

collections from Lagos harbor, a brackish to fluviatile habitat, the latter species (55 specimens) far outnumbers *C. amnicola* (2 specimens).

Le Loeuff and Intès (1968:44) made the following observations on this species:

C'est un élément important de la faune des milieux lagunaires de l'ouest Africain. Nous l'avons cependant récolté à 9 reprises en mer dans la zone littorale au-dessus de 30 mètres. Les individus étaient tous des femelles de grande taille, ovigères à une exception près. Ces collectes ont eu lieu de juillet à août, puis de décembre à février. Les deux sorties de décembre 1967 à Grand-Bassam ont permis encore de ramener onze femelles ovigères. *C. latimanus* migre donc en mer pour pondre; et il y aurait deux saisons de ponte, l'une en saison froide, après la période des fortes précipitations de Mai et Juin, l'autre au moment des petits upwellings, après les crues des fleuves de Septembre et Octobre.

In a subsequent paper these same authors commented (1969:63):

Le Crabe de lagune *Callinectes latimanus* Rathbun vient également pondre en mer; des femelles de grande taille, en grande majorité ovigères ont été récoltées à plusieurs reprises sans qu'il soit possible encore d'affirmer que la sortie en mer et la ponte ont lieu à certaines périodes définies ou tout au long de l'année.

Ovigerous females have been collected in January, February, March, May, June, July, August, October, and December (Monod, 1956; Ribeiro, 1964; Le Loeuff and Intès, 1968; Williams, 1974; Pillsbury).

DISTRIBUTION.—*Callinectes amnicola* is an inshore, estuarine species, occurring off West Africa from Baie de Saint-Jean (19°27'N, 16°22'W), Mauritania to at least as far south as a lagoon N of Luanda (08°47'S, 13°16'E), Angola. Williams (1974) summarized earlier records; distributional records from the literature not in Williams include the following:

West Africa: No specific locality (Monod, 1967).

Cape Verde Islands: Baía [Porto] de Sal Rei, Boavista (Guinot and Ribeiro, 1962; Ribeiro, 1964). Porto da Praia, São Tiago (Ribeiro, 1964).

Senegal: Sénégal River, Falémé River [?], Bakoy [?] [= ? Bako, 14°00'N, 15°16'W, or Bakor River 12°55'N, 14°44'W], Bafing [?] [= Baling ?] "et tous les Marigots tributaires," Casamance River (all De Rochebrune, 1883). Presqu'île du Cap Vert; Rosso; Dakar (Sourie, 1954a). Dakar; Saloum (Sourie, 1957).

Gambia: Gambia River (13°28'N, 16°34'W) (De Rochebrune, 1883).

Sierra Leone: Sierra Leone River (Longhurst, 1957).

Liberia: No specific locality (Büttikofer, 1890; Johnston, 1906).

Ivory Coast: Off Sassandra, off Grand-Lahou, off Grand-Bassam, 15-30 m (Le Loeuff and Intès, 1968).

Ghana: Off Accra, in shallow water (Gauld, 1960). Sakumo lagoon (Pauly, 1975).

Nigeria: Lagos (Bruce-Chwatt and Fitz-John, 1951). Elechi Creek, Port Harcourt, 04°47'15"N, 06°58'45"E (Powell, 1979).

Cameroon: No specific locality, 0-30 m (Crosnier, 1964).

**Callinectes marginatus* (A. Milne Edwards, 1861)

FIGURES 19b, 20a,b

Neptunus diacanthus.—Pechüel-Loesche, 1882:287.—Osorio, 1892:199. [Not *Portunus diacantha* Latreille, 1825 = *Callinectes sapidus* Rathbun, 1896].

?*Callinectes diacanthus*.—Gruvel, 1913:78, 106 [this species or *C. amnicola*?].

?*Callinectes diacanthus* var. *africanus*.—Gruvel, 1913:168 [listed] [this species or *C. amnicola*?].

Callinectes marginatus.—Gruvel, 1913:168 [listed].—Capart, 1951:134, fig. 48.—Monod, 1956:208, figs. 238, 239.—Rossignol, 1957:82.—Buchanan, 1958:20, 23.—Gauld, 1960:69.—Guinot and Ribeiro, 1962:48.—Rossignol, 1962:116.—Ribeiro, 1964:6.—Forest and Guinot, 1966:65.—Monod, 1967:180, pl. 15: fig. 6 [no material].—Bott, 1968:169.—Williams, 1974:722 [part, not figs. 3, 18a,b, 20a, 22b, 27] [review of genus].—Hartmann-Schröder and Hartmann, 1974:19.

Callinectes.—Bayer, 1966:102.

SYNONYM.—*Callinectes diacanthus* var. *africanus* A. Milne Edwards, 1879.

MATERIAL EXAMINED.—*Pillsbury Material*: Nigeria: Sta 1, Lagos harbor, washed ashore, 1 carapace (L).

Fernando Poo: Sta 257, shore, 2♂, 1 juv (L).

Annobon: Sta 281, shore, 2♂, 2 juv (W).

Other Material: Cape Verde Islands, Porto Grande, São Vicente, U.S. Eclipse Expedition, 1 juv (W). Porto da Praia, São Tiago (as La Praya, Santiago), Jul 1883, *Talisman*, 1♂ (W).

Ghana: Mouth of Hwini River, Takoradi, 27 Jul 1961, Bane and Richards, 1♂ (W). Virgins Pool, Takoradi, 27 Jul 1961, Bane and Richards, 1♂ (W).

Zaire: Banana, mouth of Congo River, American Museum Congo Expedition 1909-1915, Aug 1915, H. Lang, 5♂, 4♀ (W). Data same, Jul-Aug 1915, 1♀ (W).

Angola: Luanda (as St. Paul de Loanda), U.S. Eclipse Expedition, 2♂ (W).

DESCRIPTION.—Carapace (Figure 19*b*) somewhat elevated, generally flatter than in *C. amnicola*, width slightly more (2.1 to 2.3 times) than twice as great as length (lateral spines included). Granulation dense, uniform, granules anterior to epibranchial ridge as dense and large as those posterior to ridge; granules finer than in *C. amnicola* but distinct. Epibranchial ridge between cervical groove and lateral spine of carapace not straight, with strong inflection near midlength. Length of metagastric area equal to or shorter than posterior width, latter half anterior width. Front with submedian teeth very narrow, short, much shorter than half length outer teeth; latter bluntly triangular, extending somewhat beyond more widely triangular inner orbital angles. Epistomial spine distinct in dorsal view, extending about as far forward as outer frontal teeth. Anterolateral margins of carapace more strongly convex than in *C. amnicola*. Anterior teeth triangular, curved somewhat forward, blunt; posterior teeth also triangular, more sharply pointed. Lateral spine stout, about twice as long as preceding tooth.

Carinae on cheliped of adults distinct, granular. Chelae of adults slender, occasionally somewhat swollen in basal part of fingers, less strongly so than in *C. amnicola*. Basal tooth of dactylus of large chela slightly enlarged.

First somite of abdomen in both sexes terminating laterally in triangular or blunt point, neither prolonged nor turned upward.

First gonopods of male short, failing by far to reach end of sternite of third pereopod. Distal part of gonopods somewhat curved externally, curve gradual, gonopods generally not touching (Figure 20*a,b*).

Figures: Rathbun, 1921, fig. 2, pl. 19: fig. 1, pl. 20: fig. 1; Capart, 1951, fig. 48; Monod, 1956, figs. 238, 239.

Male Pleopod: Rathbun, 1921, fig. 2*d* (Zaire).

Color: Capart (1951:135) noted that "coloration après fixation non uniforme, des marbrures plus foncées sur la carapace et sur P.I." Rossignol

(1957:82) remarked that the species can best be distinguished from *C. amnicola* by its color, namely "carapace marbrée."

MEASUREMENTS.—Our specimens have carapace widths of 15 to 97 mm.

REMARKS.—Since Rathbun (1896:358, 359) referred African specimens of this species to the East American *Callinectes larvatus*, the specific identity of African and American specimens of the two forms have not been questioned. After having examined the types of *Callinectes marginatus* (A. Milne Edwards, 1861) from Gabon, *Callinectes larvatus* Ordway, 1863, from Key West, the Tortugas, the Bahamas and Haiti, and *Callinectes diacanthus africanus* A. Milne Edwards, 1879, from the Cape Verde Islands, Rathbun (1897a:149) synonymized the three species and used the oldest available name, *marginatus*, for it. Rathbun's views on the taxonomy and nomenclature of the species have since been followed by most authors, including Williams (1974) in his fundamental revision of the genus *Callinectes*.

However, a comparison of our African material with American specimens identified with *C. marginatus* showed a number of seemingly constant differences, which in our opinion necessitates the recognition of two distinct species. The American species should be given the name *Callinectes larvatus* Ordway, 1863; the well-known name *Callinectes marginatus* (A. Milne Edwards, 1861) is retained for the African species. The differences between these species are the following:

1. In *C. marginatus* (Figure 19*b*) the granulation of the carapace before the epibranchial ridges is as dense as that behind these ridges, the granules there are of the same size as those in the posterior part of the carapace. In *C. larvatus* the granules before the epibranchial ridges are larger and placed much wider apart than those behind the ridges.

2. The cervical groove behind the orbits is much deeper in *C. larvatus* than in *C. marginatus*.

3. The ventral inner orbital angle in *C. marginatus* is narrower than in *C. larvatus*.

4. The male gonopods are short in both species, but in *C. marginatus* (Figure 20*a,b*) they are more

slender and the distal part that is curved outward is relatively longer and less abruptly bent; the two gonopods as a rule do not touch. In *C. larvatus* (Figure 20*c,d*) the distal outward curved part of the gonopod is shorter and more abruptly bent; the two gonopods touch each other in the midline of the body.

BIOLOGY.—Monod (1956:210) indicated that this species is a shallow water form that prefers a sandy or sandy mud bottom, and is found in marine habitats. The latter in contrast to *C. amnicola*, which is known from fresh, brackish, and salt water, and *C. pallidus*, which Monod reported from salt and brackish waters. Buchanan (1958: 20, 23) indicated *C. marginatus* as a characteristic epifaunistic species of the inshore fine sand community. Rossignol (1962:116) described the species as a "forme littorale (eaux saumâtres, lagunes)," but possibly based this on the literature in which more than one species is confused under the name *C. marginatus*. Gauld (1960) mentioned the species to be caught intertidally. Guinot and Ribeiro (1962:48, 49) listed an abundant material, mostly from sandy beaches, either taken by hand or by beach seines; the species was mentioned once by them from the hull of a ship, and

once from under rocks near the shore; there is no indication that any of this material is estuarine. Ribeiro (1964:6) reported the species from "zona intercotidal." Forest and Guinot (1966:65) mentioned the species from a sand beach (0–9 m) and from intertidal rocks. West African material of *Callinectes marginatus* was listed by Williams (1974) from "rock pool" and "beach." The Pillsbury specimens were collected from sandy beaches (Sta 1 and 281) and from the seashore (Sta 257). All these data confirm Monod's statement that the species is marine rather than estuarine. The data are too few, however, to definitely fix the habitat of the species; specimens have been reported from the mouth of the Congo River (Rathbun, 1921; and p. 92), and from the mouth of the Hwini River (p. 92), localities that might be estuarine.

Off West Africa ovigerous females have been collected in February, May, June, September, October, and December (Guinot and Ribeiro, 1962; Ribeiro, 1964; Forest and Guinot, 1966; Williams, 1974).

DISTRIBUTION.—The species is known from the Cape Verde Islands and Port Etienne, Mauritania to central Angola. Monod (1956) summarized earlier records; distribution records from the literature not in Monod include the following.

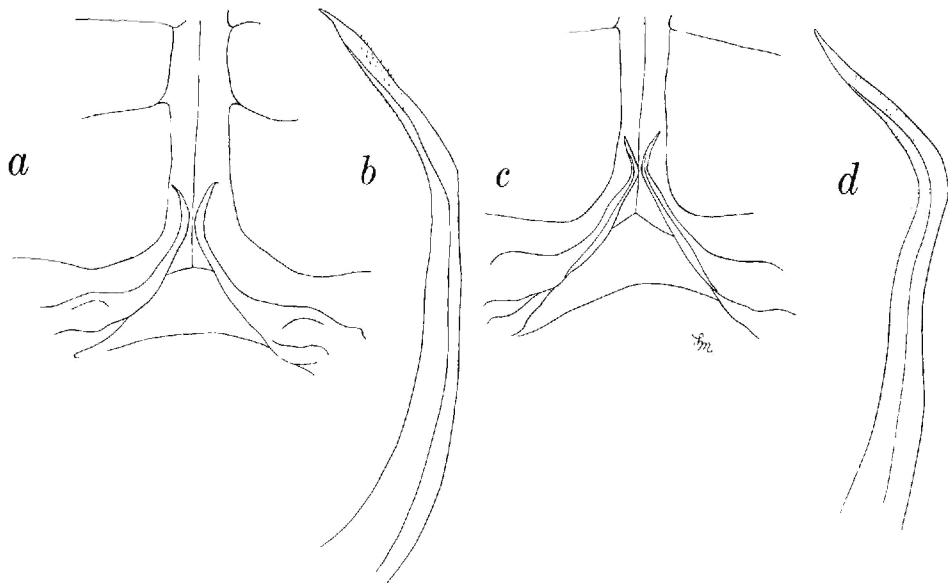


FIGURE 20.—Position and shape of gonopods: *a,b*, *Callinectes marginatus* (A. Milne Edwards), male, cb 90 mm, Congo; *c,d*, *Callinectes larvatus* Ordway, male, cb 116 mm, Jamaica.

West Africa: No specific locality (Monod, 1967).
 Cape Verde Islands: Baía das Gatas, São Vicente (Guinot and Ribeiro, 1962; Ribeiro, 1964). Porto da Praia, São Tiago (Guinot and Ribeiro, 1962; Ribeiro, 1964; Williams, 1974).
 Senegal: Dakar (Williams, 1974).
 Gambia: Near Gunjur (Williams, 1974).
 Guinea: Fotoba, 6 miles [10 km] W of Conakry (Williams, 1974).
 Sierra Leone: Murray Town (Williams, 1974).
 Ghana: Off Accra (Buchanan, 1958). Apam (Gauld, 1960).
 Togo: No specific locality (Gravel, 1913).
 Dahomey: No specific locality (Gravel, 1913).
 Nigeria: Lagos harbor (Williams, 1974).
 Fernando Poo: No specific locality (Williams, 1974).
 Principe: No specific locality (Forest and Guinot, 1966).
 São Tomé: No specific locality (Forest and Guinot, 1966; Williams, 1974). Iógoiôgo (Osorio, 1892; Forest and Guinot, 1966). Morro Peixe (Forest and Guinot, 1966; Williams, 1974).
 Annobon: 01°24'S, 05°37'E, shore (Bayer, 1966).
 Gabon: No specific locality (Williams, 1974; syntypes).
 Congo: No specific locality (Williams, 1974). Loango (Pechüel-Loesche, 1882). Djeno, lagoon (Rossignol, 1957). Near Pointe-Noire (Rossignol, 1962; Williams, 1974).
 Zaire: Mouth of Congo River near Banana (Williams, 1974).
 Angola: No specific locality (Forest and Guinot, 1966).
 Luanda (Forest and Guinot, 1966; Bott, 1968; Williams, 1974). Baía do Lobito (Guinot and Ribeiro, 1962; Williams, 1974). Praia da Rocha, Benguela (Guinot and Ribeiro, 1962). Between Cacucaco and Lobito-Benguela (Hartmann-Schröder and Hartmann, 1974).

****Callinectes pallidus* (De Rochebrune, 1883),
 new combination**

FIGURE 19c

Neptunus pallidus De Rochebrune, 1883:170.—Miers, 1886: 175.—Bals, 1921:59 [listed].—Monod, 1956:215.
Neptunus diacanthus.—De Man, 1883:150 [part].—Büttikofer, 1890:466, 487 [part]. [Not *Portunus diacantha* Latreille, 1825 = *Callinectes sapidus* Rathbun, 1896].
Portunus pallidus.—Rathbun, 1900a:290.
Callinectes Sp.?—Irvine, 1932, fig. 13.
Callinectes gladiator.—Irvine, 1932:15.
Callinectes latimanus.—Irvine, 1947, fig. 202 [not *C. latimanus* Rathbun, 1897 = *C. amnicola* (De Rochebrune, 1883)].
Callinectes gladiator.—Irvine, 1947:298.—Frade, 1950:11, 26.—Bruce-Chwatt and Fitz-John, 1951:117.—Capart, 1951:130, fig. 46.—Monod, 1956:205, figs. 236, 237.—Rossignol, 1957:82.—Sourie, 1957:13, 51.—Longhurst, 1958:87.—Gauld, 1960:69.—Guinot and Ribeiro, 1962:

48.—Rossignol, 1962:116.—Crosnier, 1964:32.—Forest and Guinot, 1966:64.—Monod, 1967:180, pl. 15: fig. 3 [no material].—Bayer, 1966:98.—Le Loeuff and Intès, 1968: 40, p. 2 of table 1, figs. 50, 61; 1969:64, 65.—Monod, 1970:66.—Uschakov, 1970:439, 455 [listed].—Ejike, 1973: 253.—Williams, 1974:735, figs. 5, 18c, 20b, 22c, 24 [review of genus].

Callinectes.—Bayer, 1966:98.

Lupa Smythiana.—Monod, 1970:66.

SYNONYM.—*Callinectes tumidus* var. *gladiator* Benedict, 1893.

MATERIAL EXAMINED.—*Pillsbury Material*: Ivory Coast: Sta 43, surface, 2♀ (W).

Nigeria: Sta 2, Lagos harbor, surface, 41 specimens (L,W). Sta 226: Lagos harbor, surface, 1♂ (W). Sta 228, Lagos harbor, surface, 1♂, 2♀ (W). Sta 229, Lagos harbor, surface, 4♂, 6♀ (W). Sta 250, 24 m, brackish water, mud, 9♂, 11♀, 1 juv (W). Sta 251, 27 m, mud, 3♂, 5♀ (1 ov), 3 juv (L). Sta 252, 30 m, mud, 1♀, 1 juv (W).

Fernando Poo: Sta 257, shore, 1♂ (L). Sta 258, shore, 1 juv (W).

Other Material: Senegal: Dakar, 3 May 1892, O. F. Cook, 1♂ (W). Dakar Harbor, 25–26 Jul 1964, Geronimo, 2♂, 2♀ (W).

Liberia: Mouth of Mesurado River, Monrovia, O. F. Cook, 1♀ (W). Farmington River at Snafu Docks, Nov 1946, H. A. Beatty, 3♂, 1♀ (W). Off Saint Paul River mouth, Monrovia, 4–11 fm (7–20 m), 6 Jan 1953, G. C. Miller, 2♀ ov (W). Data same; 3–6 fm (5–11 m), 4 Mar 1953, 1♂ (W). Grand Cape Mount, near Robertsport, 1881, J. Büttikofer and J. A. Sala, 1♂, 2♀ (L).

Ghana: Chorkor, near Accra, Dec 1950, R. Bassindale, 3♀ (L). Baya River, Elmina, Ashantee [Ghana], 1889, W. H. Brown, Jr., holotype of *Callinectes tumidus* var. *gladiator* Benedict, 1♂ (29 × 63 mm) (W). Komenda, 11 Apr 1962, Amegah, 1♀ (W). Volta River mouth [Volta delta], 23 Jul 1961, Bane and Richards, 1 juv (W). Takoradi Fisheries Bay, 14 Aug 1961, Bane and Amegah, 11 juv (W). Takoradi, Hwini River mouth, Hwini drainage, 27 Jul 1961, Bane and Richards, 2♂, 5 juv (W).

Nigeria: Between Brass and Port Harcourt, Niger delta, May–Aug 1960, H. J. G. Beets, 3♂, 1 juv (L). S bank of mouth of Escravos River, Ajudaibo, Niger delta, 30 Jul 1975, C. B. Powell, 1♂, 1♀ (L).

Cameroon: Batanga, 1♂ (W). Batanga, caught on hooks by native fishermen, 12 Aug 1930, A. J. Good, 1♀ (W). Douala, from fish market at Yaounde, 10 Feb 1964, B. de Wilde-Duyfjes, 1♂ (L). Kribi, 9 Mar 1964, B. de Wilde-Duyfjes, about 15 specimens (L); same, 9 Aug 1964, about 15 juv (L).

Gabon: 01°10'S, 08°15'E, 21 Aug 1961, G. W. Bane, 1♂ (W). Port-Gentil, 1956, J. H. Logemann, 1♂ (L).

Zaire: Banana, mouth of Congo River, American Mu-

seum Congo Expedition, 1909–1915, Aug 1915, H. Lang, 1♂, 1♀ (W). Locality same, no date, 1♂ (W).

Angola: No specific locality ("Congo"), 1880, P. Kamerman, 1♂, 2♀ (L). Musserra, 1882, P. Kamerman, 1♂, 1♀ (L).

DESCRIPTION.—Carapace (Figure 19c) flatter and wider (2.3–2.5 times wider than long, lateral spines included) than those of other West African species of *Callinectes*. Surface granulation fine, uniform. Epibranchial ridge, between cervical groove and lateral spine, almost straight, lacking inflection found in *C. marginatus*. Length of metagastric area shorter than posterior width, 2/3 to 3/4 times posterior width, much shorter than half anterior width. Front with submedian teeth distinct, short, narrow, slightly less than half as long as outer frontal teeth, latter narrowly triangularly rounded, extending distinctly beyond broadly rounded inner orbital angles. Epistomial spine distinctly visible in dorsal view, extending to or slightly beyond outer frontal teeth. Anterolateral margins somewhat more strongly arched than in *C. amnicola*. Anterolateral teeth triangular, anteriormost acute or blunt, directed outward or slightly forward; posterior teeth sharply pointed, curved forward. Lateral spine almost 3 times as long as preceding tooth.

Ridges on carpus and chela usually distinct, granular, inconspicuous in some specimens. Palm in adults never swollen as in *C. amnicola*; basal tooth of dactylus occasionally enlarged in larger chela.

First abdominal somite in both sexes terminating laterally in sharp, upcurved points, characteristic for the species.

First gonopods of male short, extending almost to end of sternite of third pair of legs. Gonopods regularly curved outward, tips recurved inward. Williams (1974) provided a good account of the species.

Figures: Rathbun, 1921, fig. 3, pl. 19: fig. 2; Capart, 1951, fig. 46; Monod, 1956, figs. 236, 237; Williams, 1974; figs. 5, 18c, 20b, 22c, 24.

Male Pleopod: Rathbun, 1921, fig. 3d (Zaire); Williams, 1974, figs. 18c, 20b (Dahomey).

Color: Irvine (1947:298) described the color of the species as follows: "A crab with a beautiful

mottled carapace and bright blue legs." Capart (1951:131) noted the color to be "brun-vert foncé." Monod (1956:208) reported that in some of his material the dactyli of the fifth legs were "noirs," "plus ou moins noirs," "foncés." Rossignol (1957:82) described the color of the species as follows: "gris-vert ou gris-bleu uniforme avec une tache bleue sur la paume et la partie proximale interne du doigt et du pouce des pinces." Gauld (1960:69) commented that this species is "sandy grey, dorsally, with bright blue legs and a dark, almost black, patch on the distal part of the fifth dactyl." Williams (1974:735) summarized other information on color and noted that "preserved specimens often have an oval dark mahogany colored spot, variable in size, on the gastric and metagastric areas." De Rochebrune's (1883:171) remark that the color of the species is "d'un gris rose" would fit the color description of Gauld, but since De Rochebrune's type is juvenile, it is difficult to compare this color with that of adult specimens.

MEASUREMENTS.—Our specimens have carapace widths of 24 to 105 mm; the carapace width of the ovigerous female is 74 mm.

REMARKS.—De Rochebrune's (1883:170–171) original description of *Neptunus pallidus* runs as follows:

Carapace plus large que haute, presque aplatie, lisse; lignes épigastriques et hypogastriques à peine visibles; bords latéro-antérieurs beaucoup plus courtes que les latéro-postérieurs; première dent obtuse, les autres très courtes, arrondies au sommet; la neuvième droite aiguë très étroite; front découpé en six dents, les deux médianes très faibles, les moyennes arrondies, les externes courtes sub-aiguës; apophyse épistomienne dépassant légèrement le front; bras comprimés, armés à la partie antérieure de deux épines faibles, à la partie postérieure et au milieu d'une épine courte; avant-bras lisse, portant un petit tubercule en dehors; mains faibles, lisses, anguleuses, ayant une petite dent à l'articulation de l'avant-bras. Couleur générale d'un gris rosé."

The measurements given of this specimen are carapace width 15 mm, carapace length 9 mm. The specimen thus obviously is a juvenile. The description best fits juveniles of the species usually named *C. gladiator*. As shown under *C. amnicola*, the young of that species have the lateral spine of

the carapace very short, but in juveniles of the present species that spine is very elongate and straight, being much longer than the anterolateral teeth. The rest of the description also fits the present species, except for the measurements, for even *C. amnicola* specimens with cl 9 mm are much broader than 15 mm; one wonders whether 15 mm for the width is not a typographical error for 25 or 19 mm. Because both *C. amnicola* and *C. gladiator* are estuarine species, and both are common in Senegal, it seems most likely that *Neptunus pallidus* belongs to one of these two species; the shape of the lateral spines and the granulation of the carapace makes clear that it can only be identified with *C. gladiator* Benedict, 1893. As Benedict's name *gladiator* was proposed 10 years after De Rochebrune's publication of *pallidus* the latter name has priority and has to be used for the species.

As the type specimen of *N. pallidus* is no longer extant, we propose to fix the identity of *Neptunus pallidus* De Rochebrune, 1883, by selecting as its neotype the holotype of *Callinectes tumidus gladiator* Benedict, 1893 (USNM 14879), a male measuring 29 × 63 mm (one lateral spine broken). In this way *N. pallidus* and *C. gladiator* become objective synonyms. The name *pallidus* is quite appropriate for the species, as preserved material usually is of a very pale color.

The specimens reported as *Neptunus diacanthus* by De Man (1883) and Büttikofer (1890) are in the collection of the Rijksmuseum van Natuurlijke Historie, Leiden. Both author's accounts were based on material of *C. amnicola* as well as *C. pallidus*. De Man's material included two specimens of *C. pallidus* from the Congo (Crust. D. 374, 1876), and Büttikofer's collection included one specimen of *C. pallidus* from Liberia (Crust. D. 1871).

As pointed out by Capart (1951:130, 132) the figures that Irvine (1932, 1947) published with his "*Callinectes gladiator*" and "*Callinectes latimanus*" have been interchanged: the figures indicated by Irvine in 1932 (fig. 13) as "*Callinectes* Sp.(?)" and in 1947 (fig. 202) as *Callinectes latimanus* actually represent *C. pallidus*. Irvine's text of "*Callinectes*

Sp.(?)" and *C. latimanus* refers to *Portunus validus* (p. 103).

BIOLOGY—Williams (1974:736) has summarized most of the available ecological information on this species, an inshore form usually found on mud, sand, or sand and shell in depths of less than about 30 m. It is less often encountered in estuaries than *C. amnicola*, although the majority of the Pillsbury specimens were taken in brackish water in Lagos harbor during outgoing tides. Monod (1956:208) indicated this species as being found in the sea and in brackish water.

Sourie (1954b) found the species on bottoms of fine shelly sand with mud and *Molgula hannensis* Pérès in 2–7 m in the Baie de Dakar; Uschakov (1970) found it in turbid water in depths of less than 20 m on unstable mud off Guinea. Gauld (1960) noted that off Ghana it was very common from low water mark to 18 m, usually on sand. Bruce-Chwatt and Fitz-John (1951) noted that in Nigeria it lives on muddy bottoms of creeks.

Le Loeuff and Intès (1968:40) made the following observations on this species from their studies off the Ivory Coast:

Extrêmement abondant et fréquent au-dessus de 30 mètres, ce *Callinectes* est très littoral car il ne descend pas au-delà de 35 m; son aire de répartition est très stable: *C. gladiator* ne se déplace pas quelle que soit la saison et est donc extrêmement tolérant aux variations de température, salinité, teneur en oxygène des eaux. CAPART (1951) a signalé *C. gladiator* comme vivant sur des fonds vaseux. En fait l'espèce est indifférente à la nature du substrat. Tous les sédiments lui conviennent, sables ou vases. Sur les petits fonds *C. gladiator* domine nettement en nombre d'individus les autres Portunidae côtiers: *Portunus inaequalis*, *Cronius ruber*, *Neptunus validus* et contribue sans doute à repousser le maximum d'abondance des deux premiers au-delà de 25 mètres et à limiter la densité de *N. validus*.

Williams (1974) noted that earlier authors had commented on the aggressiveness of this species, a characteristic of most Portunidae.

Ovigerous females have been recorded in January, February, March, April, May, June, October, and December (Capart, 1951; Forest and Guinot, 1966; Monod, 1956; Williams, 1974; Pillsbury).

DISTRIBUTION.—West Africa, from numerous

localities between Baie de Saint-Jean (19°27'N, 16°22'W), Mauritania, to Baía do Lobito (12°-20'S, 13°34'E), Angola, generally in depths of 35 m or less. Williams (1974) reported material from numerous localities and summarized earlier records. Records not in Williams include the following.

West Africa: No specific locality (Monod, 1970).

Senegal: Lac de Nguèr (as N'Guer), marigots de MBao [= Grand Mbaou], Thionk [Pointe], Leybar (all De Rochebrune, 1883). Anse de Hann, Baie de Dakar, 2-7 m (Sourie, 1954b), Saloum (Sourie, 1957).

Guinea: No specific locality, less than 20 m (Uschakov, 1970).

Sierra Leone: No specific locality, 14-19 m (Longhurst, 1958).

Liberia: No specific locality (Frade, 1950).

Ghana: No specific locality, low water mark to 18 m (Gauld, 1960).

Ivory Coast: No specific locality (Le Loeuff and Intès, 1969). Off Sassandra, off Fresco, off Grand-Lahou, off Jacquville, off Grand-Bassam, 15-35 m (Le Loeuff and Intès, 1968).

Nigeria: Lagos (Bruce-Chwatt and Fitz-John, 1951). Lagos harbor, 06°28'N, 03°23'E, surface (Bayer, 1966). 7 miles [11 km] off Lagos harbor (Ejike, 1973).

Genus *Cronius* Stimpson, 1860

Cronius Stimpson, 1860:225 [type-species: *Portunus ruber* Lamarck, 1818, by monotypy; gender: masculine].

Charybdella Rathbun, 1897b:166 [substitute name for *Cronius* Stimpson, 1860, erroneously considered to be preoccupied; type-species: *Portunus ruber* Lamarck, 1818; gender: feminine].

**Cronius ruber* (Lamarck, 1818)

FIGURE 21a,b

Cronius ruber.—Capart, 1951:128, fig. 45.—Monod, 1956:189, figs. 218-221.—Rossignol, 1957:81, 124 [key].—Longhurst, 1958:87.—Buchanan, 1958:20.—Gauld, 1960:69.—Rossignol, 1962:115.—Guinot and Ribeiro, 1962:46.—Ribeiro, 1964:5.—Forest and Guinot, 1966:61.—Monod, 1967:180, pl. 15: fig. 5 [no locality].—Le Loeuff and Intès, 1968:40, 44, table 1, figs. 51, 61; 1969:63, 64, 65.—Uschakov, 1970:445, 455 [listed].

Charybdis.—Voss, 1966:19.

SYNONYM.—*Goniosoma Millerii* A. Milne Edwards, 1867.

MATERIAL EXAMINED.—*Pillsbury Material*: Ivory Coast: Sta 46, 38-42 m, mud with dense *Jullienella*, 1 juv (W). Sta 48, 22 m, 4♂, 3♀ (L, W).

Annobon: Sta 275, 9-69 m, rubble of coralline algae, 2 juv (L).

Other Material: Ghana: Accra, 1868-1869, M. Sintenis, 1♂ (L).

DESCRIPTION.—Capart, 1951:128.

Figures: Monod, 1956, figs. 218-221.

Male Pleopod: Guinot-Dumortier, 1960, fig. 15a,b (French Guiana); Garth and Stephenson, 1966, pl. 12c (Galapagos Islands).

Color: Rossignol (1957:81) provided the following detailed color account of this species.

Face dorsale:

a. Carapace: brun verdâtre teinté de jaune dans la région postérieure. Dents antérolatérales et frontales bleu azur avec apex marron.

b. Pinces: Côté interne: paume orange avec des taches blanches. Pouce et doigt brun-rouge à apex jaune. De plus, une tache orange au milieu du doigt. Côté externe: jaune sale avec bord inférieur blanc et épines bleues.

c. Pattes: brun verdâtre; épines bleues à apex marron. Partie distale du dactyle rose violacé, apex jaune. Dactyle de P₅ bordé d'une frange de poils oranges.

Face ventrale: blanc sale.

Capart (1951:128) gave the following notes on color: "Coloration rouge orange vif tacheté de blanc crème; le bout des épines et des doigts de la pince noir."

MEASUREMENTS.—Our specimens have carapace widths of 10 to 72 mm.

REMARKS.—So far as we can determine, the male pleopod of this species has not been figured from West African specimens; the pleopod of one of our specimens is shown here (Figure 21a,b).

Garth and Stephenson (1966) gave a detailed account of this species from the eastern Pacific region.

There is a possibility that the West African population of *C. ruber* should be recognized as different from the American population. If the study of further material supports this, the name *Cronius millerii* (A. Milne Edwards, 1867), based on a young specimen from the Cape Verde Islands, is available. Adults of the West African population appear to differ from American spec-

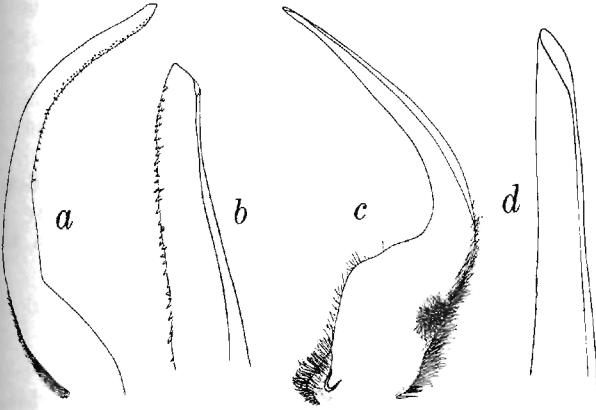


FIGURE 21.—Gonopods of two West African portunids. *Cronius ruber* (Lamarck), male, cb 72 mm, Pillsbury Sta 48: a, sternal view; b, apex, enlarged. *Portunus validus* Herklots, male, cb 151 mm, Pillsbury Sta 252: c, sternal view; d, apex, enlarged.

imens in the color pattern and ornamentation of the chelae. In adults from West Africa the dark color of the movable finger extends proximally on the cutting edge, but is not expanded dorsally on the outer margin at the base of the finger. In specimens from Brazil, the dark color extends proximally as in the West African population, but at the base of the finger it expands dorsally so the finger appears to have a large, dark spot basally on the outer margin. This enlarged proximal spot is present in juveniles from both areas. The enlarged proximal spot is present in some eastern Pacific specimens, absent in others.

The ornamentation of the propodus of the claw, which appears to be similar in American specimens from both coasts, differs significantly in the one large specimen from the Gulf of Guinea available to us (male, cb 72 mm, Pillsbury Sta 48). In American specimens the prominent longitudinal ridges on the propodus of the claw, especially the lower one on the outer face and the two ventral ones, are composed of short, transverse lines of tubercles or ridges which are inflated along the main axis of the longitudinal ridges so that the latter appear to be broad ridges with tuberculate edges. In our large specimen from West Africa the transverse lines of tubercles forming the main ridges are not inflated in the

larger chela but are distinct throughout the length of the longitudinal ridge, as illustrated by Monod (1956, fig. 220), whereas in the smaller chela the ventral longitudinal ridges are ornamented with tubercles scattered in no apparent pattern, and there is no trace of the transverse lines of granules present on the major chela.

In American specimens of *C. ruber*, the tubercles forming the lower, outer ridge on the chela also are inflated, so that the ridge appears smooth along its midline, with numerous marginal tubercles dorsally, fewer ventrally. In our West African specimen, that ridge is made up of 2 distinct rows of tubercles with a space between them.

Although the male pleopods of specimens from both sides of the Atlantic appear to be similar in shape and ornamentation, that of our largest specimen from West Africa is more curved laterally and has the apex directed anterolaterally rather than anteriorly. In available specimens from Brazil the pleopod is less strongly curved and the apex is directed anteriorly.

BIOLOGY.—This is a shallow water species occurring on a variety of bottom types off West Africa; it has been recorded from the intertidal zone to a depth of 69 (9–69) m, but the majority of depth records are from depths of 30 m or less. Sourie (1954a) characterized it as a sand dwelling species associated with the understone fauna of rocky shores; he also found it in the Dakar region (1954b) on coarse shelly sand, bottom with *Arca* and *Pyura*, and noted that juveniles were found on fine shelly sand, with mud, bottom with *Molgula hannensis* Pérès in 2–7 m. Off Guinea, Ushakov (1970) found it on the inferior mesolittoral part of rocky shores, associated with red algae and *Padina*. Buchanan (1958) characterized it as a member of the active epifauna, inshore fine sandy community, in 3–8 fm (5–15 m) off Ghana. Longhurst (1958) found it on shelly sand in 14–25 m off Sierra Leone. Le Loeuff and Intès (1968) reported that off the Ivory Coast it reached its maximum abundance at a depth of 35 m, but that on one transect in May, 465 individuals were taken at a depth of 50 m. They characterized the species as eurythermic and euryhaline and noted

that it occurred on all types of bottom. Forest and Guinot (1966) reported several lots from the offshore islands of the Gulf of Guinea from the following habitats and depths: calcareous algae in 4–5 to 10–12 m (7 stations), calcareous algae and shells in 5–6 m, sand, algae, and calcareous algae in 8–30 m, mud, calcareous algae and shells in 31 m, and mud and sand in 35 m. The *Pillsbury* specimens were taken on mud bottom with *Jullienella* in 38–42 m and in the coralline algae habitat off Annobon in 9–69 m.

Off West Africa ovigerous females have been recorded in January, March, and September (Carpentier, 1951; Monod, 1956; Guinot and Ribeiro, 1962; Ribeiro, 1964). Off West Africa, juveniles are more often found than adults; of more than 80 lots recorded by Monod (1956) more than 50 were made up of juveniles.

DISTRIBUTION.—Atlantic–East Pacific. It is widely distributed in the eastern Pacific (Garth and Stephenson, 1966), as well as in the western Atlantic (Rathbun, 1930). Off West Africa it has been recorded from localities between Mauritania and Angola; shallow water to a depth of 69 m, usually between 10 and 30 m. Monod (1956) summarized earlier West African records and reported material from Mauritania (questionable data), Senegal, Guinea, Sierra Leone, Ivory Coast, Ghana, Gabon, and Angola; since 1956 it has been recorded from the following.

West Africa: No specific locality (Monod, 1967).

Cape Verde Islands: Porto da Furna, Brava, 6–20 m and Baía de Porto Grande, São Vicente, 4–6 m (Guinot and Ribeiro, 1962; Ribeiro, 1964).

Guinea: Conakry (Uschakov, 1970).

Sierra Leone: No specific locality, 14–25 m (Longhurst, 1958).

Ivory Coast: No specific locality (Le Loeuff and Intès, 1969). 05°05'N, 04°59.5'W, 22 m (Voss, 1966). Off Sassandra, off Fresco, off Grand-Lahou, and off Grand-Bassam, 15–60 m (Le Loeuff and Intès, 1968).

Ghana: Off Accra, 3–8 fm (5–15 m) (Buchanan, 1958). Off Accra, Winneba, and Tenkpobo (as Tenpobo), low water mark to 12 m (Gauld, 1960).

Principe: 01°37'20"N, 07°21'45"E, 35 m; 01°38'25"N, 07°22'05"E, 31 m; between Ponta da Mina and Ilhéu Santana, 8–10 and 10–12 m; and in front of Praia Pequena, 5–6 m (Forest and Guinot, 1966).

São Tomé: 00°20'N, 06°46'E, 10 m; 00°25'15"N, 06°43'05"E, 8–30 m; in front of Ponta Oquedelrei, 6 m; off Ponta Diogo Nunes, 4–5 m; off São Tomé, 5 m (Forest and Guinot, 1966).

Annobon: N of San Antonio, 9 m (Forest and Guinot, 1966).

Congo: Pointe-Indienne and Baie de Pointe-Noire (Rosignol, 1957, 1962).

Angola: Baía Farta, Benguela, 22–28 m, and Baía do Lobito, intertidal (Guinot and Ribeiro, 1962).

Genus *Portunus* Weber, 1795

Portunus Weber, 1795:93 [type-species: *Cancer pelagicus* Linnaeus, 1758, by selection by Rathbun, 1926:75; see Opinion 394, International Commission on Zoological Nomenclature, 1956; gender: masculine; name 986 on *Official List*].

Portunus Fabricius, 1798:325, 363 [type-species: *Cancer pelagicus* Linnaeus, 1758, by selection by Latreille, 1810:94, 422; gender: masculine; name 410 on *Official Index*].

Lupa Leach, 1814:390 [type-species: *Cancer pelagicus* Linnaeus, 1758, by monotypy; gender: feminine; name 411 on *Official Index*].

Lima Leach, 1814:429 [possibly an erroneous spelling of *Lupa*; type-species: *Cancer pelagicus* Linnaeus, 1758, by present selection; gender: feminine; name 413 on *Official Index*].

Lupania Rafinesque, 1818:272 [substitute name for *Lupa* Leach, 1814; type-species: *Cancer pelagicus* Linnaeus, 1758; gender: feminine].

Neptunus de Haan, 1833:3, 7 [type-species: *Cancer pelagicus* Linnaeus, 1758, by selection by Miers, 1886:172; gender: masculine; name 414 on *Official Index*].

Achelous de Haan, 1833:3, 8 [type-species: *Portunus spinimanus* Latreille, 1819, by monotypy; gender: masculine].

Amphitrite de Haan, 1833:3, 8 [invalid junior homonym of *Amphitrite* O. F. Müller, 1771 (Polychaeta); type-species: *Portunus gladiator* Fabricius, 1798, by selection by Miers, 1886:172; gender: feminine].

Pontus de Haan, 1833:3, 9 [type-species: *Portunus (Pontus) convexus* de Haan, 1833, by monotypy; gender: masculine].

Lupea H. Milne Edwards, 1834:445 [erroneous spelling of *Lupa* Leach, 1814].

Monomia Gistel, 1848:viii [substitute name for *Amphitrite* de Haan, 1833; type-species: *Portunus gladiator* Fabricius, 1798; gender: feminine].

Posidon Herklots, 1851:3 [invalid junior homonym of *Posidon* Illiger, 1801 (Crustacea); type-species: *Portunus (Posidon) validus* Herklots, 1851, by monotypy; gender: masculine].

Xiphonectes A. Milne Edwards, 1873b:157 [type-species: *Amphitrite vigilans* Dana, 1852, by selection by Rathbun, 1930:33; gender: masculine].

Hellenus A. Milne Edwards, 1874, in 1873-1881:210, 221 [type-species: *Achelous spinicarpus* Stimpson, 1871, by selection by Rathbun, 1930:33; gender: masculine].

Lupocycloporus Alcock, 1899a:31, 32, 44 [type-species: *Achelous whitei* A. Milne Edwards, 1861, by monotypy; gender: masculine].

Cyclobachelous Ward, 1942:79 [type-species: *Lupea granulata* H. Milne Edwards, 1834, by monotypy; gender: masculine].

Portunus hastatus (Linnaeus, 1767)

Lupa hastata.—Barrois, 1888:14.

Neptunus (Amphitrite) hastatus.—Lenz and Strunck, 1914:278.

Neptunus hastatus.—Capart, 1951:125, fig. 44 [part, not specimen from Guinea].—Chapman and Santler, 1955:374.—Monod, 1956:203, figs. 232-235 [no material].

Portunus hastatus.—Figueira, 1960:8.—Zariquiey Alvarez, 1968:384, figs. 125d,e, 126c, 128a,b [Spain; references].—Türkyay, 1976b:61 [listed], 64, pl. 1: figs. 1, 2.

SYNONYMS.—*Cancer ponticus* Herbst, 1790; *Portunus Dufourii* Latreille, 1819; *Eriphia prismaticus* Risso, 1827; *Neptunus hastatus rubromaculatus* Steinitz, 1932.

MATERIAL EXAMINED.—*Pillsbury Material*: None.

Other Material: Madeira: Canical, 30 fm (55 m), seine, 18 Apr 1916, A. C. de Noronha, 1♂ (W). Machico Bay, seine, 16 Apr 1916, A. C. de Noronha, 1♂ (W). Same data, 30 Jun 1916, 2♀ (W). Same data, 5 Nov 1921, 12♂, 11♀ (6 ov) (W).

Angola: 8 mi [13 km] W of Rio Cuanza, 09°20'S, 13°04'E, 20-22 m, muddy sand, 31 Jan 1949, Expédition Océanographique Belge, Sta A. S. 116, 1♂, 1♀ ov (Brussels).

DESCRIPTION.—Capart, 1951:126.

Figure: Capart, 1951, fig. 44.

Male Pleopod: Monod, 1956, figs. 232-235 (Lebanon).

MEASUREMENTS.—Our specimens have carapace widths of 18 to 45 mm; the carapace widths of the ovigerous females from Madeira range from 18 to 26.5 mm, that from Angola is 42 mm.

REMARKS.—In large males, the abdomen is narrower than in *P. inaequalis*; the last somite is triangular in *P. hastatus*, ovate in *P. inaequalis*. In *P. hastatus* the width of the terminal somite of the male abdomen is half or more than half the width of the preceding somite; in *P. inaequalis* it is less than half the width of the preceding somite. Finally, the ventral incision of the orbit is a closed

∨ in *P. hastatus*, an open ∨ or U in *P. inaequalis*, as noted by Monod (1956:203).

The two specimens from Angola are those reported by Capart (1951), who correctly identified them with *Portunus hastatus*. We have compared these specimens with material of this species from several Mediterranean localities, as well as with the material from Madeira reported above, and we could find no constant differences in specimens from different areas. The specimens from Angola at first sight appear to be different from those from the Mediterranean, for, as figured by Capart (1951, fig. 44), the dorsal sculpturing of the carapace is much less pronounced on them. In addition, the lateral spine of the carapace is shorter than in most specimens of *P. hastatus* from the Mediterranean we have examined, and the chelae appear stouter with a slightly shorter movable finger.

There are relatively few records for this species outside of the Mediterranean and we have tried to compile all of them here. One record, that of Miers (1886:175), as *Neptunus (Amphitrite) hastatus*, from Tenerife or Isla de la Gomera, Canary Islands, appears to be based on specimens of *Portunus sayi*. Miers noted that his specimens were "very prettily mottled with purple on a yellowish ground" (this is the color of *P. sayi* as described by Rathbun, 1930:42) and that the same jar contained specimens of *Planes minutus*. Miers' was the only record for this species from the Canary Islands that we could find.

BIOLOGY.—*Portunus hastatus* is a sublittoral species, occurring on sandy bottoms subtidally to a depth of at least 55 m. The two specimens from Angola were taken on muddy sand in 20-22 m.

Off West Africa ovigerous females have been recorded in January (Angola) and November (Madeira).

DISTRIBUTION.—Eastern Atlantic, where it occurs primarily in the Mediterranean. Outside of that sea it has been recorded from the following:

Azores: Ponta Delgada, Ilha de São Miguel (Barrois, 1888; Lenz and Strunck, 1914). Ilha do Faial (as Fayal) (Chapman and Santler, 1955). Ilha do Pico (Figueira, 1960).

Madeira: Funchal, from fish market, Prainha[?], and Ponta de São Lourenço, 15–20 m (all Türkay, 1976b).

Angola: 8 mi [13 km] W of Rio Cuanza, 09°20'S, 13°04'E, 20–22 m (Capart, 1951).

****Portunus inaequalis* (Miers, 1881)**

Neptunus hastatus.—Capart, 1951:125 [part, not fig. 44].—Rossignol, 1957:123 [key]. [Not *Portunus hastatus* (Linnaeus, 1767).]

Neptunus inaequalis.—Monod, 1956:198, figs. 225–231.—Buchanan, 1958:24.—Longhurst, 1958:87.—Gauld, 1960:69.—Rossignol, 1962:116.—Le Loeuff and Intès, 1968:40, 44, table 1, figs. 49, 61; 1969:63, 65.—Türkay, 1976b:61 [listed] 64, pl. 1: figs. 3, 4.

Portunus inaequalis.—Guinot and Ribeiro, 1962:47.—Ribeiro, 1964:6.—Forest and Guinot, 1966:63.

MATERIAL EXAMINED.—*Pillsbury Material*: Ivory Coast: Sta 47, 37 m, bottom with *Jullienella*, 12♂, 7♀, 3 juv (W).

Ghana: Sta 24, 35–37 m, dark red bryozoans, 1 juv (L). Sta 26, 27 m, shell bottom (scallops), 3♂, 1♀ ov (L). Sta 27, 33 m, 1♀ (L).

Nigeria: Sta 246, 37 m, 1♂ (L). Sta 248, 33 m, 1♂, 1♀ ov (L). Sta 250, 24 m, brackish water, mud, 1♂, 1♀ (L). Sta 252, 30 m, mud, 1♂, 1♀ (L).

Other Material: Ghana: Chorkor, near Accra, Dec 1950, R. Bassindale, 1♂ (L).

DESCRIPTION.—Carapace more than twice as broad as long, regions distinct, surface roughened. Gastric region with long patch of raised granules, with curved branches extending onto protogastric region. Metagastric region with 2 raised submedian lobes ornamented with enlarged tubercles. Cardiac region with 2 raised submedian lobes, often united posteriorly in form of √. Epibranchial ridges raised, granular, sinuous. Mesobranchial region with raised prominence mesially, flanked laterally by 1 or more oblique granular ridges. Hepatic region with curved, granular ridges. Frontal teeth triangular, submedians smallest, sharpest, second pair larger and more triangular than blunt inner orbital spines. Interantennular spine small, visible in dorsal view. Anterolateral margin with 9 sharp, separate spines, outer orbital (first anterolateral) blunter than next spine; lateral spine long, at least as long as space occupied by preceding 4 or 5 spines, slender, curved upward and forward. Small patch

of iridescence present between bases of spines. Posterolateral margins unarmed. Chelae long, slender, merus longer than carapace, subequal. Dorsal surface of merus irregular, anterior margin with 4 or 5 spines, occasionally 1 smaller spine distally, posterior and ventral margin each with 1 distal spine. Carpus with inner and outer spine. Propodus with 1 spine proximally and 2 spines distally on upper margin. Fingers slender, shorter than palm. Pereiopods 2–5 with iridescent lines. Merus of fifth leg unarmed. Sternum and abdomen smooth.

Figures: Monod, 1956, figs. 225–231.

Male Pleopod: Monod, 1956, figs. 227–231 (Senegal, Sierra Leone).

Color: The following observations on color were provided by Monod in his list of material of this species:

Très marbrés; en alcool une tache rouge plus ou moins marquée sur le dactyle p5 [1956:200, Senegal] . . . ; rouge brique; tache carminée sur la partie postérieure du dactyle p5; ligne carmin sur la crête inf. du propode p1, se prolongeant sur le doigt fixe; face interne du dactyle également carmin [1956:202, Guinée] . . . ; traces de tache rouge au dactyle p5 [1956:202, Ghana].

The dark red color on the dactylus of the last leg also is characteristic of *P. hastatus* (Linnaeus).

MEASUREMENTS.—Our specimens have carapace widths of 16 to 53 mm; the measurable ovigerous female has a carapace width of 25 mm.

BIOLOGY.—*Portunus inaequalis* is a shallow water species, living near shore to a depth of 60–73 m, generally in depths of less than 40 m. It can tolerate waters of reduced salinity. The *Pillsbury* took it in brackish water on mud in 24 m off Nigeria, and Longhurst (1958), who reported it from Sierra Leone, characterized it as an estuarine-shelf species; he found it on stones, sand, and shelly sand in 10–25 m. Sourie (1954b) reported it from fine shelly sand with mud, bottom with *Molgula hannensis* Pérès, in 2–7 m in the Baie de Dakar. Buchanan (1958) found it in the sandy silt community in 8–20 fm (15–37 m) off Ghana. Guinot and Ribeiro (1962) reported it from algae and rocks and on sand in 10 m. It was reported from a variety of bottom types by Forest and

Guinot (1966): shell in 20–25 and 27 m; mud, shells and *Cidaris* in 60–73 m; sand or muddy sand and Foraminifera in 5 and 21–27 m; calcareous algae in 5, 6, and 12 m; rocks and coral in 3–10 m; sand and calcareous algae in 4–5 m; and from a sand beach, 0–4 m.

Le Loeuff and Intès (1968:44) found that off the Ivory Coast the species lived on sand or muddy sand and was rarely observed on mud. There it generally lives at depths between 30 and 35 m, not going below 40 m, although during periods of upwelling or cooling part of the population was found at 15–20 m; in warm periods it generally was found below 25 m.

Only two of the *Pillsbury* samples were taken at stations on mud; the species was found on shell bottom with scallops, on bottom with dark red bryozoans, and bottom with *Jullienella*.

Ovigerous females have been collected in March, April, May, June, July, September, and November (Monod, 1956; Guinot and Ribeiro, 1962; Ribeiro, 1964; Forest and Guinot, 1966; *Pillsbury*).

DISTRIBUTION.—Off West Africa, from Madeira and from Senegal to Angola, in shallow water, from shore to a depth of 60–73 m, generally in less than 40 m. Monod (1956) recorded material from the Cape Verde Islands, Senegal, Guinea, Sierra Leone, Ghana, Gabon, and Principe. Since 1956 it has been recorded from the following localities.

Madeira: No specific locality (Türkay, 1976b).

Cape Verde Islands: Baía de Porto Grande and Baía de Calheta, 8–16 m, São Vicente; Baía da Fajã di Agua (? = Porto da Fajã) and Porto da Furna, 4 m, Brava; Tarrafal and Porto da Praia, São Tiago; and Tarrafal, São Nicolau (all Guinot and Ribeiro, 1962; Ribeiro, 1964).

Guinea-Bissau: 10°19'N, 16°34'W, 60–73 m (Forest and Guinot, 1966).

Sierra Leone: No specific locality, 10–25 m (Longhurst, 1958).

Ivory Coast: No specific locality (Le Loeuff and Intès, 1969). 05°00'N, 05°28.5'W, 27 m; 05°03'N, 05°25'W, 20–25 m; and 05°02.5'N, 05°25'W, 21–27 m (all Forest and Guinot, 1966). Off Sassandra, off Fresco, off Grand-Lahou, off Jacquville, and off Grand-Bassam, 8–40 m (Le Loeuff and Intès, 1968).

Ghana: Off Accra, 8–20 fm (15–37 m) (Buchanan, 1958); 10–32 m (Gauld, 1960).

Principe: Between Ilhéu Santana and Ponta Capitão, 12 m (Forest and Guinot, 1966).

São Tomé: Baía de Ana de Chaves; Praia de Santa Catarina, W coast, 3–10 m; in front of Ponta Oquedelrei, 6 m; Morro Peixe, 0–4 m; Ilhéu das Cabras, 4–5 m; off São Tomé, 5 m (all Forest and Guinot, 1966).

Annobon: 01°26'20"S, 05°36'25"E, 22–25 m (Forest and Guinot, 1966).

Congo: W of Pointe-Noire (Rossignol, 1962).

Gabon: 00°38'25"S, 08°46'E, 5 m (Forest and Guinot, 1966).

Angola: Baía de Caota, Benguela, 10 m (Guinot and Ribeiro, 1962).

* *Portunus validus* Herklots, 1851

FIGURES 21c,d, 22, 23a,c,e,g

Lupa Cranchiana White, 1847a:27 [nomen nudum; under *Neptunus sanguinolentus*].—Monod, 1970:66, 72.

Neptunus validus.—Pechüel-Loesche, 1882:287.—Büttikofer, 1890:466, 487, fig. on p. 465.—Johnston, 1906:862.—Frade, 1950:11, 26.—Capart, 1951:123, fig. 43.—Monod, 1956:196, fig. 224.—Rossignol, 1957:80, 123 [key], pl. 2: fig. 6.—Buchanan, 1958:20.—Longhurst, 1958:87.—Gauld, 1960:69.—Rossignol, 1962:115.—Crosnier, 1964:32, 87, 90, 92, 98, 105, 106, 110, 112, 120, 121.—Crosnier and Berritt, 1966:68, 100, 101, 102, 109, 123, 127, 131, 132, 136.—Le Loeuff and Intès, 1968:40, 46, table 1, figs. 49, 61; 1969:64, 65.

Callinectes sp.?.—Irvine, 1932:14.

Callinectes Gladiator.—Irvine, 1932: fig. 9 [not *C. gladiator* Benedict, 1893 = *C. pallidus* (De Rochebrune, 1883)].

Callinectes gladiator.—Irvine, 1947: fig. 203 [not *C. gladiator* Benedict, 1893 = *C. pallidus* (De Rochebrune, 1883)].

Callinectes latimanus.—Irvine, 1947:297 [not *Callinectes latimanus* Rathbun = *C. amnicola* (De Rochebrune, 1883)].

Portunus validus.—Monod, 1967:180, pl. 15: fig. 1 [no locality]; 1970:66, 72.—Ushakov, 1970:439, 455 [listed].—Baron, 1975a:3–13 [physiology]; 1975b:103, figs. 1–4.

MATERIAL EXAMINED.—*Pillsbury Material*: Nigeria: Sta 241, 59–63 m, mud and shell, 1♀ (L). Sta 252, 30 m, 2♂, 2♀ (W).

Other Material: Liberia: Off St. Paul River, Monrovia, 3–6 fm (5–11 m), 4 Mar 1953, G. C. Miller, 1♂ (W). Liberia, 1881, J. Büttikofer, 2♀ (L).

Ghana: Elmina (as St. George-del-Mina), 1840–1855, H. S. Pel, lectotype, 1♂ (L). Same data, paralectotypes, 2♀ (L). Accra, 1868–1869, M. Sintenis, 1♀ (L).

Cameroon: Batanga, 17 Sep 1930, A. J. Good, 1♀ (W). Between Kribi and Douala, at Yaounde fish market, 14 May

1964, B. de Wilde-Duyfjes, 1♂, 2♀ (L). Kribi, beach seine, 9 Mar 1964, B. de Wilde-Duyfjes, 1♀ (L). Same, 10 Aug 1964, B. de Wilde-Duyfjes, 1♀ (L).

Angola: No specific locality, 1879, P. Kamerman, 2♀ (L).

DESCRIPTION.—A. Milne Edwards, 1861:321; Capart, 1951, fig. 124.

Figures: A. Milne Edwards, 1861, pl. 29: fig. 1; Capart, 1951, fig. 43; Monod, 1956, fig. 224.

Color: The carapace is rather uniformly greenish gray with some brown tinges. A large conspicuous, white triangular spot is present on each side just before the middle of the posterolateral margin. This white spot is surrounded by a ring of darker gray than is on the rest of the carapace. The posterior margin also is white. The uniform color of the carapace contrasts strongly with the brightly marbled upper surface of the chelipeds (Figure 22). The upper half of each cheliped is very dark purple with numerous rather large white spots, which at some places are confluent. The lower half of the cheliped is white. The same marbled purple color is present on the upper half of the merus and carpus of the next 3 legs, the purple color and size of the white spots being very variable. The propodus and dactylus are greenish gray as is the carapace. The fifth leg has the upper surface of all segments except the dactylus purplish to greenish with white spots. The dactylus is gray dorsally with a white streak along

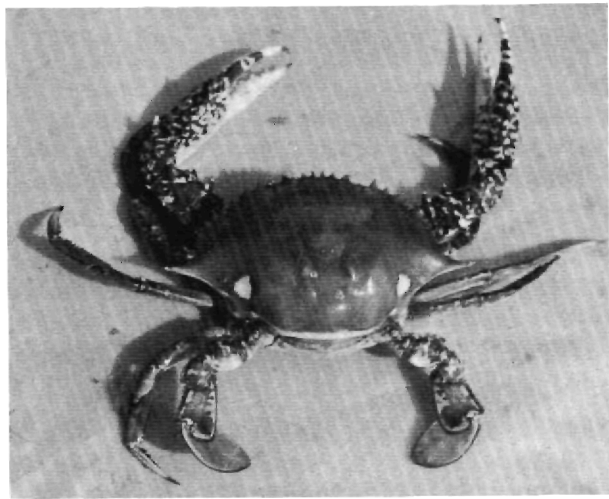


FIGURE 22.—*Portunus validus* Herklots, female, Pillsbury Sta 241.

the basal half of the outer margin. The lower surface of the body and legs is uniformly pale.

Irvine (1947:297, under *Callinectes latimanus*) described the color of this species as follows: The carapace "is khaki in colour, with a bluish tinge. The claws are blue. . . . The legs are also blue. . . ."

Capart (1951:124) gave the following color account of this species: "Carapace bleu-vert, avec deux taches blanches sur les aires branchiales."

Rossignol (1957:81) gave the following color description:

Le ♂ et la ♀ sont identiques. Face dorsale:

a. Carapace: marron ou brun violacé plus ou moins irrisé, avec deux taches arrondies d'un blanc crème sur chaque aire branchiale en arrière des dents postérieures. Souvent, une autre petite tache blanche de forme imprécise juste au-dessus de la précédente. Extrémité de la dent postérieure blanche.

b. Chélicèdes: brun-violacé marbré de blanc (mèrus, carpe, propode, dactyle). Face interne de la pince: moitié inférieure de la paume blanche: pouce bleu turquoise.

c. Pattes: bleu turquoise avec des taches blanches sur le mèrus (P₂, P₃). P₄ et P₅: mèrus et carpe brun-violacé marbré de bleu et de blanc. Dactyle de P₅ beige légèrement rosé.

Face ventrale de la carapace et face externe des pinces: blanc crème.

MEASUREMENTS.—The carapace width of our specimens varies between 62 and 180 mm. In the literature males with carapace lengths of 46 to 114 mm, carapace widths of 85 to 205 mm, females with carapace lengths of 41.5 to 93 mm, widths 82 to 190 mm, and ovigerous females with carapace lengths of 83 to 97 mm, widths of 150 to 170 mm, have been reported.

REMARKS.—*Portunus validus* is remarkable in having the carapace finely and evenly granular, almost evenly convex, lacking sharp ridges or grooves. It falls within the genus *Portunus* sensu lato, as currently defined, but a careful revision of this heterogeneous genus may necessitate the recognition of a new genus for the preoccupied genus *Posidon* Herklots, 1851, originally established for *Portunus validus*. Judging from the accounts of Stephenson and Campbell (1959) and Stephenson (1972), *Portunus validus* shows little similarity to any of the many Indo-West Pacific species of the genus, and it shows little affinity

with any of the American species of the genus (Rathbun, 1925; Garth and Stephenson, 1966).

Indeed, a comparison of *P. validus* with *P. pelagicus*, the type-species of *Portunus*, reveals some interesting differences in addition to the ornamentation of the carapace and the structure of the male pleopod. In *P. validus* the interantennular spine is very short and does not extend to the front; it is not at all visible in dorsal view (Figure 23a), whereas in *P. pelagicus* the entire spine, including its base, is visible in dorsal view, and the apex of the spine extends well beyond the level of the frontal spines (Figure 23b). In *P. validus* there are two strong spines on the posterior margin of the merus of the claw, one subdistal (Figure 23c), whereas in *P. pelagicus* (and in *Calinectes* as well) the subdistal spine is absent (Figure 23d).

In *P. validus* (Figure 23e,g) the epistome is distinct and has its margins with antennular fos-

sae and that with the oral cavity elevated and separated from each other by a distinct distance; in *P. pelagicus* (Figure 23f,h) there is no epistome, the oral cavity reaches to the antennular fossae and its anterior margin forms the posterior margin of the fossae. In *P. validus* the oral cavity is not completely filled by the third maxillipeds, there is a distinct gap between the anterior margin of the maxillipeds and that of the oral cavity; in *P. pelagicus*, however, the third maxillipeds fill the entire oral cavity: their anterior margins lie against the anterior margin of the oral cavity, leaving only two small sharply defined afferent branchial apertures.

The male pleopod of *P. validus* (Figure 21c,d) is stout, curved laterally, and unarmed, not slender and elongate as in *P. pelagicus* (see Stephenson and Campbell, 1959, fig. 2a). The second male pleopod is thin and slender, rather straight, and

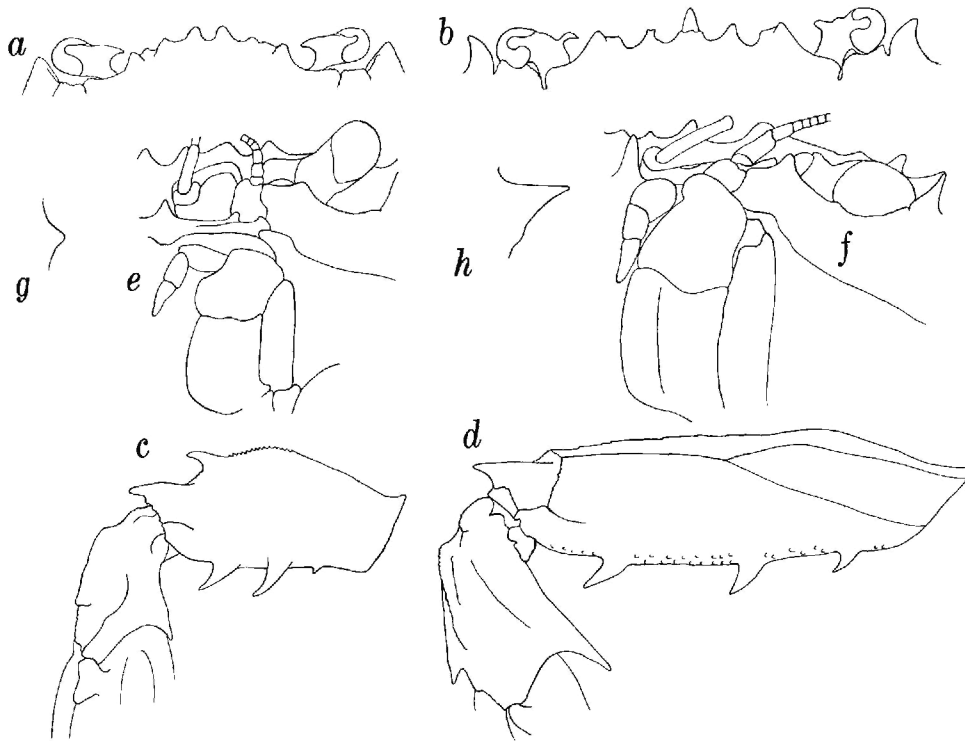


FIGURE 23.—Comparison of two species of *Portunus*. *Portunus validus* Herklots, male, cb 61 mm, Liberia: a, front, dorsal view; c, merus and carpus of chela; e, buccal region; g, interorbital spine, lateral view. *Portunus pelagicus* (Linnaeus), male, cb 90 mm, Philippines: b, front, dorsal view; d, merus and carpus of chela; f, buccal region; h, interorbital spine, lateral view.

terminates in a bifid tip. The male abdomen has been well figured by A. Milne Edwards (1861).

This species has some limited commercial importance and great commercial potential. Baron (1975b) has summarized observations on catch, size distribution, sex ratio, and growth of claw in specimens taken commercially off Senegal and Gambia.

A male collected off Elmina (St. George-del-Mina), Ghana, by H. S. Pel, between 1840 and 1855, is here selected as the lectotype of the species (Crust. D.395). It is in the collection of the Rijksmuseum van Natuurlijke Historie.

Irvine (1932) mentioned two species of *Callinectes* from Ghana; one he indicated correctly as *C. gladiator* Benedict (= *C. pallidus* (De Rochebrune)), the other was referred to as "*Callanectes* Sp.(?)" In 1947 Irvine again described and figured the two species and identified the latter as *Callinectes latimanus* Rathbun. The true identity of the two forms puzzled many subsequent authors, because Irvine had interchanged the figures illustrating these two species, as was first pointed out by Capart (1951:130, 132). The figures said to represent *Callinectes* sp. (Irvine, 1932, fig. 13) and *Callinectes latimanus* Rathbun (Irvine, 1947, fig. 202) actually are those of *C. gladiator* (= *C. pallidus*). Irvine's text of "*Callanectes* Sp.(?)" (1932:14) and his figure 9, as well as his later text of *C. latimanus* (1947:297) do not represent *Callinectes latimanus* as was thought by Capart (1951), but *Portunus validus*. The great size of the species, the shape of the front, the fact that the merus of the chelipeds bears two distal teeth on the posterior margin, all this proves the identity of Irvine's material with *P. validus*. Even the peculiar white spots on the carapace are correctly indicated in the drawing, which, however, shows the carapace grooves somewhat overaccentuated. Monod (1956:196) already recognized Irvine's figures of "*Callinectes gladiator*" as representing *Portunus validus*, but evidently did not realize that they did not belong to the text of *C. gladiator*, but to that of the other species of "*Callinectes*." Williams (1974:737) recognized that something was wrong and referred to Capart and Monod, but con-

cluded that "since the features [of Irvine's figures] are sketchy, it is best to accept the author's designation with allowance for error."

BIOLOGY.—This species inhabits shallow water in depths mostly between 0 and 40 m. Among the almost 50 depth records for this species known to us there are only two records of the capture of specimens that originate from hauls made entirely in water deeper than 40 m, viz. 50 m (Crosnier, 1964:91, 92) and 50–55 m (Crosnier and Berritt, 1966:135, 136); more than two-thirds of the records are from depths between 10 and 30 m. Rossignol (1957:81) therefore is mistaken in giving the range as 0–70 m and sublittoral (from 50 to 99 m).

The species is frequently taken with beach seines. Buchanan (1958) found it in the inshore fine sandy community in 5 to 15 m off Accra. Crosnier (1964) characterized it as a warm water species, living in depths between 0 and 30 m off Cameroon. Le Loeuff and Intès (1968:46) made the following observations on the species off the Ivory Coast:

Il est assez fréquent dans les traits mais jamais en grandes quantités: 10 individus constituent un maximum. Espèce côtière qui ne descend pas au-dessous de 35 m, *N. validus* tolère de gros écarts des facteurs physico-chimiques des eaux, ainsi que tous les types de sédiments puisqu'on le pêche aussi bien sur les sables de Fresco que sur les vases de Grand-Lahou.

Off Guinea, Uschakov (1970) found the species in depths of less than 20 m on unstable mud in turbid water. It has been reported from bottoms consisting of shells and sand, sand and Gorgonaria, sand, muddy sand, fine sand and mud, sandy mud, mud, mud and Foraminifera, or on shells and mud.

Ovigerous females have been collected in March, September, and December (Capart, 1951; Monod, 1956; Baron, 1975a).

Irvine (1947:297) commented on the "ferocious disposition" of this species and the harm it can do to fishes caught in fish pots. In Ghana the crabs are caught and sold as food. According to Irvine (1947:297) "there is reason to believe that they migrate to the sea at times and it is very

probable that they do so during the breeding season."

DISTRIBUTION.—Off tropical West Africa, from Mauritania to Angola, sublittoral to about 55 m. Monod (1956), who summarized earlier records, reported material from Mauritania, Senegal, Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, and the Congo. In addition, the species has been recorded from the following localities.

West Africa: No specific locality (White, 1847a; Balss, 1921; Monod, 1967, 1970).

Senegal: 13°25'N, 16°55'W, 15 m; 12°25'N, 17°15'W, 26 m; 12°20'N, 17°50'W (all Baron, 1975a). Saint-Louis; off the Casamance River (Baron, 1975b).

Gambia: Off the Gambia River (Baron, 1975b).

Guinea: No specific locality, less than 20 m (Uschakov, 1970).

Sierra Leone: No specific locality, 18–39 m (Longhurst, 1958).

Liberia: No specific locality (Büttikofer, 1890; Johnston, 1906).

Ivory Coast: No specific locality (Le Loeuff and Intès, 1969). Off Sassandra, off Fresco, off Grand-Lahou, off Jacquenville, off Grand-Bassam, 8–35 m (Le Loeuff and Intès, 1968).

Ghana: Elmina [as S. Jorge da Mina] (Frade, 1950). Off Accra, 3–8 fm (5–15 m) (Buchanan, 1958); from shallow water to 25 m (Gauld, 1960).

Togo: 06°15'N, 01°53'E, 15–17 m; 06°07'N, 01°53'E, 50–55 m (Crosnier and Berritt, 1966).

Dahomey: 06°10'40"N, 02°02'E, 35 m; 06°10'30"N, 02°02'E, 35–40 m; 06°17'N, 02°22'E, 20 m; 06°18'30"N, 02°24'E, 16 m; 06°21'N, 02°37'E, 12–14 m; 06°16'N, 02°37'E, 22 m; 06°12'30"N, 02°37'E, 35–36 m (Crosnier and Berritt, 1966).

Cameroon: 03°55'N, 09°00'E, 50 m; 03°47'N, 09°12'30"E, 20 m; 03°39'30"N, 09°14'E, 30 m; 03°32'N, 09°34'E, 13–15 m; 03°27'N, 09°38'30"E, 12 m; 03°15'N, 09°51'30"E, 9 m; 03°09'N, 09°44'30"E, 30 m; 02°41'30"N, 09°49'30"E, 20 m; 02°28'N, 09°45'30"E, 7–10 m (Crosnier, 1964).

Congo: Loango (Pechüel-Loesche, 1882). Off Pointe-Noire (Rossignol, 1957, 1962).

Portunus vocans (A. Milne Edwards, 1878)

Neptunus vocans.—Monod, 1956:194, figs. 222, 223 [Cape Verde Islands].—Forest, 1959:19 [Annobon, São Tomé].

Portunus vocans [*Neptunus vocans*].—Guinot-Dumortier and Dumortier, 1960:120, 144 [table 2] [islands of Gulf of Guinea; discussion of stridulation].

Portunus [*Neptunus*] *vocans*.—Guinot-Dumortier and Dumortier, 1960:142 [listed].

Portunus vocans.—Forest and Guinot, 1966:62, fig. 4 [Annobon, São Tomé].—Türkyay, 1976b:61 [listed], 66, pl. 2: figs. 1, 2 [Madeira].

DISTRIBUTION.—An insular species in the Atlantic. In the eastern Atlantic it is known from Madeira, the Cape Verde Islands, and Annobon and São Tomé Islands in the Gulf of Guinea. It also has been recorded from Ascension Island in the central Atlantic and from several western Atlantic localities; in moderate depths, 7–10 m to about 309 m (Rathbun, 1925).

Genus *Thalamita* Latreille, 1829

Thalamita Latreille, 1829:33 [type-species: *Cancer admete* Herbst, 1803, by monotypy; gender: feminine; name 195 on *Official List*].

Thalamita poissonii (Audouin, 1826)

Portunus Poissonii Audouin, 1826:84 [Egypt].

Thalamita integra var. *africana* Miers, 1881a:218.

Thalamita africana.—Sourie, 1954b:151.—Monod, 1956:186, figs. 213–217.—Rossignol, 1957:124 [key].—Guinot and Ribeiro, 1962:46.—Crosnier, 1962:116 [discussion].—Ribeiro, 1964:5.—Forest and Guinot, 1966:61.—Uschakov, 1970:455 [listed].—Stephenson, 1972:19 [key], 44 [listed].

Thalamita integra africana.—Stephenson and Hudson, 1957:319 [key].

Thalamita poissonii.—Holthuis and Gottlieb, 1958:89, 118, pl. 2: fig. 10a,b [Eastern Mediterranean references].—Stephenson, 1976:23.

Thalamita africana.—Hartmann-Schröder and Hartmann, 1974:19 [erroneous spelling].

MATERIAL EXAMINED.—*Pillsbury Material*: None.

Other Material: Gulf of Guinea, no specific locality, 1956, *Calypso*, 1♂ (L).

Angola: Luanda (as St. Paul de Loanda), American Museum Congo Expedition 1909–1915, 23 Sep 1915, H. Lang, 3♂, 3♀ ov (W).

DESCRIPTION.—Rathbun, 1921:402.

Figures: Rathbun, 1921, fig. 5; Monod, 1956, figs. 213–217.

Male Pleopod: Monod, 1956, figs. 215–217 (Senegal).

Color: Little information is available on color in

life of this species. Monod (1956) gave the following notes in his list of material: "rougeâtre" (p. 187); "doigts des chélicèdes (en alcool) rouges avec les apex noirs, la couleur se poursuivant, en liseré, le long des bords internes, dentigères" (p. 188).

MEASUREMENTS.—Our specimens have carapace widths of 28 to 41 mm; the carapace widths of ovigerous females are 28 to 31 mm.

REMARKS.—Crosnier (1962:117) noted the similarity between the male pleopods of *T. poissonii* and *T. africana*. Stephenson (1976:23) synonymized *T. africana* with *T. poissonii* and noted that "these [specimens from Angola] are identical in all respects with *T. poissonii*." We have compared our material from Angola with specimens from other areas and can find no differences.

This is one of a few Indo-West Pacific species of brachyurans to occur off West Africa; it has also colonized the eastern Mediterranean via the Suez Canal (Holthuis and Gottlieb, 1958).

BIOLOGY.—*Thalamita poissonii* is a shallow water species, occurring off West Africa from the littoral zone to a depth of about 30 m. Rathbun (1921:404) noted that it was "the most common species in the quiet stretches of the bay near town of St. Paul de Loanda, and easily caught at low tide on the many submerged sand flats. Their behavior is much the same as that of *Callinectes* . . . but their habitat there is typically marine." Sourie (1954b) found this species on fine shelly sand, bottom with *Molgula hannensis* Pérès, in the Baie de Dakar. The specimens collected by the *Calypto* were taken on the following types of bottom (Forest and Guinot, 1966): mud, 18 m; calcareous algae, 11 m; sand, 0–4 m; sand, algae, and calcareous algae, 8–30 m; mud and calcareous algae, 4 and 5 m.

Off West Africa, ovigerous females have been collected in January, February, March, April, June, August, September, and October, suggesting that there the species breeds all year (Rathbun, 1921; Monod, 1956; Forest and Guinot, 1966).

DISTRIBUTION.—Eastern Atlantic and Indo-West Pacific. In eastern Atlantic, from eastern

Mediterranean and off West Africa at scattered localities between the Canary Islands and Angola, in depths between the littoral zone and about 30 m; Indo-West Pacific from localities between Japan and Madagascar and the Red Sea (Crosnier, 1962). Monod (1956) summarized the West African literature and reported material from localities off Mauritania, Senegal, Guinea, and Angola. Records since then include the following.

Cape Verde Islands: Baía de Porto Grande, São Vicente, 4–6 and 8 m (Guinot and Ribeiro, 1962; Ribeiro, 1964).

Senegal: Baie de Dakar (Sourie, 1954b).

Guinea: No specific locality (Uschakov, 1970).

Principe: In front of [Cais de] Santana, 11 m (Forest and Guinot, 1966).

São Tomé: 00°25'15"N, 06°43'05"E, 8–30 m; Baía de Ana de Chaves, 5 m; in front of Ponta Diogo Nunes, 4 m; Morro Peixe, 0–4 m (all Forest and Guinot, 1966).

Gabon: 00°40'S, 08°46'25"E, 18 m (Forest and Guinot, 1966).

Angola: Baía de Luanda (Guinot and Ribeiro, 1962). Luanda (as St. Paul de Loanda) (Stephenson, 1976). Between Cacuaco and Lobito-Benguela (Hartmann-Schröder and Hartmann, 1974).

Family GERYONIDAE Colosi, 1923

GERYONIDAE Colosi, 1923:249.

EASTERN ATLANTIC GENERA.—Due to the uncertainty of the taxonomic status of this family and of the genera sometimes assigned to it, we are unable to give here a reliable list of the eastern Atlantic geryonid genera. Guinot (1971:1077) included in the Geryonidae the following three genera that are represented in the eastern Atlantic: *Geryon*, *Paragalene*, and *Progeryon*; of these only *Geryon* is known from tropical West Africa.

Paragalene Kossmann (1878:253). Type-species: *Paragalene neapolitana* Kossmann, 1878, a junior subjective synonym of *Eriphia longicrura* Nardo, 1869, by monotypy; gender: feminine; name 341 on *Official List*.

Progeryon Bouvier (1922:71). Type-species: *Progeryon paucidens* Bouvier, 1922, by monotypy; gender: masculine.

We are not convinced that these two genera are correctly assigned to the Geryonidae, but as

we have not had the opportunity to study this question in detail, we follow Guinot, at least for the time being. The genus *Platycheloniion* (p. 155), placed by Guinot (1971:1078) with some doubt in the Geryonidae, in our opinion finds a better place in the Xanthidae.

EASTERN ATLANTIC SPECIES.—The above-mentioned three genera are represented in the eastern Atlantic area by 6 species; only two of these have been found in tropical West African waters. The other four are as follows:

Geryon tridens Krøyer, 1837. North Atlantic from N Norway and Iceland to the British Isles and the North Sea; records from the Bay of Biscay, the Mediterranean and Morocco need to be verified and at least partially pertain to *G. longipes*; 32–690 m, usually deeper than 100 m (Christiansen, 1969).

Geryon longipes A. Milne Edwards, 1881. Bay of Biscay, Morocco, Mediterranean; 600–1370 m (Zariquiey Alvarez, 1968).

Paragalene longicrura (Nardo, 1869). Mediterranean (Algeria, Malta, Naples, Adriatic and Aegean Seas) and Madeira; 20-ca. 120 m (Türkay, 1976b).

Progeron paucidens Bouvier, 1922. Off Morocco, 2165 m (Bouvier, 1922).

Monod (1956:337) recognized a single West African species: *Geryon quinquedens* Smith, synonymizing *G. affinis* with it. In the present publication two tropical West African species are distinguished: *G. affinis* and *G. maritae*, new species; *G. quinquedens* is thought to be restricted to East American waters.

Only one species of *Geryon*, *G. maritae*, was taken by the *Pillsbury* in West African waters.

Genus *Geryon* Krøyer, 1837

Geryon Krøyer, 1837:10, 20, 21 [type-species: *Geryon tridens* Krøyer, 1837, by original designation and monotypy; gender: masculine; name 309 on *Official List*].
Chalaeopus Gerstaecker, 1856:118 [type-species: *Cancer trispinosus* Herbst; 1803, by monotypy; gender: masculine].

REMARKS.—The place of the genus *Geryon* in the system of the Brachyura has been subject to many different interpretations by zoologists.

Krøyer (1837:19, 20), when describing his new genus remarked that it should be placed in the "famille des Cyclométopes" of H. Milne Edwards (1834:363) although in some respects it showed some resemblance to the Catometopes, and because of the shape of the dactyli of the last pair of pereopods ("ifølge de bageste Tarsers Beskaffenhed") thought it should be placed in the former of the two tribes (Cancériens and Portuniens) in which H. Milne Edwards had subdivided his Cyclométopes. Miers (1886:223) placed *Geryon* in the subfamily Carcinoplacinae of the family Ocypodidae. Ortmann (1894:685; 1899:1176) left it in that subfamily, which he made the nominal subfamily of a new family Carcinoplacidae; he is followed in this by Stebbing (1905:35). A Milne Edwards and Bouvier (1894:41) first placed the genus in the family Cancériens sensu lato (= Cancridae + Xanthidae), but later (1899:34) assigned it to the family Galenidae. Alcock (1899c:84) accepted this disposition, but made the Galeninae a subfamily of the Xanthidae. Doflein (1904:105), without comment, ranged *Geryon* in the Potamidae. Colosi (1923:249) partly agreed with Doflein and erected a new (monotypic) family Geryonidae, which he placed near the Potamidae. Several authors, like Balss (1927:1020, 1933a:298), Bouvier (1940:261), Stephensen (1945:222), Monod (1956:337), Guinot and Ribeiro (1962:62), Zariquiey Alvarez (1968:388), and Crosnier (1970:1216) placed the genus in the family Xanthidae; others, e.g., Rathbun (1937:265), Barnard (1950:290) and Capart (1951:173) kept it in the Goneplacidae. In recent years the family Geryonidae Colosi, 1923 (often attributed to Beurlen, 1930) is recognized by many authors. It then is usually placed between the Xanthidae and Goneplacidae (Balss, 1957:1654; Christiansen, 1969:83; Glaessner, 1969:R524) or closer to the Goneplacidae than to the Xanthidae (Kaestner, 1970:349). Serological investigations by Leone (1949:284, 1951:44–48) suggested that the Geryonidae are more closely related to the Xanthidae and Portunidae on the one hand, than to the Cancridae, Ocypodidae, Grapsidae, and Majidae on the other. All in all, Stebbing's (1893:

93) remark, made 80 years ago, still holds good: "The genus *Geryon*, Krøyer, 1837, may claim a passing notice as one of those instances in which systematic arrangement finds itself at fault. It is sometimes placed among the Cyclometopa and sometimes among the Catometopa. . . . That, on the theory of the evolution of different groups from a common stem, such inosculant forms are almost sure to occur, has long been recognized. Darwin himself humorously admits that while as a theorist he delighted in coming across them, as a naturalist engaged in classification he found them an unmitigated nuisance."

In studying the present material, we were struck by the great resemblance in general and in detail of *Geryon* with the Portunidae. In practically every point our specimens resemble Portunidae, except in the shape of the last pereopods which lack the paddle-shape of the distal segments. Were the distal segment of these pereopods broadened, no one would have hesitated to assign the genus to the Portunidae. The resemblance with species of *Benthochascon* is especially striking. The resemblance of the Geryonidae to the Portunidae is much closer, we think, than to either Xanthidae or Goneplacidae. In our opinion the family Geryonidae is close to the Portunidae, perhaps between Portunidae and Xanthidae, which incidentally would also agree with the serological findings by Leone (1949, 1951) and a study of the larvae of *Geryon tridens* by Ingle (1979: 230), who noted that "the larvae of *G. tridens* possess many portunid features. . . ." The taxonomy of the Brachyrynchous crabs, especially at the family level, is still highly unsatisfactory and a thorough revision is badly needed.

The strong resemblance of the chelae of *Geryon* to those of Portunidae is shown in Figure 24. As in Portunidae the basal tooth of the dactylus of the large chelipeds in *Geryon* is blunt, enlarged and often directed somewhat backward. The other teeth are often flanked by small teeth; in *Geryon* the larger teeth usually have a single smaller tooth separating them, while in portunids the larger teeth often are flanked each with two teeth.

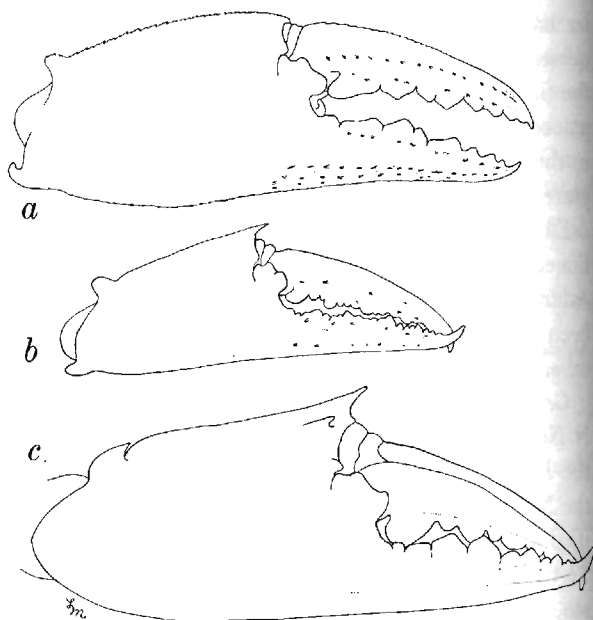


FIGURE 24.—Chelae: *a*, *Geryon maritae*, new species, paratype, female, cb 59.5 mm, Pillsbury Sta 51; *b*, *Benthochascon schmitti* Rathbun, female, cb 50.3 mm, Florida; *c*, *Scylla serrata* (Forskål), male, cb 55.1 mm, China.

Guinot (1969c:692) mentioned the fact that between the first two abdominal segments of *Geryon* and the coxa of the fifth pereopod a very small section of the 8th thoracic sternite is visible, and considered this as a goneplacid character. However, in portunid genera like *Ovalipes* and *Benthochascon* a similar situation exists, and as pointed out by Guinot (1971:1066) also in Xanthidae, like *Panopeus* and *Rhithropanopeus*, part of the 8th thoracic sternite is visible, in the last mentioned genus even "une assez importante partie latérale." In *Geryon* the third abdominal somite of the male covers the basal part of the coxa of the fifth pereopod and the 8th thoracic sternite is only visible lateral to the first and second abdominal somites. All this demonstrates that the taxonomy of these crabs is still far from clear.

***Geryon affinis* A. Milne Edwards and Bouvier,
1894**

Geryon affinis A. Milne Edwards and Bouvier, 1894:41, figs. A, C, pl. 1; 1899:35.—Hansen, 1908:18, pl. 1: fig. 1.—

Bouvier, 1922:70.—Rae and Lamont, 1963:24.—Kjennerud, 1967:193, fig. 1.—Sankarankutty, 1968:50.—Christiansen, 1969:87, fig. 35, map 29.—Mason and Davidson, 1969:208.—Türkay, 1976b:61 [listed], 70.

Geryon quinquedens.—Bouvier, 1922:70, pl. 6: fig. 7.—Monod, 1956:337 [part, not fig. 441]. [Not *Geryon quinquedens* Smith, 1879.]

Geryon tridens.—Saemundsson, 1937:21 [not *Geryon tridens* Krøyer, 1837].

MATERIAL EXAMINED.—*Pillsbury Material*: None.

Other Material: Azores: E of Corvo, 39°41'35"N, 31°04'07"W of Paris (= 28°44'07"W of Greenwich), 844 m, sand and gravel, 7 Aug 1888, *Princesse Alice* Sta 222, syntypes, 1♂, 1♀ (MP).

SE of Madeira: 32°42'N, 16°43'W, 670 m, tent trap, 13 Mar 1976, *Onversaagd* Sta 63, 1♂, 1♀ ov (L).

Cape Verde Islands: 16°44'N, 24°48'05"W, 692 m, hard bottom, 21–22 Jul 1901, *Princesse Alice* Sta 1138, 1♂ (MP).

DESCRIPTION.—A. Milne Edwards and Bouvier, 1894:41–45; Christiansen, 1969:87.

Figures: A. Milne Edwards and Bouvier, 1894, figs. A, C, pl. 1 (color); Christiansen, 1969, fig. 35.

Male Pleopod: We have found no illustrations of the male pleopod of this species. Sankarankutty (1968:51) remarked that it was similar to that of *G. maritae* as figured by Doflein (1904).

Color: A colored figure of one of the type-specimens was published by A. Milne Edwards and Bouvier (1894, pl. 1). It shows a pale brown crab with the cervical groove and posterolateral margins, as well as the spine on the carpus, with a pink hue; the central part of the carapace is somewhat greenish. Kjennerud (1967:194) remarked of her specimen: "The colour of the specimen before it was preserved in alcohol was dull yellow with patches of red and red brown, the tips and the margins of the dactyls in the walking legs were dark brown. In general it may be said that the colour was very like the colour of one of the type-specimens illustrated by Milne-Edwards and Bouvier." Christiansen (1969:85) on the other hand described the color as "red to brick-red." A. Milne Edwards and Bouvier (1899:35) mentioned a probably abnormal specimen "à pattes blanches."

MEASUREMENTS.—The male and female syntypes examined have the carapace lengths 109

and 112 mm, the carapace widths 134 and 135 mm, respectively. In the male and female from Madeira the carapace widths are 140 and 145 mm, respectively. In the male from the Cape Verde Islands the carapace length is 133 mm, the carapace width 158 mm. A. Milne Edwards and Bouvier (1894) gave the following measurements of some of the types: males, carapace lengths 15, 97, and 133 mm, carapace widths 17, 112, and 153 mm, respectively; females, carapace length 128 mm, carapace width 14(?) mm. (Due to a printer's error the last digit of this number was not printed so that the width may be anywhere between 140 and 149 mm). One of Saemundsson's (1937) specimens was 160 mm long by 180 mm wide; Kjennerud's (1967) male had a length of 150 mm and a width of 180 mm. The 5 males reported upon by Mason and Davidson (1969) had carapace widths ranging from 192 to 210 mm. In contrast to these large specimens are the specimens reported upon by Hansen (1908), the male of which was 40 mm long, the ovigerous female 42 mm. The only other ovigerous female of which the measurements are known is the one (cb 145 mm) from Madeira (above). A. Milne Edwards and Bouvier, (1894:43) mentioned the eggs as very small. Hansen (1908:19) gave the egg size in his specimen as 0.5–0.6 mm.

REMARKS.—The differences between the present species and *G. maritae* are enumerated under the latter species. Most records of *Geryon affinis* or *Geryon quinquedens* from West Africa pertain to *G. maritae*. It was a surprise to find that the male from the Cape Verde Islands listed above, and already reported upon by Bouvier (1922), belongs to *G. affinis* rather than to *G. maritae*; this shows that both species do inhabit the tropical West African region. The *Princesse Alice* specimens were examined by Holthuis in Paris on 4 October 1971.

The specimen from the Azores assigned by Bouvier (1922) to *Geryon quinquedens* is, as shown by Bouvier's illustration, a good *Geryon affinis*.

BIOLOGY.—In the eastern Atlantic the species is known from depths between 130 and 2047 m; almost 50% of the records is from 1165 to 2047

m, the other half is from 130 to 844 m. The bottom on which the species was found was described as sand and gravel (A. Milne Edwards and Bouvier, 1894); muddy sand, black sand, sand and rock (A. Milne Edwards and Bouvier, 1899); hard bottom (Bouvier, 1922).

Ovigerous females have been collected in August (A. Milne Edwards and Bouvier, 1894); our ovigerous female from Madeira was taken in March.

DISTRIBUTION.—In the eastern Atlantic the species has been reported from the following localities:

Near Iceland: SW edge of Hvalsbakbanki (approximately 64°N, 13°W), 140 m (Saemundsson, 1937). SW of Geirfuglasker, Vestmanneyjar (approximately 63°N, 21°W), 130 m (Saemundsson, 1937). SW of Vestmanneyjar (approximately 63°N, 21°W), 240 fm (440 m) (Rae and Lamont, 1963). S of Iceland, 61°30'N, 22°30'W, 975 fm (1785 m), and 61°33'N, 19°0'W, 1089 fm (2000 m) (Hansen, 1908).

Off SW Norway: Nyegga Bank (approximately 63°38'N, 05°52'E), 410 m (Kjennerud, 1967; Sankarankutty, 1968).

Färöe Islands: ? Off Enniberg (approximately 62°24'N, 06°33'W) (Mason and Davidson, 1969).

Atlantic Ocean, NW of Scotland: Lousy Bank (approximately 60°N, 13°30'W), 440 m (Mason and Davidson, 1969). Rosemary Bank (approximately 59°15'N, 10°W), 480 m (Mason and Davidson, 1969). George Bligh Bank (approximately 59°N, 13°30'W), 240 fm (440 m) (Rae and Lamont, 1963; Mason and Davidson, 1969). 30 miles [48 km] SW of Rockall, 57°18'N, 14°25'W (Mason and Davidson, 1969).

Azores: 39°39'10"N, 31°03'40"W, 1300 m; 39°21'20"N, 31°06'08"W, 1360 m; 38°27'N, 26°31'W, 1165 m; 38°25'50"N, 28°34'30"W, 785 m; 38°01'N, 29°22'30"W, 1260 m; 37°43'N, 25°06'W, 1385 m (all A. Milne Edwards and Bouvier, 1899). Near Ilha de São Miguel, 37°37'N, 25°20'45"W, 1187 m (Bouvier, 1922). E of Ilha do Corvo, 39°41'35"N, 28°44'07"W, 844 m; SE of Ilha do Corvo, 1386 m; between Ilha do Pico and Ilha de São Jorge, 38°38'N, 28°08'15"W, 620 m (A. Milne Edwards and Bouvier, 1894).

Madeira: No specific locality, ca. 1000 m (Türkyay, 1976b).

Cape Verde Islands: W of the Cape Verde Islands, 16°44'N, 24°48'05"W, 692 m; near Ilha de Maio, 15°17'40"N, 23°02'45"W, 1300 m (Bouvier, 1922).

Christiansen (1969, map 29) provided distribution charts of the species. Outside the eastern Atlantic region *Geryon affinis* has been reported from the east coast of America, from South Africa,

the Indian Ocean, and Australia. A comparison of material from those areas with specimens from the eastern Atlantic is highly desirable in order to ascertain whether or not a single species is involved in all these records. The taxonomic confusion within the genus *Geryon* is notorious. Many authors (including Rathbun, 1937:271; Barnard, 1950:291; Monod, 1956:337) considered *Geryon affinis* and *G. quinquegens* synonymous, notwithstanding the fact that A. Milne Edwards and Bouvier (1894:41–45, figs. A–D) and Chace (1940:38–40) had convincingly shown the differences between the two species. A revision of the genus is highly desirable.

**Geryon maritae*, new species

FIGURES 24a, 25, 26

Geryon chuni Doflein, 1903:21 [nomen nudum].

Geryon affinis.—Doflein, 1903:23; 1904:106, 110, 111, 175, 177, 180, 186, 190, 204, 206, 208, 210, 211, 213, 214, 219, 220, 251, 253, 255, 257, 258, text figs. 9, 14, 32, 62, unnumbered pl.: figs. 1, 2, pls. 3, 33, 34, 38; figs. 1–5, 9, pl. 41; figs. 3–7, pl. 43; figs. 2, 8, pl. 49/50; fig. 1, pl. 52; fig. 7, pl. 55; fig. 6, pl. 58; figs. 2, 4 [part]. [Not *Geryon affinis* A. Milne Edwards and Bouvier, 1894.]

Geryon quinquegens.—Capart, 1951:173, fig. 66.—Monod, 1956:337, fig. 441 [part].—Guinot and Ribeiro, 1962:62.—Forest, 1963:628.—Monod, 1967:180, pl. 17; fig. 2 [no material].—Le Locuff and Intès, 1969:66.—Crosnier, 1970:1216.—Le Locuff, Intès, and Le Guen, 1974:73, figs. 1–4.—Intès and Le Locuff, 1976:101. [Not *Geryon quinquegens* Smith, 1879.]

Geryon.—Voss, 1966:19.—Maurin, 1968b, figs. 1, 4.

Geryon quinquegens.—Maurin, 1968a:50; 1968b:484, 487, 491, 492, fig. 6 [erroneous spelling.]

"Third form of *Geryon*".—Christiansen, 1969:87.

Geryon sp.—Dias and Seita Machado, 1973:1.—Bas, Arias, and Guerra, 1976, table 3.

MATERIAL EXAMINED.—*Pillsbury Material*: Liberia: Sta 74, 641–733 m, 1♂ (holotype, L), 1♀ (W).

Ivory Coast: Sta 41, 641–842 m, 1♂, 1♀, 10 juv (L). Sta 44, 403–586 m, hard, dark gray mud, 4♂, 2♀ (L, W). Sta 51, 329–494 m, 1♂, 4♀ (L, W).

Geronimo Material: Gabon: Sta 191, 300 m, 2♀ (W). Sta 198, 300 m, 2♀ (W). Sta 203, 200 m, 2♀ (W).

Undaunted Material: South-West Africa: Sta 107, 359 m, 2♀ (L).

DESCRIPTION.—Carapace (Figure 25) about 1.1