, Acheloüs, and Charybdella.*

- 1.—Carapace convex, nearly smooth, glossy, with feeble areolations and few hairs ..... *Sayi*
- 2.—Lateral marginal teeth alternately distinctly larger and smaller. ....  
*tumidula; rubra*
- 3.—Posterior corners of carapace distinctly angular ..... *spinicarpus*
- 4.—Posterior lateral marginal spine scarcely longer than the rest .. *depressifrons*
- 5.—Inner orbital tooth bilobed, so that the front has eight teeth or lobes between the orbits, counting the inner orbitals.  
*tumidula; rubra; Smithii; Gibbesii* (bilobing feeble); *spinimanus*
- 6.—Carapace when fresh having a pair of well defined, round, ocellated, red spots on the flanks. .... *Sebae*
- 7.—Carapace having a pair of ill defined red or brownish spots on the flanks. ....  
*tumidula*
- 8.—One or two round silvery spots on each side of carapace, near bases of marginal spines ..... *Gibbesii*
- 9.—Merus of chelipeds having five or six spines on the inner margin.  
*Gibbesii; rubra* (not always); *Sebae; depressifrons; spinimanus* (sometimes).

- 10.—Posterior distal spine of merus of chelipeds obsolete or reduced to a tubercle ..... *tumidula*; *depressifrons*; *Sayi*
- 11.—Manus of chelipeds with two distal spines, one behind the other.  
*anceps*; (*ventralis*); *sulcatus*; *Sebae*
- 12.—Manus with three distal spines, each on a different rib ..... *rubra*
- 13.—Manus with a brilliant silvery or iridescent area on the superior outer surface ..... *Ordwayi*
- 14.—Inner spine of carpus more than half as long as manus ..... *spinicarpus*
- 15.—Ambulatory legs long, oar-like, with the three distal segments wider, much flattened, and strongly fringed on the under margin ..... *Sayi*
- 16.—Swimming (posterior) leg with an erect acute spine on the basal joint.  
*Sebae*
- 17.—Swimming legs having the posterior distal end of merus angular and armed with a sharp spine ..... *spinimanus* (spine small); *rubra*; *Sebae*
- 18.—The same, armed with a row of small, often unequal denticles.  
*spinimanus*; *Smithii*; *tumidula*; *Gibbesii*; *Ordwayi*

Analytical table of the Bermuda species of *Portunus*, *Acheloüs*, and *Charybdelta*.

- A. Frontal teeth six, counting the inner orbitals, which are not bilobed.
- B. Anterior ambulatory legs remiform with the distal segments flat and strongly fringed; merus not flat nor fringed. Carapace wide, with margin broadly arched in front ..... Genus *Portunus*
- b. Carapace nearly smooth, glossy, not pubescent ..... *Sayi*
- B'. Anterior legs adapted for walking, not distinctly remiform, nor much flattened distally; dactylus slender. Carapace margin more narrowly arched anteriorly; dorsal surface strongly areolated or sculptured, usually closely covered with short hairs ..... Genus *Acheloüs*
- C. Posterior lateral tooth distinctly longer than those in front of it.
- D. Basal joint of posterior legs with a sharp erect spine; also a straight spine on outer distal angle of its merus. Four inner frontal spines prominent. A pair of round red spots on the flanks ..... *Sebae*
- D'. Basal joint of posterior legs without a spine; no large spine on its merus.
- E. Chelæ with a smooth, iridescent area on upper outer surface of manus; a single distal spine on manus; four inner frontal teeth prominent... *Ordwayi*
- E'. Chelæ without an iridescent area.
- F. Chelæ with two distal spines on manus, one before the other; posterior lateral tooth elongated, spiniform ..... *anceps*
- C'. Posterior lateral tooth little or not at all larger than the others. Chelæ with a single distal spine on manus. Frontal teeth very short, middle two much smaller ..... *depressifrons*
- A'. Frontal teeth eight, counting the inner orbitals, which are bilobed, each as two. Carapace sculptured, closely pubescent; posterior lateral tooth moderately elongated ..... Genera *Acheloüs* (*paucis*) and *Charybdelta*
- F. Antero-marginal teeth, except last, equal or nearly so.
- G. Two interior frontal teeth decidedly more prominent than the others.  
*spinimanus*
- G'. Two interior frontal teeth scarcely more prominent than the others... *Smithii*
- F'. Antero-marginal teeth unequal, alternately larger and smaller... *C. tumidula*

**Portunus Sayi** (Gibbes) Rathbun.

*Portunus pelagicus* Bosc, Hist. nat. des Crust., p. 219, pl. v, fig. 3, 1805.

*Lupa pelagica* Say, Jour. Acad. Nat. Sci. Philad., i, p. 97, 1817. DeKay, Nat. Hist. New York, Crust., p. 11, pl. vi, fig. 8, 1844 (*non* Linn., spec., *nee* Fabr.).

*Lupa Sayi* Gibbes, Proc. Amer. Assoc. Adv. Sci., 3d meeting, p. 178, 1850. Dana, U. S. Expl. Exped. Crust., p. 273, pl. xvi, fig. 8, 1852. Stimpson, Proc. Acad. Nat. Sci. Philad., 1858, p. 38.

*Neptunus Sayi* Stimpson, Anu. Lyc. Nat. Hist. New York, vii, p. 220 (92), 1860; Bulletin Mus. Comp. Zoöl., i, p. 147, 1870. A. Milne-Edw., Nouv. Arch. du Mus. d'Hist. Nat., x, p. 317, pl. xxix, figs. 2, 2a, 2b, 1861. Smith and Harger, Trans. Conn. Acad., iii, p. 26, 1874. Kingsley, Proc. Acad. Nat. Sci. Philad., 1878, p. 319, 1878; op. cit., for 1879, p. 398. A. M.-Edw., Miss. Sci. Mex., v, p. 210, 1879. Smith, these Trans., v, p. 121, 1879.

*Portunus Sayi* M. J. Rathbun, Bull. Labr. Nat. Hist. Univ. Iowa, p. 276, 1898; Amer. Nat., xxxiv, p. 140, 1900.

? *Neptunus hastatus* W. Stone, in Heilprin's Berm. I., p. 147 (*non* Linné sp.).

FIGURE 25. PLATE XVIII, FIGURE 1. PLATE XXI, FIGURE 1.

This has the anterior ambulatory legs longer, and decidedly more flattened and fringed more strongly with long hairs on the distal

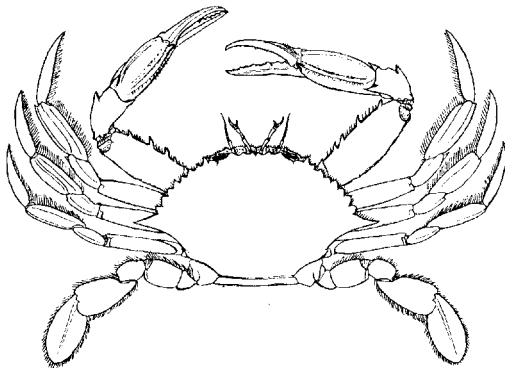


Figure 25.—*Portunus Sayi*,  $\frac{1}{2}$  nat. size. Drawing by J. H. Emerton, from nature.

joints than any other of our allied species, and its swimming legs are long and thick, in accordance with its more strictly oceanic habits. The merus and carpal joints of the swimming legs, also, are smooth, ovate, and thickened, and the basal joints are longer than usual. It is an active swimmer. The carapace is smoother than in the other Bermuda species. In addition to these characters, it has, as other diagnostic characters, four small, but nearly equally prominent and regular frontal teeth; the inner ones rather smaller and

narrower; the posterior lateral tooth is stout, thickened, excavate on the front edge; the other lateral teeth are regular, triangular, nearly equilateral, not much inclined forward.

The ratio of length to breadth of carapace, not including lateral spines, is about 1:1.60.

The inner orbital tooth is usually simple, but in one case (4036*b*) it was bilobed on one side, entire on the other.

Measurements.

No.	Sex	lgth	Carapace		Front bet. orbits	Chale		Locality
			br'dth total	br'dth -spines		length	height -spines	
11074 <i>a</i>	♀ eggs	30	61	48	11	r. 35.5 l. 34.0	9.5 8.5	Off Hatteras
11074 <i>b</i>	♂	31	62	53	10	r. 46	10	Off Hatteras
4036 fig.	♂	22.5	44	36	9	31	7.0	Off N. Jersey
4036 <i>b</i>	♀ eggs	23	46	38	10	27	7.5	Off N. Jersey
1903 <i>a</i>	♀ eggs	17	34	21	8	r. 19	5.5	Bermuda
1903 <i>b</i>	♂ juv.	14	26	21.5	5.5	17	4.0	Bermuda

No. 1903*a*, with few eggs, was taken by the Biological Station party in July, 1900. The specimen (No. 4036*b*), carrying eggs, was taken in July, 1883, by the "Albatross." No. 11074*a* was taken Sept. 21.

This is one of the numerous species of invertebrates that have acquired the habit of living normally among the masses of floating "gulf-weed" or *Sargassum*, etc., in mid-ocean, and especially along the course of the Gulf Stream. Like most of the other animals associated with it, this crab has colors imitative of the gulf-weed and the whitish patches of encrusting bryozoa (*Biflusa*), so common on the gulf-weed. The whitish patches of bryozoa look much like the pale patches on the back of the crab, while the olive-green and brown mottled colors of the latter are like those of the plants. It is, however, able to leave the gulf-weed and swim rapidly for some distance. Perhaps it does not come ashore at the Bermudas except when cast on the shores in masses of gulf-weed, etc. Most of those collected, if not all, have thus occurred. It is usually associated, in such cases, with *Planes minutus*, *Leander tenuicornis*, and other species having the same mode of life.

It was in the collection of Mr. Goode, 1876. We took it, in the same way, in 1898 and 1901. Young specimens were contained in the collections of the Bermuda Biological Station, obtained in the summer of 1903, associated with *Planes*.

It is often carried northward in the Gulf Stream to Cape Cod, St. Georges Bank, and even off Nova Scotia. Prof. Smith took it in

N. lat.  $41^{\circ} 30'$ , in *Sargassum*, 1872. Southward it is abundant along the Gulf Stream to Florida, Cuba, and the Gulf of Mexico. Few of the Bermuda specimens carried eggs; most are quite young.

**Achelous anceps** (Saus.) Stimpson.

*Lupa anceps* Saussure, Crust. Antilles, Mex., Mem. Soc. Phys. Hist. Nat. Genève, xiv, p. 434 [18], pl. ii, fig. 11-11b, 1858 (Cuba).

*Neptunus anceps* A. M.-Edw., Arch. Mus. Nat. Hist., x, p. 328, 1861; Miss. Sci. Mex., v, p. 213, 1879. Rankin, Ann. N. York Acad. Sci., xii, p. 530, 1900. S. I. Smith, Annual Rep. U. S. Fish Comm. for 1895, p. [30], 1886 (Cape Hatteras).

*Lupa Duchassaqui* Desb. and Schramm, Crust. Guadeloupe, p. 39, pl. iv, fig. 25 (*t.* Stimpson).

*Portunus (Achelous) anceps (pars)*, M. J. Rathbun,\* Amer. Naturalist, vol. xxxiv, p. 140.

*Neptunus ventralis* A. M.-Edw., Exp. Sci. Mex., v, pl. xi, fig. 3, 1879. Rathbun, Brach, and Maer. Porto Rico, p. 45.

*Achelous anceps* Stimpson, Ann. Lye. Nat. Hist. N. York, p. 113, 1871.

FIGURE 26. PLATE XX, FIGURES 1, 2. PLATE XXVII, FIGURE 4.

This species is easily recognizable by the long, sharp, posterior lateral spines; the four very short, obtuse, unequal frontal teeth; and

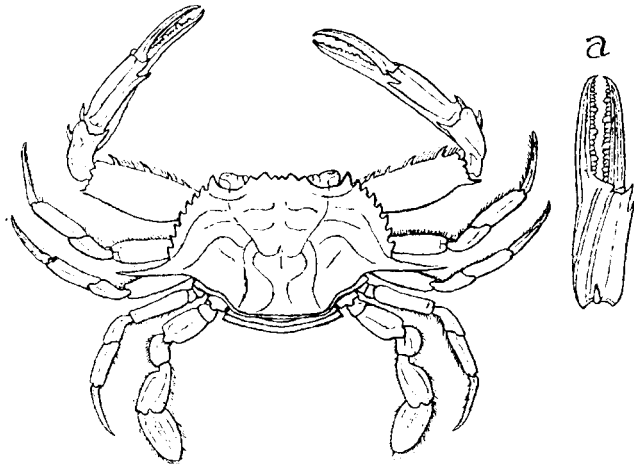


Figure 26.—*Achelous anceps*, female, enlarged  $11\frac{1}{2}$  times; *a*, chela. After Saussure.

the two distal spines, one behind the other, on the chela, besides other obvious characters. The two middle frontal teeth are much smaller than the others. The lateral teeth are acute and curve

\* Miss Rathbun (*loc. cit.*), in her analytical table, placed *anceps* in a group with short posterior lateral spines. She informs me that she then had another species in mind.

forward. This appears to be a small species. The Bermuda specimens taken in Castle Harbor, March and April, 1901, were all small; in life the carapace was usually mottled with gray and yellowish white, so as to imitate the color of the sand pretty closely. The first pair of ambulatory legs in some were yellow, in others red; the chelipeds and other legs had, in part, the same colors. Perhaps the difference was sexual; both sexes were in the lot noted.

The colors soon fade in alcohol or formol to uniform yellowish or salmon, with a tinge of red on the tips of the chelæ. The ratio of length to breadth, less spines, is from 1:1.5 to 1:1.60. All our specimens are small, but apparently about adult, as several carry eggs.

Measurements of specimens.

No.	Sex	Carapace			Front bet. orbits	Chelæ		Locality
		length	breadth total	br'dth —spines		length	height	
4038, fig.		12	24	18	5.5	17	3.5	Bermuda
4044	♂	13	26	20	5.5	19	3.5	Bermuda
4045a	♀ eggs	13	25	19	5	17.5	3.5	Off Hatteras
4045b	♀ eggs	12.5	25	19	5	16	4.25	Off Hatteras

Our largest male has the carapace 16<sup>mm</sup> long and 32<sup>mm</sup> wide, including the lateral spines, or 24<sup>mm</sup> without the spines.

One Bermuda specimen, taken in April (No. 4060) carried eggs. Similar specimens were taken in a seine at Nonesuch I., Sept. 4, 1905, by the party from the Field Mus. Nat. History (No. 158), one of which carried a large mass of eggs, indicating sexual maturity, but probably not full size.

Specimens taken in 7 fathoms, off Cape Hatteras, by the "Albatross," station 2288, Oct. 20, 1884, average a little larger. Three of them (No. 4045, a, b, c) carried large clusters of eggs; these were all 12 to 14<sup>mm</sup> in length of carapace.

It is not uncommon at Bermuda, in the shallow waters of sheltered sandy bays. Our specimens were taken in March and April, mostly in Hungry Bay and at "Waterloo," near Walsingham Bay, Castle Harbor.

Its known range is from the Antilles to Cape Hatteras. Off C. Hatteras, 7-16 fathoms (Smith).

It seems to me probable that *N. ventralis* A. M.-Edw. (op. cit., fig. 3) is identical with this species, with which it agrees in nearly all details. Miss Rathbun gives measurements of *ventralis* from Porto Rico as follows: length of carapace, 15<sup>mm</sup>; total breadth, 30<sup>mm</sup>; breadth less spines, 23.7<sup>mm</sup>. The proportions, therefore, are the same as some of those in my table.

**Achelous Sebæ** (H. M.-Edw.) Smith.

*Portunus sanguinolentus (pars)* Latreille, Encyc. Method., pl. 272, fig. 6.  
(non Herbst sp. nec Stimpson).

*Lupa Sebæ* H. M.-Edw., Hist. Nat. Crust., i, p. 455, 1834.

*Neptunus Sebæ* A. M.-Edw., Arch. Mus. Hist. Nat., x, p. 329, pl. xxviii, figs. 2, 2a, 1861; Miss. Sci. Mex., v, p. 217, 1879.

*Achelous Sebæ* S. I. Smith, Crust. Brazil, these Trans., ii, p. 34, 1869 (Brazil).

*Portunus (Achelous) Sebæ* Rathbun, Brach. and Macr. Porto Rico, p. 46, 1901.

## FIGURE 27.

This fine species grows to large size. It is easily recognized by an upright, acute spine on the basal joint of the posterior legs, and a small spinule on the outer distal angle of the merus joint of the same legs; and when recent by a pair of large round red spots on the flanks of the carapace. But these spots are liable to fade in alcohol, and in dry specimens exposed to light, becoming pale yellow.

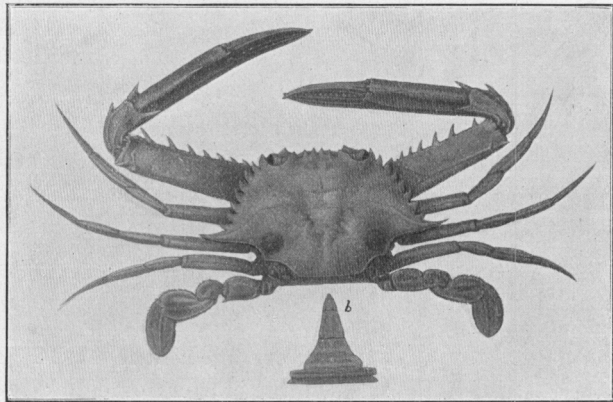


Figure 27.—*Achelous Sebæ*, about  $\frac{1}{3}$  nat. size; *b*, abdomen of male. After A. M.-Edwards.

It is said to be the only species having an upright spine on the basal joint of the swimming legs.

The chelæ have two distal dorsal spines, one behind the other. The middle two frontal teeth are a little more prominent than the outer ones, which are more acute. The inner orbital tooth is acute. The posterior lateral tooth is sharp, rather long, somewhat curved forward, and bears the small preceding tooth on the inner basal portion.

In life the carapace and legs are closely pubescent and the legs and chelipeds are fringed with longer red hairs. The merus of the

chelipeds has six sharp spines on its anterior edge with a close fringe of long red hairs above, and a smaller one below them; it has also a sharp distal spine on the posterior side. There are three sharp dorsal spines on the manus: the proximal at the joint, one sharp and curved toward the distal end, and a smaller one at the extreme end. Carpal spines two, very sharp. Nearly all the spines are red at base with a pale middle band and darker tip. The dactylus has a dorsal fringe of red hairs. The general color of preserved specimens is pale orange yellow; three faint reddish bands on the legs and chelæ; fingers red.

Measurements.

No.	Sex	Carapace			Front between orbits	Chelæ		Locality
		length	total breadth	breadth —spines		length	height	
47*	♀	45.2	89	—	—	{ r. 56 l. 60		Bermuda
4084a	♂	45	91	69	20	{ r. 69 l. 68	{ r. 15 l. 14	Dominica

\* No. 47 was measured by Prof. S. I. Smith (Goode's coll.).

This species has rarely been taken in the Bermudas. An adult female was obtained by Mr. G. B. Goode in 1876 (coll. Wesleyan Univ.). It probably lives in rather deep water. Large specimens collected at Dominica I., Antilles, in 1906, were taken in fish-nets, in shallow water (A. H. Verrill, Yale Mus.).

Its range extends from North Carolina through the West Indies to Brazil. Martinique and Brazil (Edw.); Porto Rico (Rathbun).

**Achelous Ordwayi** Stimp. *Silvery-clawed Crab.*

*Achelous Ordwayi* Stimpson, Notes on N. Amer. Crust., ii, p. 96 [224], 1860 (Florida and St. Thomas); Bulletin Mus. Comp. Zool., ii, p. 148. S. I. Smith, Brazilian Crustacea, these Trans., ii, p. 9, 1869 (descr.).

*Neptunus Ordwayi* A. M.-Edw., Arch. Mus., p. 450, 1861, Addenda; Miss. Sci. Mex., p. 217, pl. xl, fig. 2-2b, 1879.

*Portunus (Achelous) Ordwayi* M. J. Rathbun, Bulletin Labr. Nat. Hist. Univ. Iowa, 1898, p. 276; Brach. and Macr. Porto Rico, p. 46, 1901.

FIGURES 28, 29. PLATE XVIII, FIGURE 3.

This species is easily recognized by the smooth silvery or iridescent area on the outer surface of the chelæ. The four frontal teeth are narrow, prominent, and subacute; the inner orbital tooth is simple, triangular and acute. The posterior lateral tooth is larger than the others, but not very long; it is sharp and curves forward; all the other teeth curve forward. The carapace and legs are pubescent