like those in the male. The fingers of both legs are closing over their entire length. The chelae are similar in shape; their spinulation is like that in the adult male, while also traces of the pubescence of the palm in the larger leg are visible. In both legs the fingers are about as long as the palm. The carpus is as long as the palm and shorter than the merus. The spinules on the merus of the 3rd and 4th leg are absent.

*Size:* Males with fully developed legs range in my material from 58 to 90 mm in length. My ovigerous females are 59 to 70 mm long. The eggs are numerous and small, they are 0.5 to 0.63 mm in diameter.

*Material examined:* In the U. S. National Museum the following material of this species is present: In shallow stream emptying into Pejebobo River, Panama (February 25, 1906, R. E. B. McKenney coll.), Upper Reservoir Creek, Toro Point, W. of Colon, Canal Zone (January 25, 1912, S. E. Meek and S. F. Hildebrand coll.), La Guayra, Venezuela (June 25, 1895, W. Robinson coll.), fresh water of rocky brook, Macuto, Venezuela (August 1, 1900, Lyon and W. Robinson coll.), Flint River near Sandy Beach, Jamaica (August 13, 1910, E. A. Andrews coll.), Spring in streamlet, Montego Bay, Jamaica (July 5, 1910, E. A. Andrews coll.), fresh water of Waterworks Pond, St. Croix, Virgin Islands (W. A. Beatty coll.), La Situ, Guadeloupe (L. Guesde coll.), Mount Pleasant, N. E. Grenada (March 19, 1942, G. S. Miller Jr. coll.), Trinidad (W. O. Crosby coll.). In the Museum of the Academy of Natural Sciences at Philadelphia I examined a specimen of this species, which probably came from Panama. The American Museum of Natural History possesses juvenile specimens, probably referable to this species from Panama (Rio Chagres) and from Santo Domingo (Barahona). The Turin Museum possesses this species from Macuto near La Guayra, Venezuela.

*Type:* Holotype (U.S.N.M. Cat. No. 39446) is the specimen (adult male) from Pejebobo River, Panama. The type material is preserved in the U. S. National Museum.

*Remarks:* In literature the species has been mentioned four times as belonging to *Bithynis,* or *Palaemon olfersii.* Sharp's (1893) specimen n. 121, which probably originates from Panama proved to belong in the present species. Nobili's (1897) specimens from Macuto near La Guayra on examination also showed to belong to *M. crenulatum.* The specimens from La Guayra and Guadeloupe, present in the U. S. National Museum, were identified by Miss Rathbun (1902a) as *Bithynis olfersii.* Schmitt (1933) reports on Rathbun's Guadeloupe specimen as *M. olfersii.* In 1950 a preliminary description of this species was published.

## Macrobrachium hancocki Holthuis

Pl. 29, figs. a-e

? *Palaemon Olfersii* p. p. Nobili, 1897, Boll. Mus. Zool. Anat. comp. Torino, vol. 12, no. 280, p. 6.

*Bithynis olfersii* p. p. M. J. Rathbun, 1902a, Bull. U. S. Fish Comm., vol. 20, pt. 2, p. 124.

*Macrobrachium olfersi* Beebe, 1926, Arcturus Adventure, p. 435; Belanske, 1927, In Vanderbilt's To Galápagos on the Ara, p. 148, pl. 29. (non *Palaemon Olfersii* Wiegmann, 1836.)

*Macrobrachium olfersii* Boone, 1930, Bull. Vanderbilt Mar. Mus. vol. 3, p. 142, pl. 50; Meredith, 1939, Voyages Velero III, p. 104, fig.; Schmitt, 1939, Smithson. Misc. Coll., vol. 98, no. 6, p. 28.

*Macrobranchium olfersii* Coventry, 1944, Monogr. Acad. Nat. Sci. Phila., vol. 6, p. 535.

*Macrobrachium hancocki* Holthuis, 1950, Proc. Kon. Nederl. Akad. Wetensch., vol. 53, p. 96; 1950a, Siboga Exped., mon. 39a9, p. 14.

*Description:* This species is very closely related to the preceding, resembling it in almost every respect. Therefore only the difference between the two forms will be mentioned here.

1. The rostrum generally is shorter, never reaching beyond the end of the antennular peduncle, and usually reaching to the middle of its last joint. The first rostral tooth is placed in the anterior quarter of the carapace. The distance to the orbit being less than ¼ of the length of the carapace (rostrum excluded).

2. The carpus of the first leg is distinctly less than twice as long as the chela.

3. The second legs resemble strongly those of *M. crenulatum,* but differ in having only few spinules arranged in 2 or 3 rows on the outer surface of the fixed finger and by having the region without spines, on the outer surface of the palm, flat or even slightly concave and large, well defined. The pubescence of the outer surface of the palm is restricted to this spinuleless area and is not found outside it. In *M. crenulatum* this area, if present is small and ill defined, the pubescence occurring in, as well as outside of it. The row of spinules of the outer surface of the palm, which runs just above the ventral row, generally is straight and runs parallel to the lower row, at last converging with it. In *M. crenulatum* this upper row is somewhat irregular, diverging from the ventral row distally. On the palm of the smaller leg too the naked area is more conspicuous and the number of spinules on the fixed finger is smaller.

4. The ovigerous females differ in the same characters as the males do, only the 2nd legs in my largest specimen are of equal shape, resembling the smaller leg of the female of *M. crenulatum*.

*Size:* Males with well developed chelae are 44 to 87 mm long. Ovigerous females are 42 to 44 mm in length. The eggs are numerous and small, being 0.45 to 0.60 mm in diameter.

*Colour:* The specimen from Cubita Bay, Colombia, an adult male of 52 mm was accompanied by the following collector's note: "Chelipeds cobalt blue, large hand tending towards a black blue (= marine blue). Abdomen same, becoming darker posteriorly. At articulation of movable finger of large hand bright Chinese orange, an especially large spot on left side of finger. Articulation of small finger dull, not more than brownish." Meredith (1939) gives a photograph of the anterior part of the body of the large male (56 mm) of Chatham Island (Allan Hancock Expedition, 1933), and states it to be "a blue shrimp." Furthermore Boone (1930), remarks that "the pair of large chelipeds are deep gentian blue with a purplish cast; the body and other appendages are mottled reddish brown, the tips of the antennae and pleopods being yellowish." Belanske (1927) gives a coloured plate of the specimen described by Boone (1930). The blue colour of the large cheliped thus seems to be very constant.

*Material examined:* The species was collected in fairly large numbers (about 120 specimens in total) by the Allan Hancock Expeditions 1933, 1934, 1935, and 1938 from the following localities:

Panama: Bahia Honda. Shore, in drinking hole, March 9, 1933, Sta. 111-33. Fresh-water pool, March 9, 1933, Sta. 112-33. Habitat unknown, purchased together with specimens of *Macrobrachium americanum* Bate from an old lady for a cake of soap, March 10, 1935.

Secas Islands. Fresh-water stream and pools, February 5, 1935, Sta. 452-35.

Colombia: Cubita Bay. In stream at watering place, February 13, 1934. Gorgona Island, Watering Bay. Fresh-water stream, February 24, 1938, Sta. 852-38.

Cocos Island (Costa Rica): Chatham Bay. Fresh-water stream, February 28, 1933, Sta. 103-33. Fresh water stream, March 3, 1933, Sta. 109-33. Wafer Bay. Fresh water, March 2, 1933, Sta. 107-33.

Galapagos Islands (Ecuador): Chatham Island, Fresh-water Bay. Upstream ½ mile, seined with 40 ft. special seine, February 1, 1933, Sta. 44-33.

In the collection of the United States National Museum specimens of this species are represented from: Gulf of Nicoya, Costa Rica, fresh water (November 15, 1906, J. F. Tristan coll.), Esparta, Rio Barranca, Costa Rica (June 25, 1928, M. Valerio coll.), Rio Platanales, Golfo Dulce, Costa Rica (April, 1896, H. Pittier coll.), Rio Marino, Hog Creek, and some unnamed streams and pools, San José Island, Archipielago de las Perlas, Gulf of Panama (February 12 to September 27, 1944, J. P. E. Morrison coll.), Cocos Island, Costa Rica (June 6, 1929, W. K. Fisher coll., Pinchot Expedition), Old Providence Island, Colombia, or Cocos Island, Costa Rica (1938, W. L. Schmitt coll., Franklin D. Roosevelt Presidential Cruise). The American Museum of Natural History at New York possesses specimens of this species from San José Island, Archipielago de las Perlas, Gulf of Panama, and from Cocos Island (fresh-water brook emptying in Wafer Bay).

The specimens recorded by Nobili (1897) under the name *Palaemon Olfersii* from Rio Sabana, S. Panama, were examined by me in the Turin Museum. The specimens in all probability belong in the present species, but since in both the second legs are lacking, the identity could not be made fully certain.

*Distribution:* This species lives in fresh water of W. America, from Costa Rica to Colombia, Cocos Island and the Galapagos Archipelago. It is recorded in literature from: Golfo Dulce, Costa Rica! (M. J. Rathbun, 1902a), Esparta, Costa Rica! (Holthuis, 1950), ? Sabana River, Darien! (Nobili, 1897), Mt. Sapo, Piñas Bay, Panama (Coventry, 1944), Cocos Island (Beebe, 1926), Chatham Bay, Cocos Island (Belanske, 1927; Boone, 1930), Chatham Island, Galapagos Archipelago! (Meredith, 1939), Old Providence Island, Colombia! (Schmitt, 1939). (See under remarks.)

*Type:* Holotype (U.S.N.M. Cat. No. 62218) is the largest male of the collection, namely the specimen from Esparta, Rio Barranca, Costa Rica. Part of the Hancock paratype material is preserved in the collection of the Allan Hancock Foundation at Los Angeles. All other material is deposited in the United States National Museum.

*Remarks:* The specimen recorded by Schmitt (1939) as *Macrobrachium olfersii* from Old Providence Island, is present in the collection of the U. S. National Museum and was examined by me. It proves to be a typical *Macrobrachium hancocki,* which is the more surprising as Old Providence Island is situated in the Caribbean Sea. The jar in which the specimen is kept, contains, however, a label with the inscription in Dr. Schmitt's handwriting: "Cocos? *Old Providence*?" Another

label states: "My recollection is that this is an Old Providence specimen." The locality thus is by no means certain and it may be very well possible (and according to the identity of the specimen it seems very probable) that the specimen was collected at Cocos Island.

It is a great pleasure to me to name this beautiful and brilliantly coloured species for Captain Allan Hancock, the leader of the Allan Hancock Expeditions.

## Macrobrachium carcinus (L.)

Pl. 30; pl. 31, a-c

*Potipema Marcgraf,* 1648, Hist. Rer. nat. Bras., p. 187.

*Astacus fluviatilis major, chelis aculeatis* Sloane, 1725, Nat. Hist. Jamaica, vol. 2, p. 271, pl. 245, fig. 2.

*Cancer Carcinus* Linnaeus, 1758, Syst. Nat., ed. 10, p. 631.

*Cancer* 44 Linnaeus, 1759, Anim. Spec., p. 203.

*Cancer Carcinus* Linnaeus, 1760, Syst. Nat., ed. 11, p. 631.

*Squilla, Crangon, Americana major* Seba, 1761, Thesaur., vol. 3, p. 54, pl. 21, fig. 4.

*Astacus minor chelis denticulatis* Gronovius, 1764, Zooph. Gronov., p. 231.

*Cancer Carcinus* Linnaeus, 1767, Syst. Nat., ed. 12, p. 1051; Linnaeus, 1767a, Syst. Nat., ed. 13, p. 1051; Houttuyn, 1769, Nat. Hist., vol. 1, pt. 13, p. 406.

*Cancer carcinus* Forster, 1771, Catal. Anim. N. America, p. 33.

*Astacus carcinus* Fabricius, 1775, Syst. Ent., p. 414.

*Cancer carcinus* Müller, 1775, Linn. Natursyst., vol. 5, pt. 2, p. 1124.

*Astacus carcinus* Fabricius, 1781, Spec. Ins., vol. 1, p. 510; Fabricius, 1787, Mant. Ins., vol. 1, p. 332.

Camaròn de Agua dulce Parra, 1787, Descript. dif. Piezas Hist. nat., p. 157, pl. 55, fig. 2.

*Astacus* 2 Browne, 1789, Nat. Hist. Jamaica, p. 424.

*Cancer Carcinus* Gmelin, 1789, Linn. Syst. Nat., ed. 13, vol. 1, p. 2986.

*Astacus Carcinus* Olivier, 1791, Encycl. méth. Hist. nat., vol. 6, p. 344.

*Cancer* (*Astacus*) *Jamaicensis* Herbst, 1792, Vers. Naturgesch. Krabb. Krebse, vol. 2, p. 57, pl. 27, fig. 2.

non *Cancer* (*Astacus*) *Carcinus* Herbst, 1792, Vers. Naturgesch. Krabb. Krebse, vol. 2, p. 58, pl. 28, fig. 1.

*Astacus carcinus* Fabricius, 1793, Ent. Syst., vol. 2, p. 479.

*Palaemon carcinus* Weber, 1795, Nomencl. Ent., p. 94.

non *Palaemon carcinus* Fabricius, 1798, Suppl. Ent. Syst., p. 402.

*Palaemon jamaicensis* Olivier, 1811, Encycl. méth. Hist. nat., vol. 8, p. 659.

*Palaemon carcinus* Leach, 1815, Zool. Miscell., vol. 2, p. 92, pl. 92; Latreille, 1818, Tabl. encycl. méthod., vol. 24, p. 6, pl. 327, fig. 1.

*Palaemon Jamaicensis* Lamarck, 1818, Hist. nat. Anim. s. Vert., vol. 5, p. 207; Desmarest, 1823, Dict. Sci. nat., vol. 23, p. 330; Desmarest, 1825, Consid. gén. Class. Crust., p. 237.

*Palaemon Carcinus* Guilding, 1825, Trans. Linn. Soc. Lond., vol. 14, p. 338.

*Astacus* (*Palaemon*) *jamaicensis* Voigt, 1836, Cuvier's Thierreich, ed. 2, vol. 4, p. 184.

*Palaemon brachydactylus* Wiegmann, 1836, Arch. Naturgesch., vol. 2, pt. 1, p. 148.

*Palemon Jamaicensis* H. Milne Edwards, 1837, Hist. nat. Crust., vol. 2, p. 398.

*Palaemon Jamaicensis* H. Milne Edwards, 1838, Lamarck's Hist. nat. Anim. s. Vert., ed. 2, vol. 5, p. 366.

*Palemon punctatus* Randall, 1839, J. Acad. Nat. Sci. Phila., vol. 8, p. 146.

*Palaemon jamaicensis* Gibbes, 1845, Proc. Boston Soc. Nat. Hist., vol. 2, p. 70; White, 1847, List Crust. Brit. Mus., p. 78.

*Palemon brevicarpus* De Haan, 1849, Fauna Japonica, Crust., p. 172.

*Palaemon punctatus* Gibbes, 1850, Proc. Acad. Nat. Sci. Phila., 1850, p. 25.

*Palaemon Jamaicensis* Gibbes, 1850, Proc. Acad. Nat. Sci. Phila., 1850, p. 29.

*Palemon jamaicensis* Gibbes, 1850a, Proc. Amer. Assoc. Adv. Sci., vol. 3, p. 198.

*Palemon punctatus* Gibbes, 1850a, Proc. Amer. Assoc. Adv. Sci., vol. 3, p. 198.

*Palemon jamaicensis* Guérin, 1856, Sagra's Historia de Cuba, Crust., p. xx.

*Palemon jamaicensis* Guérin, 1857, Sagra's Histoire de Cuba, Crust., p. liv.

*Palaemon aztecus* De Saussure, 1857, Rev. Mag. Zool., ser. 2, vol. 9, p. 504.

? *Palaemon Montezumae* De Saussure, 1857, Rev. Mag. Zool., ser. 2 vol. 9, p. 504.

*Palaemon brachydactylus* Stimpson, 1857, Boston J. Nat. Hist., vol. 6, p. 502.

*Palaemon jamaicensis* De Saussure, 1858, Mém. Soc. Phys. Hist. nat. Genève, vol. 14, p. 465.

*Palaemon aztecus* De Saussure, 1858, Mém. Soc. Phys. Hist. nat. Genève, vol. 14, p. 466, pl. 4, fig. 29.

? *Palaemon Montezumae* De Saussure, 1858, Mém. Soc. Phys. Hist. nat. Genève, vol. 14, p. 467, pl. 4, fig. 28.

*Palaemon Jamaicensis* Von Martens, 1858, Ann. Mag. Nat. Hist., ser. 3, vol. 1, p. 51.

*Palaemon jamaicensis* p. p. Semper, 1868, Proc. Zool. Soc. Lond., 1868, p. 585.

*Palaemon Jamaicensis* Von Martens, 1869, Arch. Naturgesch., vol. 35, pt. 1, p. 22.

*Palaemon laminatus* (Gollmer MSS.) Von Martens, 1869, Arch. Naturgesch., vol. 35, pt. 1, p. 24.

*Palaemon Jamaicensis* Smith, 1869, Trans. Conn. Acad. Arts Sci., vol. 2, pp. 23, 40.

*Palaemon* (*Macrobrachion*) *Jamaicensis* Von Martens, 1872, Arch. Naturgesch., vol. 38, pt. 1, p. 137.

*Palemon Jamaicensis* Streets, 1872, Proc. Acad. Nat. Sci. Phila., 1872, p. 134.

*Palaemon jamaicensis* Kingsley, 1878a, Bull. Essex Inst., vol. 10, p. 68.

*Palaemon brachydactylus* Kingsley, 1878a, Bull. Essex Inst., vol. 10, p. 68.

*Palaemon aztecus* Kingsley, 1878a, Bull. Essex Inst., vol. 10, p. 68.

? *Palaemon montezumae* Kingsley, 1878a, Bull. Essex Inst., vol. 10, p. 68.

*Palaemon Jamaicensis* Neumann, 1878, Syst. Uebers. Gatt. Oxyrh., p. 37.

non *Palaemon jamaicensis* Huxley, 1879, The Crayfish, p. 269, figs. 71, 79.

*Palaemon brevicarpus* De Man, 1879, Notes Leyden Mus., vol. 1, p. 179.

non *Palaemon jamaicensis* Huxley, 1880, L'écrevisse, p. 197, figs. 71, 79.

non *Palaemon jamaicensis* Huxley, 1881, Der Krebs, p. 226, figs. 71, 79.

*Palaemon jamaicensis* p. p. Kingsley, 1882, Bull. Essex Inst., vol. 14, p. 107.

*Palaemon jamaicensis* Gundlach, 1887, An. Soc. Esp. Hist. nat., vol. 16, p. 132.

*Bithynis jamaicensis* Pocock, 1889, Ann. Mag. Nat. Hist., ser. 6, vol. 3, p. 10.

? *Palaemon montezumae* Ortmann, 1891, Zool. Jb. Syst., vol. 5, p. 728.

*Palaemon jamaicensis* Ortmann, 1891, Zool. Jb. Syst., vol. 5, p. 729, pl. 47, fig. 7.

*Palaemon brevicarpus* Ortmann, 1891, Zool. Jb. Syst., vol. 5, p. 731.

*Palaemon Jamaicensis* Andrews, 1892, Johns Hopkins Univ. Circ., vol. 11, p. 75.

*Palaemon aztecus* Thallwitz, 1892, Abh. Ber. zool. anthrop. Mus. Dresden, 1890-91, pt. 3, p. 6.

*Palaemon brevicarpus* Thallwitz, 1892, Abh. Ber. zool. anthrop. Mus. Dresden, 1890-91, pt. 3, p. 7.

*Palaemon jamaicensis* Thallwitz, 1892, Abh. Ber. zool. anthrop. Mus. Dresden, 1890-91, pt. 3, pp. 9, 49.

*Palaemon laminatus* Thallwitz, 1892, Abh. Ber. zool. anthrop. Mus. Dresden, 1890-91, pt. 3, p. 9.

*Palaemon montezumae* Thallwitz, 1892, Abh. Ber. zool. anthrop. Mus. Dresden, 1890-91, pt. 3, p. 11.

*Palaemon jamaicensis* Verrill, 1892, Trans. Conn. Acad. Arts Sci., vol. 8, p. 353.

*Palaemon jamaicensis?* p. p. Benedict, 1893, Proc. U. S. Nat. Mus., vol. 16, p. 540.

*Palaemon jamaicensis* Pocock, 1893, Journ. Linn. Soc. Lond. Zool., vol. 24, p. 407.

*Palaemon jamaicensis* p. p. Sharp, 1893, Proc. Acad. Nat. Sci. Phila., 1893, p. 122.

*Palaemon olfersii* p. p. Sharp, 1893, Proc. Acad. Nat. Sci. Phila., 1893, p. 123.

*Palaemon jamaicensis* Von Ihering, 1897, Rev. Mus. paul., vol. 2, p. 423; Von Ihering, 1897a, Rev. Mus. paul., vol. 2, p. 156; Ortmann, 1897, Rev. Mus. paul., vol. 2, p. 208.

*Bithynis jamaicensis* M. J. Rathbun, 1897, Ann. Jamaica Inst., vol. 1, p. 44.

non *Palaemon Montezumae* Nobili, 1898, Boll. Mus. Zool. Anat. comp. Torino, vol. 13, no. 314, p. 2.

*Palaemon jamäicensis* Doflein, 1900, S. B. Bayer Akad. Wiss., vol. 30, p. 128.

*Palaemon aztecus* Doflein, 1900, S. B. Bayer. Akad. Wiss., vol. 30, p. 128.

*Bithynis jamaicensis* Young, 1900, Stalk-eyed Crust. Brit. Guian., p. 485.

*Bithynis aztecus* Young, 1900, Stalk-eyed Crust. Brit. Guian., p. 486.

? *Bithynis montezumae* Young, 1900, Stalk-eyed Crust. Brit. Guian., p. 486.

*Palaemon jamaicensis* Moreira, 1901, Arch. Mus. nac. Rio de J., vol. 11, p. 13.

*Bithynis jamaicensis* M. J. Rathbun, 1902a, Bull. U. S. Fish Comm., vol. 20, pt. 2, p. 123.

*Bithynis Jamaicensis* Coulon, 1907, Bull. Soc. Étud. Sci. Nat. Elbeuf, vol. 25, p. 191.

*Palaemon Jamaicensis* Valdés Ragués, 1909, Mis Trabajos Acad., p. 182.

*Macrobrachium jamaicense* Pearse, 1915, Proc. U. S. Nat. Mus., vol. 49, p. 551.

*Palaemon jamaicensis* Tesch, 1914-1917, Encycl. Nederl. West Indië, p. 250.

*Palemon ornatus* (Forns MSS.) Torralbas, 1917, An. Acad. Habana, vol. 53, p. 616, figs. 56, 57. (non Olivier, 1811.)

*Palemon jamaicensis* Torralbas, 1917, An. Acad. Habana, vol. 53, p. 617.

*Macrobrachium jamaicense* Luederwaldt, 1919, Rev. Mus. paul., vol. 11, p. 430.

*Palaemon jamaicensis* Luederwaldt, 1919a, Rev. Mus. paul., vol. 11, p. 387.

*Macrobrachium jamaicense* Pearse, 1921, Proc. U. S. Nat. Mus., vol. 59, p. 462; Beebe, 1924, Galapagos, p. 431; Schmitt, 1924b, Zoologica, New York, vol. 5, p. 169; Schmitt, 1924c, Univ. Iowa Stud. nat. Hist., vol. 10, pt. 4, p. 83.

*Palaemon* (*Macroterocheir*) *jamaicensis* De Man, 1925, Ann. Mus. Congo Belg., Zool., ser. 3, sect. 3, pt. 1, fasc. 1, p. 51, fig. 13.

*Palaemon carcinus* Sunier, 1925, Tijdschr. Nederl. dierk. Ver., ser. 2, vol. 19, p. cxvi.

*Palaemon jamaicensis* Boone, 1927, Bull. Bingham Oceanogr. Coll., vol. 1, pt. 2, p. 112.

*Macrobrachium jamaicense* Luederwaldt, 1929, Rev. Mus. paul., vol. 16, p. 53.

*Macrobrachium jamaicense* Boone, 1931, Bull. Amer. Mus. Nat. Hist., vol. 63, p. 179, fig. 19.

*Palaemon jamaicensis aztecus* Pesta, 1931, Ann. naturh. Mus. Wien, vol. 45, p. 177.

*Macrobrachium jamaicense* Geiser, 1933, Field and Lab., vol. 2, p. 31; Geiser, 1933a, Abstr. Pap. ann. Meet. N. Texas biol. Soc., April 22, 1933, p. 7; Schmitt, 1933, J. Wash. Acad. Sci., vol. 23, p. 314.

*Periclimenes portoricensis* Schmitt, 1933a, Amer. Mus. Novit., vol. 662, p. 3, fig. 2.

*Palaemon jamaicensis* Gordon, 1935a, Journ. Linn. Soc. Lond. Zool., vol. 39, p. 323.

*Macrobrachium jamaicense* Schmitt, 1935, Sci. Surv. Porto Rico, Virgin Isl., vol. 15, p. 158.

*Periclimenes portoricensis* Schmitt, 1935, Sci. Surv. Porto Rico, Virgin Isl., vol. 15, p. 165, fig. 28.

? *Macrobrachium jamaicense* Hildebrand, 1939, Zoologica, New York, vol. 24, pp. 23, 24.

*Macrobrachium ohionis* Reed, 1941, Marine Life Texas, pp. 36, 46, 73, fig. (non *Palaemon ohionis* Smith, 1874.)

*Macrobrachium jamaicense* p. p. Coventry, 1944, Monogr. Acad. Nat. Sci. Phila., vol. 6, p. 535.

*Macrobrachium jamaicense* Sawaya, 1946, Zoologica, São Paulo, vol. 11, p. 402, pl. 1, fig. 9, pl. 3, figs. 10, 11; Hedgpeth, 1947, Texas Game and Fish, vol. 5, pt. 8, p. 14, figs.; Hedgpeth, 1947a, Progr. Fish Cult., Oct. 1947, p. 182, figs.; Chace & Holthuis, 1948, Hummelinck's Stud. Fauna Curaçao, vol. 3, p. 24.

*Macrobrachium carcinus* Hedgpeth, 1949, Texas J. Sci., vol. 1, p. 31, figs. 1b, 3, 5; Holthuis, 1950a, Siboga Exped., mon. 39a9, pp. 13, 117, figs. 23, 24; 1950b, Zool. Meded., vol. 31, p. 31.

*Description:* The rostrum reaches to or slightly beyond the end of the antennular peduncle, it is rather narrow. The tip is somewhat curved upwards. The upper margin, which is a little arched over the eyes, bears 11 to 14 (in young specimens up to 16) teeth, which are regularly divided over the margin, sometimes the ultimate teeth are placed a little wider apart than the proximals. The first 4 to 6 teeth are placed on the carapace behind the orbit, they occupy about ⅓ of the length of the carapace (rostrum excluded). The lower margin bears 3 or 4 teeth. The carapace is smooth, in old males the lateral parts show coarse pits.

The abdomen, too, is smooth. The pleura of the fifth segment ends in a rectangle, with the tip rounded. The sixth segment is less than 1.5 times as long as the fifth. The telson is slightly more than 1.5 times as long as the 6th abdominal segment. The 2 dorsal pairs of spinules are

placed in the middle and at ¾ of the length of the telson. The posterior margin of the telson ends in an acute point, which in old specimens becomes truncate. The inner of the 2 posterior pairs of spinules is the longer and in young specimens it reaches distinctly beyond the tip of the telson, in old specimens it is much reduced and fails to reach even to the end of the truncated tip of the telson. Numerous feathered setae are present.

The eyes and antennular peduncles are normal in shape.

The scaphocerite is about 2.5 times as long as broad. The outer margin is about straight.

The first legs reach with about half of the length of the carpus beyond the scaphocerite. The fingers are as long as the palm. The carpus is twice as long as the chela and 5/4 as long as the merus. Merus and ischium are roughened by the presence of spinules. Carpus and chela are smooth. The second pereiopods are strong and far more heavy than the other legs. The left and right leg are equal in shape and size. They reach with part of the merus beyond the scaphocerite. The fingers are slender, and are only slightly shorter than the palm. They distinctly gape in the proximal part. The fingers cross so that the tip of the dactylus reaches far beyond the lower margin of the fixed finger and the tip of the fixed finger reaches distinctly beyond the upper margin of the dactylus. Each finger has the cutting edge provided with one large tooth; that of the dactylus is situated in the middle of the length of the cutting edge, that of the fixed finger lies distinctly proximally of the upper tooth. Between these large teeth and the base of the finger, the cutting edge bears some 2 to 4 smaller denticles. The rest of the edge is entire. Along the cutting edges a distinct brown pubescence is visible. Furthermore the fixed finger is provided with a brown pubescence on its inner surface and on the basal part of its outer surface. The palm is elongate and only slightly compressed, it is almost 4 times as long as high and is, like the fingers, covered with many spinules which are smallest and placed closest together in the upper part, being larger and placed wider apart in the lower region. A feeble pubescence is sometimes visible on the lower surface of the palm being most distinct anteriorly. The carpus is about half as long as the palm, it is about circular in transverse section and gradually narrows posteriorly. It is 2.5 times as long as high. The merus is about 4/5 as long as the carpus. The ischium is slightly less than ½ as long as the merus. Ischium, merus and carpus show a spinulation similar to that of the palm, here, too, traces of a pubescence are sometimes visible on the ventral surface. The third leg reaches with about

the dactylus beyond the scaphocerite. The propodus is somewhat more than twice as long the the dactylus, about 1.7 times as long as the carpus and distinctly shorter than the merus. The fifth leg reaches about to the middle of the scaphocerite. The propodus is about 2.5 times as long as the dactylus, slightly less than twice as long as the carpus and about as long as the merus. All the joints of the last 3 legs are thickly covered with minute spinules.

Pleopods and uropods are normal in shape.

Ovigerous females differ from the adult males mainly by having the 2nd chelae less strong. They reach with a part of the carpus only beyond the scaphocerite. The fingers close over their entire length, the tip of each finger does not reach beyond the outer margin of the opposing finger. The teeth of the cutting edge are distributed like in the male, but they are much weaker. The pubescence, too, is less developed than in the male. The whole chela is more slender. The fingers are even longer than the palm. The carpus is slightly more than half as long as the palm.

Young specimens have less teeth of the rostrum situated behind the orbit. The first legs reach less far forwards, generally overreaching the scaphocerite with the chela only. The carpus is less than twice as long as the chela. The second legs show much resemblance to those of the female except that the fingers are about as long as or slightly shorter than the palm. The carpus is longer in relation to the merus. Of the last three legs the third is relatively shorter, the fifth somewhat longer than in the larger specimens. Furthermore the spinulation of these legs is much less strong, in very young specimens it often is entirely absent. It is very difficult, sometimes almost impossible, to tell young specimens of this species apart from juveniles of the *M. olfersi* group.

*Size:* The largest specimen, an adult male, examined by me is 233 mm long. Ovigerous females are 130 to 170 mm in length. The eggs are numerous and small being 0.44 to 0.67 mm in diameter.

*Colour:* In the first published description of the present species, namely that of Marcgraf (1648), also a description of the colour of Brazilian specimens is given: "Color totius testae pallidus, crassis striis cinereis secundum longitudinem variegatus: brachia sunt inferius cinerea, superius obsoleti coloris instar ligni querni veteris. Oculi nigri; cirrhi albi." With brachia the large second legs are meant, with cirrhi the antennal and antennular flagella. About three centuries later for the second time notes on the colour of the species are given, when Hedgpeth (1947) shortly described the colour of Texas specimens. In 1949 the

same author gives the following more extensive account of the colour of Texas prawns of the present species: "The general dorsal color is dark brown with rich opaque cream mottling on the sides, shading into a light olive green on the edges of the pleura and the legs. The large chelipeds are greenish, with brown-black tubercles and pale orange articulations. The outer uropods are dark, almost black-green, the inner are opaque cream. The telson is dark green but not as dark as the outer uropods." Colour notes of the living animals were made also by Dr. Waldo L. Schmitt in Villa Bella, São Sebastiao, Brazil on his 1925 expedition to South America, and were kindly placed at my disposal. The species is described as follows: The body is greenish blue (marine blue x French green), with broad longitudinal stripes of olive buff to olive yellow tinged with Nile blue. The carapace shows a median stripe, which, however, does not reach the base of the rostrum, neither the posterior margin of the carapace. Furthermore the carapace shows at both sides 3 longitudinal stripes, the upper starting from the posterior margin of the carapace and ending in the rostrum, the upper and lower margin of which, however, are coloured greenish blue; the second stripe also begins at the posterior margin of the carapace (where it merges with the basal part of the upper stripe) and ends in the antennal spine, the third runs along the lower margin of the carapace. The abdomen possesses 2 stripes over the entire length of each half, one along the lower margin and the other over the middle of the lateral surface. The caudal fan is bluish green, with 2 light spots at the base of the telson and fairly large muddy brown spots at the distal part of the uropodal endo- and exopods. The chelipeds are marine blue, with blackish spines, and a flush of French blue at the articulations. The last three legs have the dactyli, propodi and carpi dark china blue above, lighter below; the meri and ischii are much paler, nearly whitish. Another specimen was described as being marine blue black-bottle green, striped with buff lines. The lower lateral surface of the carapace being bright yellow. The legs are china blue, the smaller chela prune purple, with the basal half of the fixed and the tips of both fingers whitish, while a white spot is present at the inside of the distal end of the carpus and a smaller one at the proximal end. The large chela is marine blue, which is worked out to whitish on the inner lower margin of the palm and carpus. A spot is present on the distal end of the merus. Mr. Frederick M. Bayer, assistant curator of the division, Marine Invertebrates of the U.S. National Museum, kindly provided me with the following colour description of specimens from Miami, Fla.: The body "has a rich brown color,

with two lighter brown longitudinal bands along the sides of the abdomen. The sides of the carapace are likewise light, and there are lighter spots on the dorsal part as well. The articulation of the carpus and propodus has a brilliant blue spot, and a smaller spot is present on the articulation of propodus and dactylus."

*Material examined:* The Allan Hancock Expeditions 1933 and 1939 collected juvenile specimens of this species from:

Panama: Canal Zone, Barro Colorado Island, Biological Station. Freshwater stream, March 6, 1933, Sta. 110-33.

Colombia: Barranquilla near Terminal. Dipnet over ship's side, April 6, 1939.

Venezuela: Cubagua Island. 2-5 fms, sand and algae, April 14, 1939, Sta. A24-39.

The U. S. National Museum possesses material of this species from the following localities: Florida (St. Augustine, St. Johns Co.; Silver Glen Springs, Marion Co.; Miami River, Dade Co.; Big Pine Key, Monroe Co.), Texas (Matagorda and Palacios Bays, Matagorda Co.; Colorado River near Austin, Travis Co.; San Marcos River near San Marcos, Hays Co.; Guadeloupe River, Victoria Co.; San Antonio, Bexar Co.; Devils River, Valverde Co.; Las Moras Creek, Kinney Co.; Brownsville, Cameron Co.), Mexico (Tamazunchale; Zacatlan in N. E. Puebla State; Santa Maria near Vera Cruz), Nicaragua (Greytown), N. Costa Rica (Rio Frio), Panama (Gorgona; Rio Chagres; Frijoles; Miraflores; Gatun; Mindi; Empire), Colombia (Sabanilla; Loma Larga in Santa Marta Mts.), Venezuela (Ocumare; La Guayra; Macuto), British Guiana (Cuyuni River; Kartabo), Brazil (Ilha São Sebastiao; Sacco São Francisco), Cuba (Havana; Calabazar; Guantanamo; Baracoa), Jamaica (Lucea), Santo Domingo (Rio San Juan), Porto Rico (San Sebastian; Juana Diaz; Arroyo; Carolina Viejo; Trujillo Alto; Caguas), Virgin Islands (St. Thomas; St. Croix), Guadeloupe, St. Lucia (Port Castries), Barbados (Bathsheba), Grenada, Curaçao (Pos Europa), Aruba (Bron di Rooi Bringamosa), Old Providence Island. The American Museum of Natural History possesses material of this species from Florida (West Palm Beach), Mexico (Axtla River in San Luis Potosi Province), Panama (Barro Colorado Island in Gatun Lake), Venezuela (La Brea), British Guiana, Cuba (Santiago de Cuba), Santo Domingo, Virgin Islands (St. Croix). Furthermore, I examined in the Rijksmuseum van Natuurlijke Historie at Leiden, Holland, some specimens from Surinam, and from Bonaire (Tanki Kerkhof).

*Distribution:* This species lives in fresh, and also in brackish, waters of eastern America from Florida to S. Brazil and in the West Indies. The records in literature are:

America (Linnaeus, 1758, 1760, 1767, 1767a; Fabricius, 1775, 1781, 1793; Müller, 1775; Gmelin, 1789), South America (Olivier, 1791, 1811; Lamarck, 1818; Desmarest, 1823, 1825; H. Milne Edwards, 1838; Coulon, 1909), St. Augustine and Silver Springs, Florida! (Schmitt, 1933), Miami and Big Pine Key, Florida! (Hedgpeth, 1949), Matagorda Bay!, Aransas Bay, Colorado River near Austin!, San Marcos River near San Marcos!, Texas (Hedgpeth, 1949), San Marcos and New Braunfels, Texas (Geiser, 1933), San Antonio, Texas! (M. J. Rathbun, 1899!; Geiser, 1933; Reed, 1941), Comal, Texas (Geiser, 1933), Lake Corpus Christi, Texas (Hedgpeth, 1949), Nueces River and Rio Grande (Hedgpeth, 1947), Devils River, Texas! (Geiser, 1933; Schmitt, 1933!), Las Moras Creek and Brownsville, Texas! (M. J. Rathbun, 1899!; Geiser, 1933), Mexico (Wiegmann, 1836), Rio Tampico, Mexico (De Saussure, 1857, 1858), Amixtlan and Zacatlan, Puebla State, Mexico! (M. J. Rathbun, 1899), Vera Cruz, Mexico (De Saussure, 1858), Guatemala! (Kingsley, 1882!; Sharp, 1893!), Nicaragua (Benedict, 1893), Escondido River, Nicaragua (M. J. Rathbun, 1899), Rio Pacuare, Puerto Limon, Costa Rica (Pesta, 1931), Rio Chagres, Panama (Doflein, 1900), Barro Colorado Island, Canal Zone (Boone, 1931), Colon, Panama (Beebe, 1924; Schmitt, 1924b), Old Providence Island off the coast of Nicaragua, Colombia (Benedict, 1893; Coventry, 1944), La Rosa near Santa Marta, Colombia (Pearse, 1915), Rio Tuy, El Concejo, near Lake Valencia, Venezuela (Pearse, 1921), Caracas, Venezuela (Von Martens, 1869), British Guiana (Semper, 1868; Gordon, 1935a), Surinam! (Semper 1868; De Man, 1925!; Holthuis, 1950b), Surinam River near Paramaribo, Surinam! (Tesch, 1914-1917; Holthuis, 1950b!), Rio Paute, Amazon basin, Ecuador (Ortmann, 1891), Napo and Marañon Rivers in Amazon basin, Peru (Kingsley, 1878), Brazil! Marcgraf, 1648; White, 1847; Semper, 1868; Kingsley, 1882!; Sharp, 1893!), Pernambuco (White, 1847), Penedo (Smith, 1869), Bahia (Semper, 1868; Ortmann, 1891), Rio de Janeiro (Von Martens, 1869; Ortmann, 1897), Piauhy and Jacarépaguá near Rio de Janeiro (Moreira, 1901) Ubatuba, São Paulo State (Luederwaldt, 1919; Sawaya, 1946), Perús (Luederwaldt, 1919), Ilha São Sebastiao Tieté near São Paulo (Sawaya, 1946), Santos (Luederwaldt, 1919, 1919a; Sawaya, 1946), Concseição de Itanhaem (Luederwaldt, 1919),

Xiririca, Rio Ribeira de Iguapé (Sawaya, 1946), Iguapé, São Paulo State (Von Ihering, 1897; Sawaya, 1946), Itajahy River, St. Catherine State, Brazil (Von Ihering, 1897), West Indies (Gronovius, 1764; Houttuyn, 1769; Olivier, 1811; Lamarck, 1818; Desmarest, 1823, 1825; Voigt, 1836; H. Milne Edwards, 1837, 1838; Randall, 1839; Semper, 1868; Von Martens, 1869; Thallwitz, 1892), Cuba! (Parra, 1787; Gibbes, 1850a; Guérin, 1856, 1857; Von Martens, 1869, 1872; Gundlach, 1887; Sharp, 1893!; Hay, 1903; Valdés Ragués, 1909; Torralbas, 1917; Boone, 1927), Jamaica (Sloane, 1725; Browne, 1789; Herbst, 1792; Leach, 1825; White, 1847; Gundlach, 1887; Andrews, 1892; M. J. Rathbun, 1897), Haiti (Ortmann, 1891), Porto Rico! (Gundlach, 1887; M. J. Rathbun, 1902a!; Schmitt, 1933a, 1935), St. Thomas (Nobili, 1898), St. Martin! (Streets, 1872!; Kingsley, 1882; Sharp, 1893!), Dominica (Pocock, 1889; Verrill, 1892), Port Castries, St. Lucia! (M. J. Rathbun, 1899), St. Vincent (Guilding, 1825), Cumberland and Chateaubilair Rivers, St. Vincent (Pocock, 1893), Barbados (Young, 1900; Schmitt, 1924a), Port of Spain, Trinidad (De Man, 1925), Kralendijk, Bonaire! (Chace & Holthuis, 1948), Pos Europa, Curaçao! (Chace & Holthuis, 1948), Bron di Rooi Bringamosa, Aruba! (Chace & Holthuis, 1948).

*Type:* Linnaeus (1758) gives as locality "*in* Americae *fluviis.*" As Linnaeus species probably only is based on the description and figure given by Sloane (1725) of his *Astacus fluviatilis major,* and not on actual specimens, we may consider Jamaica to be the type locality and Sloane's material the type material. If Sloane's specimens still are extant, then they are preserved in the British Museum, London.

*Remarks:* In the tenth edition of his Systema Naturae, Linnaeus gave the following account of his *Cancer carcinus*: "C.[ancer] macrourus, thorace laevi, manibus teretiusculis: brachiis hispido-aculeatis. *Sloan. iam. 2. p.* 271. *t.* 245. *f.* 2. Astacus fluviatilis maior, chelis aculeatis. *Habitat in* Americae *fluviis.*" This makes it certain that his *Cancer Carcinus* is the same species as is generally named at present *Macrobrachium jamaicense* and is distinctly different from the indo-westpacific species generally named *Palaemon carcinus* Fabr. That the name *carcinus* generally is applied to the wrong species probably is due to Herbst, who was the first to separate the indo-westpacific and east American forms, which by former authors had been considered to be one species namely *Cancer* (or *Astacus*) *carcinus.* Unfortunately Herbst gave the name *carcinus* to the indo-westpacific species, while the real *carcinus* was named *jamaicensis* by him. Most of the subsequent authors followed Herbst in

this error. Sunier (1925) already pointed to this, but his communication, being written in Dutch and published in the proceedings of the sessions of the Nederlandsche Dierkundige Vereeniging (Netherlands Zoological Society), certainly must have been overlooked.

*Palaemon brachydactylus* Wiegmann (1836) distinctly belongs to the present species, as is already shown by Ortmann (1891), who also pointed to the fact that *P. aztecus* only is a juvenile specimen of *P. jamaicensis*. The identity of *P. punctatus* with the present species was shown by Kingsley (1882), moreover I examined the type specimen of Randall's species, which is present in the Museum of the Academy of Natural Sciences at Philadelphia and entirely agree with Kingsley's conclusion.

*Palaemon montezumae* De Saussure resembles in all respects *M. carcinus* but for the shape of the rostrum. In juvenile specimens (and De Saussure's specimens are juvenile, being only 50 mm long), the rostrum often is variable in shape, though I never found them with the large number of ventral teeth on the lower margin as figured by De Saussure; this may be an abnormality. The status of the species, however, remains uncertain and until more data are available I provisionally consider it identical with *M. carcinus*. Nobili's (1898) specimen brought by him to *Palaemon Montezumae* preserved in the Zoological Museum in Turin, Italy, and on examination proved to be *Brachycarpus biunguiculatus* (Lucas).

In the Crustacea part of Siebold's Fauna Japonica, De Haan (1849) described a species as *Palemon brevicarpus* new species from Japan. This species later never has been recorded in literature[7]), and its status generally was considered dubious. In the collection of the Leiden Museum, the type specimens of De Haan's species still are preserved. Examination of these specimens showed them to be females of *M. carcinus* (L.). Probably some American Palaemonid material has been intermixed with De Haan's Japanese material, to which also points the discovery that De Haan's *"Palemon lamarrei"* from Japan is nothing else than *M. amazonicum* (vid. p. 18). De Haan himself already noted the close resemblance of his *Palemon brevicarpus* with *P. jamaicensis*.

The material mentioned by Sharp (1893) in his list of Crustacea in the Museum of the Academy of Natural Sciences at Philadelphia as *Palaemon jamaicensis* was examined by me. Most of his identifications

[7] In 1936 Yu (Bull. Fan Mem. Inst. Biol., vol. 6, p. 305, figs. 1, 2), however, described a new variety of De Haan's species. Yu's form proves to belong to a distinct species *Macrobrachium yui* Holthuis (1950a).

were correct only the numbers 94 (San Domingo, W. M. Gabb coll.) and 1001 (Kingston, Jamaica, W. J. Fox coll., 1891) proved to belong to *Macrobrachium faustinum,* while his no. 357 (no locality) in all probability is a *Macrobrachium vollenhoveni* (Herklots). Furthermore Sharp's no. 354 (Brazil) listed by him under *Palaemon olfersii,* does not belong there but distinctly is a *Macrobrachium carcinus* (L.). Kingsley (1882) mentions some specimens of the Philadelphia Academy as *Palaemon jamaicensis;* his material from Santo Domingo and Cuba, however, in reality belongs to *Macrobrachium faustinum.*

The figure given by Huxley (1879, 1880, 1881) of his *Palaemon jamaicensis* show not that species, but *Macrobrachium olfersi.*

The West African specimens mentioned in literature under the name *Palaemon jamaicensis* do not belong to the present species, but are *Macrobrachium vollenhoveni* (Herklots).

The specimens mentioned in Hildebrand's (1939) paper as *Macrobrachium jamaicense* were examined by me. As both specimens lack the 2nd pereiopods it is not possible to state with certainty whether these specimens are *M. carcinus* or *M. americanum.*

In a paper entitled "Contribución al estudio de los Crustaceos de Cuba" Dr. F. Torralbas (1917, An. Acad. Ci. méd. fis. nat. Habana, vol. 53) published manuscript notes of Dr. J. Gundlach, which were compiled and completed by Dr. J. I. Torralbas. It seems that both Dr. J. I. Torralbas and Dr. F. Torralbas are not carcinologists, so that the great confusion in the work is nothing to be surprised about. The large number of errors, wrong transcription of names and inaccuracies throughout the work, make it almost worthless. So, for instance, in the description of "Alphous Gundlach" a species is mentioned as *"P. sprinienamus,"* which probably means *Palaemon spinimanus.* A new species is described, viz., *"Palemon ornatus* Forns mss." of which figures are given. It distinctly is the common *Macrobrachium carcinus.* The "new" species not only is not new, but the name used is preoccupied (by *Palaemon ornatus* Olivier, 1811) and the generic name is incorrectly spelled. On one of the plates three figures are shown, two of *Macrobrachium carcinus* (L.), and one of *Justitia longimana* (H. Milne Edwards). The explanation only states "fig. 56 and 57 *Palaemon ornatus* Forns." Either the figure of the Palinurid is only used to fill a blank space, or it also is considered to be *Palaemon ornatus.* The latter supposition is improbable, however, as the same species is twice figured in almost the same position in figs. 47 and 48 under the (correct) name *Palinurus longimanus.* A similar case is found in figs.

53-55. Figs. 53 and 54 give a *Macrobrachium faustinum,* the specimen of fig. 55 belongs to *M. acanthurus.* Fig. 53 bears the "correct" inscription *Palemon Faustinum,* while figs. 54 and 55 are placed on 1 plate and both are named *Palemon forceps.* Also outside of the Palaemonids such grave errors and inaccuracies may be found. The publication of this paper, though done with the best intentions, in no way will further our knowledge of the group and only will confuse those who try to use this article.

In 1933 Schmitt described a new Pontonid prawn, which he named *Periclimenes portoricensis,* was collected at Porto Rico (exact locality unknown). An examination of the description and figure reveals that the specimen in question certainly is no Pontonid but a Palaemonid prawn, as the telson bears 2 pairs of spines with 2 feathered hairs between them. These hairs, it is true, are rather strong, but certainly cannot be compared with the inner spines of *Periclimenes* (nothing is said of the branchiae of the specimen). Comparing this description and the figures with young specimens of *Macrobrachium carcinus* and *M. americanum* at my disposal, I found an extremely close resemblance. The shape of the rostrum, the place of the hepatic spine, the armature of the tip of the telson, the shape of the scaphocerite and the legs, all show perfect resemblance to Schmitt's figure. Only the young of *M. carcinus* and *M. americanum* had the mandible provided with a three-articulated palp, while such a palp is missing in all species of *Periclimenes* and is not (or at least not distinctly) figured in Schmitt's article. I, however, do not hesitate to identify *Periclimenes portoricensis* as a juvenile stage of *Macrobrachium carcinus.* The very young stages of *Macrobrachium* species often give rise to confusion. Nobili (1905) once described a juvenile stage of the common indo-westpacific *Macrobrachium lar* (Fabr.) as *Leander dionyx,* while Kemp (1925, p. 285) was inclined to place Nobili's species in a new genus. De Man (1915) described a juvenile specimen of *Macrobrachium australe* (Guérin) as *Leander lepidus.*

### Macrobrachium americanum Bate

Pl. 31, figs. d, e

*Macrobrachium americanum* Bate, 1868, Proc. Zool. Soc. Lond., 1868, p. 363, pl. 30.

*Palaemon jamaicensis* p.p. Semper, 1868, Proc. Zool. Soc. Lond., 1868, p. 585.

*Palaemon jamaicensis* Smith, 1871, Rep. Peabody Acad. Sci., 1869, p. 97.

(non *Cancer (Astacus) Jamaicensis* Herbst, 1792.)

*Palaemon jamaicensis* p.p. Kingsley, 1882, Bull. Essex Inst., vol. 14, p. 107.

*Palaemon Jamaicensis* p.p. Miers, 1891, Whymper's Travels Great Andes suppl., p. 124.

*Palaemon americanus* Thallwitz, 1892, Abh. Ber. Zool. Anthrop. Mus. Dresden, 1890-91, pt. 3, p. 6.

*Palemon jamaicensis* Bouvier, 1895, Bull. Mus. Hist. nat. Paris, vol. 1, p. 160.

*Palaemon jamaicensis* Faxon, 1895, Mem. Mus. Comp. Zool. Harvard, vol. 18, p. 148.

*Bithynis jamaicensis* M. J. Rathbun, 1899, North Amer. Fauna, vol. 14, p. 74.

*Palaemon (Brachycarpus) jamaicensis* Nobili, 1901, Boll. Mus. Zool. Anat. comp. Torino, vol. 16, n. 415, p. 7.

*Bithynis jamaicensis* Meek, 1908, Publ. Field Mus. Zool., vol. 7, p. 202.

*Macrobrachium jamaicense* M. J. Rathbun, 1910, Proc. U. S. Nat. Mus., vol. 38, pl. 51, fig. 1 (non p. 561); Beebe, 1924, Galapagos World's End, p. 432; Schmitt, 1924, Proc. Calif. Acad. Sci., ser. 4, vol. 13, p. 386; Beebe, 1926, *Arcturus* Adventure, p. 435; Boone, 1930, Bull. Vanderbilt Mar. Mus., vol. 3, p. 146, pl. 51; Sivertsen, 1934, Nyt Mag. Naturv., vol. 74, p. 5; Hult, 1938, Ark. Zool., vol. 30A, pt. 5, p. 5; Steinbeck and Ricketts, 1941, Sea of Cortez, p. 445.

*Macrobranchium jamaicense* p.p. Coventry, 1944, Monogr. Acad. Nat. Sci. Phila., vol. 6, p. 535.

*Macrobrachium americanum* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 12.

*Description: Macrobrachium americanum* and *M. carcinus* are so closely related, that up till now they generally have been considered to form only one species. They agree in almost all respects. Their differences are:

1. The rostrum in adult males of *M. americanum* generally is shorter and higher than in *M. carcinus,* with the arching over the eye and the upward curve of the tip more pronounced.

2. The first tooth of the upper margin of the rostrum in *M. americanum* is placed more anteriorly, its distance to the posterior margin of the orbit is less than ¼ of the length of the carapace, in *M. carcinus* this distance mostly is 1/3 to 2/7 of the length of the carapace.

3. The second legs in adult males of *M. americanum* are smaller than in adult males of the same size of *M. carcinus*. They are more thickset. The carpus is about twice as long as wide (in *M. carcinus* about 2.5 times). The palm is about thrice as long as high. The pubescence on the fingers is much less pronounced than in *M. carcinus*. When the chelae are closed, the fingertips never reach so far beyond the exterior margin of the opposing finger as in *M. carcinus*. Also the spinulation of the legs is less strong.

It is very difficult or almost impossible to distinguish between the females and young males of *M. carcinus* and *M. americanum*. It perhaps should be better to regard *M. americanum* a subspecies of *M. carcinus* only.

*Size:* Males with the chelae well developed range in size from 98 to 235 mm. Ovigerous females are 67 to 193 mm in length. The eggs are numerous and small, they are 0.36 to 0.50 mm in diameter.

*Material examined:* The Allan Hancock Expeditions 1933, 1934, and 1935 collected a large amount of material (about 500 specimens) of this species from:

Mexico: Petatlan Bay, Guerrero State. Shore, collecting inside Morro de Petatlan, between it and lagoon, March 17, 1933, Sta. 120-33 (juveniles, therefore identification not fully certain).

Panama: Secas Islands. Fresh water seepage, February 5, 1935, Sta. 452-35.

Bahia Honda. Freshwater pool, March 9, 1933, Sta. 112-33. Habitat unknown, purchased together with specimens of *Macrobrachium hancocki* new species, from an old lady for a cake of soap, March 10, 1933.

Colombia: Port Utria. February 15, 1934 (juveniles, identification not certain).

Gorgona Island. Habitat unknown, purchased from natives, January 22, 1935.

Cocos Island (Costa Rica): Chatham Bay. Fresh-water stream entering bay, March 3, 1933, Sta. 109-33.

Wafer Bay. Fresh-water, March 2, 1933, Sta. 107-33 (juvenile, identification not certain).

Galapagos Islands (Ecuador): Indefatigable Island, Academy Bay. From drinking water pool, January 20, 1934.

Chatham Island, Freshwater Bay. Upstream ½ mile, seined with 40 ft. special seine, February 1, 1933, Sta. 44-33.

Furthermore I examined in the U. S. National Museum specimens from the following localities: Mexico (Cape San Lucas and La Paz, Lower California; Guaymas, Sonora State; Quelite and Presidio Rivers, and Mazatlan, Sinaloa State; Maria Magdalena and Maria Cleofas, Tres Marias Islands; Santiago River and Ameca, Jalisco State; Armeria River, Colima State), Guatemala (Rio Aguacapa tributary S. of Guatemala City; Rio de los Esclavos near Cuilapa; Rio Paz tributary near Jutiapa), San Salvador (Escarara; Rio Santo Tomás), Honduras (Rio Cobre near San Antonio), Nicaragua (Polvon; Realejo; Fonseca), Costa Rica (Quebrada Chavarria-Golfito and Rio Platanales, Golfo Dulce), Panama (David; Chiriqui; Rio Capira; Chorrera; Araijan; Culebra; Paraiso; Pedro Miguel; Corozal; Cardenas; Panama; Rio Morte Arnode; Rio Abaco; Rio Pacora; Rio Mamoni near Chepo; Rio Jaqué and tributaries; Taboga Island; San José Island; Rio Chucunaque, Darien), Cocos Island, Colombia (near Buenaventura), Ecuador (Guayaquil), N. Peru (Pariñas River; Quebrada near Mancora). In the American Museum of Natural History at New York specimens of *M. americanum* are present from: Mexico (Rio Rosario in Sinaloa Province), Panama (San José Island, Archipielago de las Perlas; Rio Chico, Darien; Atenanga del Rio Balsas, Darien), Cocos Island.

The specimen recorded by Nobili (1901) as *Palaemon (Brachycarpus) jamaicensis* from Rio Daule, Balzar, Ecuador is still present in the Turin Museum. It was examined there by me and proved to belong to *M. americanum*.

*Distribution:* The species lives in fresh-water of western America between Lower California and N. Peru, and of the Cocos and Galapagos Islands. The records in literature are: Mulege River, Lower California (Bouvier, 1895), La Paz, Lower California! (M. J. Rathbun, 1899), Cape St. Lucas, Lower California (Faxon, 1895), Guamuchi Ranch, Sierra Laguna Mts., Cape Region, Lower California (Schmitt, 1924), Guaymas, Sonora State, Mexico! (Steinbeck and Ricketts, 1941), Rio Presidio, Sinaloa State, Mexico! (M. J. Rathbun, 1899), Rio de Alica,[8] Tepic State, Mexico (M. J. Rathbun, 1899), Barranca Ibarra, Santiago River, Jalisco State, Mexico! (M. J. Rathbun, 1899), Maria Magdalena and Maria Cleofas, Tres Marias Islands! (M. J. Rathbun, 1899), Armeria River, Colima State, Mexico! (M. J. Rathbun, 1899), Lake Amatitlan, Guatemala (Bate, 1868; Meek, 1908), Polvon, W. Nicaragua (Smith, 1871; Kingsley, 1883), Rio

[8] I could not find Alica material in the U. S. National Museum and the name Alica does not occur on any of the maps consulted by me.

de los Platanales and Quebrada Chavarria Golfito, Costa Rica! (M. J. Rathbun, 1899), Panama (Faxon, 1895), David River, Chiriqui, Panama! (M. J. Rathbun, 1899), Mt. Sapo, Piñas Bay, Panama (Coventry, 1944), Guayaquil, Ecuador! (M. J. Rathbun, 1899), Rio Daule, Balzar, Ecuador! (Nobili, 1901), Tanti, Ecuador (Miers, 1891), Chatham Bay, Cocos Island (Boone, 1930), Indefatigable Island (= Santa Cruz), Galapagos Islands (Sivertsen, 1934; Hult, 1938), Chatham Island, Galapagos Islands (Hult, 1938).

*Type:* The type locality is Lake Amatitlan, Guatemala. The type is preserved in the British Museum, London, as a dry specimen (Reg. No. 68, 41).

*Remarks:* The specimens described by M. J. Rathbun (1910) as *Macrobrachium jamaicense* from Peru in reality are *M. inca,* her figure (pl. 51, fig. 1) is a copy of Bate's (1868, pl. 30) figure of *M. americanum.*

### "**Palaemon fluvialis** Streets"

Pl. 31, figs. f, g

*Palaemon fluvialis* Streets, 1871, Proc. Acad. Nat. Sci. Phila., 1871, p. 227, pl. 2, fig. 5; Kingsley, 1878a, Bull. Essex Inst., vol. 10, p. 68; Ortmann, 1891, Zool. Jo. Syst., vol. 5, p. 710; Thallwitz, 1892, Abh. Ber. Zool. Anthrop. Mus. Dresden, 1890-91, pt. 3, p. 8.

*Palaemon fluviatilis* Sharp, 1893, Proc. Acad. Nat. Sci. Phila., 1893, p. 122.

*Macrobrachium fluviale* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 14.

Streets gives the following description of this species: "Rostrum short, lanceolate, somewhat arched above; not as long as the lamelliform appendages of the external antennae, reaching to the end of the second joint of the antennae; superior margin armed with seven teeth, the inferior margin with two, situated near the point of the rostrum. One specimen of this species had but four teeth above and one below. Two flagella of the internal antennae united for a very short distance; spines on the lateral portion of the carapax very small; first pair of legs slender; hand more than half the length of the carpus; hand of the second pair stout; carpus shorter than the palmar portion of the hand, gradually enlarged toward the hand; fingers cylindrical and straight, shorter than half of the hand, the same length as the carpus, beset with a few stiff hairs; legs smooth. Length 1.3 inches."

The type specimens are still present in the collection of the Museum of the Academy of Natural Sciences at Philadelphia. They are very young and in a very poor condition. I am unable to identify them with certainty with any of the species of *Macrobrachium* at present known from America. They may prove to be juveniles of a species, which has not yet been discovered in adult stage. This question, however, can only be settled after the carcinological fauna of Mexico is better known. After Streets' record the species seems not to have been found again.

The species is recorded by Streets from fresh-water of a tributary of Coatzacoalcos River, Mexico.

## Genus **PSEUDOPALAEMON** Sollaud, 1911

*Definition:* The rostrum is well developed, compressed and provided with teeth. The carapace is armed with antennal and hepatic spines.

The telson bears two pairs of dorsal and two pairs of posterior spines. Feathered hairs are present on the posterior margin.

The eyes have the cornea well developed and pigmented.

The mandible lacks the palp. Exopods are present on all maxillipeds. Pleurobranchs are found at the bases of the third maxilliped and all pereiopods.

The dactyli of the last three pereiopods are simple. The propodus of the fifth leg bears numerous transverse rows of hairs in the distal part of its posterior margin.

The endopod of the first pleopod of the male bears no appendix interna.

*Type species: Pseudopalaemon bouvieri* Sollaud, 1911.

This genus consists only of 1 species

### **Pseudopalaemon bouvieri** Sollaud

**Pl. 32, figs. a-i**

*Pseudopalaemon Bouvieri* Sollaud, 1911, Bull. Mus. Hist. Nat. Paris, vol. 17, p. 12, figs. 1, 2.

*Pseudopalaemon Iheringi* Sollaud, 1911a, Bull. Mus. Hist. Nat. Paris, vol. 17, p. 285, fig. 1.

*Pseudopalaemon Bouvieri* Sollaud, 1923, Bull. Biol. France Belg., vol. 57, p. 579, fig. 21.

*Pseudopalaemon bouvieri* Cordero and Vaz-Ferreira, 1938, Ann. Acad. Bras., Sci., vol. 10, p. 383, text figs. 1-3, pls. 1, 2; Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 11.

*Description:* The rostrum is elongate and slender, it reaches about to the end of the scaphocerite. The upper margin bears 5 to 10, generally 7, teeth, the first of which is placed above the posterior margin of the orbit, sometimes just before, sometimes just behind it. The lower margin bears 2 to 5, in my specimens 3 or 4, teeth. The teeth are rather regularly divided over the rostrum, the distals, however, generally being separated by larger interspaces than the proximals. The carapace is smooth and provided with antennal and hepatic spines.

The abdomen is smooth. The pleura of the fifth segment has the apex broadly rounded. The sixth segment is more than twice as long as the fifth. The telson in my specimens has the posterior of the two pairs of spinules placed much closer to the anterior pair than to the posterior margin of the telson. This posterior margin ends in a sharp median point, which is flanked by two pairs of spinules, the inner of which is much longer than the outer. Between these spinules feathered setae are present.

The eyes are well developed. The stalk is longer than the cornea. An ocellus is present.

The antennules have the anterior margin of the first segment convex. The anterolateral spine just slightly reaches beyond that margin. The inner flagellum has the two rami fused for 8 to 9 joints. This fused portion is much shorter than the free part which in my specimens consists of 12 to 16 joints. The scaphocerite is thrice as long as broad. The outer margin is concave.

The mandible bears no palp, but otherwise exactly resembles that of *Macrobrachium*. Exopods are present on all maxillipeds, while pleurobranchs are found on the third maxilliped and all pereiopods.

The first legs are not very slender and distinctly fail to reach the end of the scaphocerite. The chela is oval in shape and has the fingers about as long as the palm. The carpus is twice as long as the chela and slightly longer than the merus. The right and left second chelae are equal in shape, and in size. There is, however, a large difference in the shape of these chelae in the two sexes. In the male the second legs reach with slightly less than half the carpus beyond the scaphocerite. The fingers are very long and slender, being 1.5 times as long as the palm. There are no teeth on the cutting edges. The palm is narrow and cylindrical. The carpus is slightly longer than the chela (about 1.1 times) and about 1.2 times as long as the merus. The ischium is half as long as the carpus. No spinulation or pubescence is present on these legs. In the females the second legs are shorter, reaching with the chela only beyond the scaphocerite. The fingers are as long as the palm. The

carpus is 1.5 times as long as the chela, 1.2 times as long as the merus, and about twice as long as the ischium. The last three legs are slender. The dactylus is simple. The third leg reaches about as far forwards as the first. The propodus is 2.5 times as long as the dactylus, twice as long as the carpus and slightly shorter than the merus. The fifth leg reaches beyond the third, but still fails to reach the end of the scaphocerite. The propodus is fully thrice as long as the dactylus, slightly more than twice as long as the carpus and longer than the merus. The last three legs are smooth, but for a row of spinules along the posterior margin of the propodi, while in the fifth leg numerous transverse rows of setae are present in the distal part of the posterior margin. At the inner side of the base of the fifth leg in the male a large copulatory papilla is present, which bears a triangular flap at the apex.

The second to fifth pleopods are provided with an appendix interna on the endopod. This appendix is absent from the endopod of the first pleopod. The endopod of the second pleopod of the male is provided with an appendix masculina, which is much larger than the appendix interna.

The uropods are very elongate. The outer margin of the exopod ends in a strong tooth, which at its inner margin bears a movable spine.

*Size:* The specimens seen by me range in size between 15 and 36 mm. My largest males, measuring 26 to 29 mm, have the second chelae with long slender fingers as described above. Males of 17 to 19 mm have the chelae as in the females. My females are up to 36 mm long. According to Sollaud (1911), the eggs are few and large, measuring 1.03 to 1.45 mm in diameter.

*Material examined:* In the U. S. National Museum material of this species is present from Uruguay (Arroyo Maestre Campo, Durazno Department; Paso de la Arena, Montevideo Department; 14 km N.E. of San Carlos, Maldonado Department) and from Argentina (Arroyo Mandisovi near Concordia, Entre Rios Province).

*Distribution:* The species inhabits fresh-waters of eastern S. America. It is recorded in literature from: Arroyo del Bellaco, Brazil[9] (Sollaud, 1911a), Uruguay (Sollaud, 1923), Montevideo, Uruguay (Sollaud, 1911), Las Piedras rivulet and San José river near Montevideo, Uruguay (Cordero and Vaz-Ferreira, 1938).

[9] Cordero and Vaz-Ferreira point out that the locality Arroyo del Bellaco to all probability is situated not in Brazil but in Uruguay, as many rivulets of this name are known from Uruguay. Moreover the name is given in Spanish, while it should have been written in Portuguese, when the locality is situated in Brazil.

*Type:* The type locality is: Neighborhood of Montevideo, Uruguay. The two syntypes are preserved in the Museum d'Histoire naturelle at Paris, France.

*Remarks:* Sollaud (1911, 1911a) thought his material belonged to two different species, *Pseudopalaemon bouvieri* and *P. iheringi,* which should differ in the shape of the rostrum, of the telson, in the oral parts and in the shape of the first legs. As Cordero and Vaz-Ferreira (1938) pointed out, the specimens seen by Sollaud belong to one variable species. The specimens examined by me support this supposition.

Sollaud based his new species, *Pseudopalaemon Bouvieri* on two specimens, which, according to him, are a male of 32 mm and an ovigerous female of 34 mm. His description of the second leg of his male specimen, however, closely resembles that of my female specimens, and does not show the peculiar form of the male specimens in my material. As his "male" is much larger than any of my males, and therefore the shape of the second leg certainly is not due to the juvenile age of the specimen, I am inclined to believe Sollaud's "male" to be either abnormal or to be a female.

## Genus **CRYPHIOPS** Dana, 1852

*Definition:* The rostrum is well developed, compressed and provided with teeth; it is rather short. The carapace is armed with antennal spines only, no hepatic or branchiostegal spines are present. There is a distinct branchiostegal groove.

The telson bears two dorsal and two posterior pairs of spinules. Numerous hairs are present on the posterior margin of the telson.

The eyes have the cornea well developed and pigmented.

The mandible possesses a three-jointed palp. All maxillipeds are provided with exopods. Pleurobranchs are present on the third maxilliped and all pereiopods.

The dactyli of the last three pairs of legs are simple. The propodus of the fifth leg bears numerous transverse rows of hairs in the distal part of its posterior margin.

The first pleopod of the male bears no appendix interna at the endopod.

*Type species: Cryphiops spinulosomanus* Dana, 1852, a species at present considered identical with *Cryphiops caementarius* (Molina).

This genus differs from *Macrobrachium,* with which it often is united, mainly by the absence of the hepatic spine on the carapace. Only one species is known of this genus:

## Cryphiops caementarius (Molina)

Pl. 33; pl. 34, figs. a, b; pl. 35, figs. a-g

*Cancer caementarius* Molina, 1782, Saggio Stor. nat. Chili, p. 208; Molina, 1786, Versuch Naturgesch. Chili, p. 183.

*Cancer Caementaroius* Molina, 1786, Versuch Naturgesch. Chili, p. 308.

*Cancer caementarius* Gmelin, 1789, Linn. Syst. Nat., ed. 13, vol. 1, p. 2986; Molina, 1789, Essai Hist. nat. Chili, pp. 184, 328; Molina, 1788-95, Compend. Hist. geogr. nat. civ. Chili, vol. 1, p. .....

*Cancer cementarius* Molina, 1808, Geogr. nat. civ. Hist. Chili, vol. 1, p. 144.

*Cancer Cementarius* Molina, 1808, Geogr. nat. civ. Hist. Chili, vol. 1, p. 243.

*Astacus caementarius* Molina, 1810, Saggio Stor. nat. Chili, ed. 2, p. 188.

*Cancer caementarius* Poeppig, 1835, Reise Chile, Peru, vol. 1, p. 314.

*Palaemon caementarius* Poeppig, 1836, Arch. Naturgesch., vol. 2, pt. 1, p. 143.

*Palemon Gaudichaudii* H. Milne Edwards, 1837, Hist. nat. Crust., vol. 2, p. 400.

*Palaemon Gaudichaudii* H. Milne Edwards & Lucas, 1843, d'Orbigny's Voy. Amér. mérid., vol. 6, pt. 1, p. 37, pl. 17, fig. 2; Nicolet, 1849, Gay's Hist. fis. Chile, Zool., p. 218.

*Palaemon caementarius* Nicolet, 1849, Gay's Hist. fis. Chile, Zool., p. 219.

*Palaemon Gaudichaudii* Gibbes, 1850, Proc. Acad. Nat. Sci. Phila., 1850, pp. 25, 28.

*Palæmon gaudichaudii* Gibbes, 1850[a], Proc. Amer. Ass. Adv. Sci., vol. 3, p. 198.

*Cryphiops spinuloso-manus* Dana, 1852, Proc. Acad. Nat. Sci. Phila., 1852, p. 26.

*Palaemon Gaudichaudii* Dana, 1852, U. S. Explor. Exped., vol. 13, p. 592.

*Cryphiops spinuloso-manus* Dana, 1852, U. S. Explor. Exped., vol. 13, p. 595.

*Cryphiops spinulosomanus* Weitenweber, 1854, Lotos, Praha, vol. 4, p. 62.

*Cryphiops spinulosi-manus* Dana, 1855, U. S. Explor. Exped., vol. 13, atlas, p. 12, pl. 39, fig. 4.

*Cryphiops spinulosomanus* Von Martens, 1858, Ann. Mag. Nat. Hist., ser. 3, vol. 1, p. 51.

*Bithynis longimana* Philippi, 1860, Arch. Naturgesch., vol. 26, pt. 1, p. 164.

*Palaemon caementarius* Heller, 1862, S. B. Akad. Wiss. Wien, vol. 45, pt. 1, p. 414.

*Macrobrachium africanum* Bate, 1868, Proc. Zool. Soc. Lond., 1868, p. 366, pl. 31, fig. 3.

*Palaemon Gaudichaudii* Von Martens, 1868, Arch. Naturgesch., vol. 34, pt. 1, p. 65.

*Palaemon gaudichaudii* Semper, 1868, Proc. Zool. Soc. Lond., 1868, p. 586.

*Palaemon caementarius* Cunningham, 1870, Trans. Linn. Soc. Lond., vol. 27, p. 497; Cunningham, 1871a, Notes Nat. Hist. Strait Magellan, p. 415.

*Palaemon gaudichaudii* Miers, 1877, Proc. Zool. Soc. Lond., 1877, p. 661.

*Palaemon gaudichaudii* var. *caementarius* Miers, 1877, Proc. Zool. Soc. Lond., 1877, p. 662.

*Bithynis gaudichaudii* Ortmann, 1891, Zool. Jb. Syst., vol. 5, p. 748.

*Palaemon africanus* Thallwitz, 1892, Abh. Ber. Zool. Anthrop. Mus. Dresden, 1890-91, pt. 3, p. 6.

*Palaemon (Bithynis) gaudichaudii* Thallwitz, 1892, Abh. Ber. Zool. Anthrop, Mus. Dresden, 1890-91, pt. 3, p. 8.

*Bithynis gaudichaudii* Sharp, 1893, Proc. Acad. Nat. Sci. Phila., 1893, p. 119.

*Palaemon caementarius* Philippi, 1894, Zool. Anz., vol. 17, p. 266; Philippi, 1894, An. Univ. Chile, vol. 87, p. 375.

*Bithynis caementaria* Ortmann, 1897, Rev. Mus. Paulista, vol. 2, p. 214.

*Bithynis Gaudichaudii* Doflein, 1899, S. B. Bayer. Akad. Wiss., vol. 29, p. 186.

*Bithynis gaudichaudii* Lenz, 1902, Zool. Jb. Suppl., vol. 5, p. 735.

*Bithynis Gaudichaudii* Porter, 1903, Rev. Chil. Hist. Nat., vol. 7, p. 152.

*Bithynis caementarius gaudichaudii* M. J. Rathbun, 1910, Proc. U. S. Nat. Mus., vol. 38, pp. 560, 604, pl. 54, fig. 1.

*Bithynis caementarius* M. J. Rathbun, 1910, Proc. U. S. Nat. Mus., vol. 38, p. 604.

*Cryphiops spinulosomanus* M. J. Rathbun, 1910, Proc. U. S. Nat. Mus., vol. 38, p. 605.

*Palaemon gaudichaudii* Kemp, 1925, Rec. Indian Mus., vol. 27, p. 285.

*Cryphiops* Kemp, 1925, Rec. Indian Mus., vol. 27, pp. 285, 286.

*Cryphiops* Gordon, 1935a, Journ. Linn. Soc. Lond. Zool., vol. 39, p. 327.

*Palaeman caementarius* Boone, 1938, Bull. Vanderbilt mar. Mus., vol. 7, p. 255, pl. 102.

*Cryphiops caementarius* Holthuis, 1950a, Siboga Exped., mon. 39a9, pp. 11, 98.

*Description:* The rostrum is straight and very short, reaching to or slightly beyond the end of the first segment of the antennular peduncle. It is rather high. The upper margin bears 6 to 8 teeth, 1 or 2 of which are placed behind the orbit. All the teeth are divided regularly over the upper margin. The lower margin bears 0 to 4 teeth. The carapace is smooth, but is provided with short erect hairs, which especially are distinct in the anterolateral parts. The antennal spine is present, the hepatic is missing. A branchiostegal groove is present.

The abdomen is smooth and a little hairy too. The pleura of the fifth segment is bluntly angled, the segment is a little shorter than the sixth. The telson bears 2 pairs of dorsal spines, one in its middle and one at ¾ of its length. The posterior margin is rounded or truncate in old specimens, only in very young specimens a median point is visible. The two posterior pairs of spinules are short. Numerous setae are placed between the inner spines.

The eyes and antennulae do not differ from those of *Macrobrachium*.

The scaphocerite is twice as long as broad. The outer margin is convex at base, straight or somewhat concave in the distal part.

The oral parts strongly resemble those of *Macrobrachium* and the branchial formula is like in that species.

The first pereiopods are slender, they reach with the larger part of the carpus beyond the scaphocerite. The fingers, which are slightly longer than the palm have their cutting edges directed somewhat outwards, so that when they are closed the inner surface of the fingers forms a hollow concavity, while the outside is slightly convex. The carpus is somewhat less than twice as long as the chela. The merus and ischium are distinctly spinulated, the carpus and chela are smooth. The second legs are strongly unequal in the adult male. The larger reaches with half the merus beyond the scaphocerite. The fingers are slightly shorter than, to ¾ as long as, the palm, they are gaping a little. The cutting edges each are provided with 5 to 7 distinct blunt teeth of equal size. The palm is somewhat compressed. It is elongate, being twice as long as high and having the lower margin somewhat convex. The fingers and the palm are covered with strong spinules. No pubescence, apart from some scattered hairs, is present. The carpus is short, being about half as long as the palm; it is strongly constricted near the base. The merus is longer

than the carpus. The ischium is more than half as long as the merus. Ischium, merus and carpus are covered with spinules similar to, but smaller than, those of the chela. No pubescence is present on these joints. The smaller leg reaches with the chela, sometimes with the carpus, beyond the scaphocerite. The fingers are distinctly longer than the palm; they close over their entire length. There are 4 or 5 small denticles in the proximal part of their cutting edges. The palm is somewhat swollen, being broader than both fingers together. Small spinules are present on both palm and fingers. The carpus is about as long as the palm and is strongly constricted near the base. The merus is longer than the carpus. The spinulation of the ischium, merus and carpus is like that of the chela. The third leg reaches with the dactylus, sometimes even with part of the propodus beyond the scaphocerite, but in some cases it fails to reach the end of that scale. The dactylus is simple. The propodus is less than twice as long as the dactylus, 1.5 times as long as the carpus and ⅔ to ¾ as long as the merus. The fifth leg reaches about to the middle of the scaphocerite, but sometimes fails to reach the base of it. The propodus is almost twice as long as the dactylus, somewhat more than 1.5 times as long as the carpus and slightly shorter than the merus. All joints of the last three legs are covered with numerous spinules. No transverse rows of hairs are present in the distal part of the posterior margin of the propodus of the fifth leg.

The pleopods and uropods are similar to those in *Macrobrachium*.

Ovigerous females have the first legs relatively shorter, they reach with only half the carpus beyond the scaphocerite. The second legs are equal in shape and size, they strongly resemble the smaller second leg of the adult male. The tips of the fingers, however, do not end in sharp conical points as in the adult male, but are hoofshaped. In young males the tips of the smaller second leg sometimes still show traces of a hoof-shape. The rostrum in juvenile specimens reaches farther forward than in adult specimens, the second legs are equal, they resemble those of the female, but in very young specimens they are smooth.

*Colour:* Doflein (1894, p. 185) gives the following account of the colour of the living animal: "Yellowish green with yellowish brown spots on the back. Joints of the first [probably second is meant] leg reddish, chelae greenish blue."

*Size:* My specimens range between 21 and 185 mm in length. The ovigerous females are 28 to 102 mm long. The eggs are numerous and small, being 0.43 to 0.57 mm in diameter. Ovigerous females were collected in the months November, January and April.

*Material examined:* During the 1935 Allan Hancock Expedition 28 specimens of this species were purchased at the railroad station at Chosica, 25 miles from Lima, Peru, 2800 ft. elevation, January 8, 1935. In the U. S. National Museum I examined material from Peru (Rio Moche near Salavery, Rimac River near Lima, Callao, Vitor River, Mollendo), Chile (Arica, La Serena and Rio Aconcagua near Culera). The American Museum of Natural History at New York possesses material of this species from Mollendo, Peru.

*Distribution: Cryphiops caementarius* is the common fresh-water prawn of the west coast of S. America, it is known from Peru and Chile. The records in literature are: Peru (Von Martens, 1868; Sharp, 1893), Pacasmayo, Peru, (M. J. Rathbun, 1910), Chancay (M. J. Rathbun, 1910), Ancon, Peru[10] (Ortmann, 1891, 1897), Rio Chillon (Doflein, 1899), Callao (Boone, 1938), Rimac River near Villegas (M. J. Rathbun, 1910), Lima (Miers, 1877; M. J. Rathbun, 1910), Arequipa (M. J. Rathbun, 1910), Mollendo (M. J. Rathbun, 1910), Rio Tambo near Mollendo (Doflein, 1899), Rio Tambo, Peru (Bate, 1868), Chile (Molina, 1782, 1786, 1788-1795, 1789, 1808, 1810; Gmelin, 1789; H. Milne Edwards, 1837; H. Milne Edwards & Lucas, 1843; Nicolet, 1849; Dana, 1852, 1852a; Von Martens, 1868; Miers, 1877; Sharp, 1893), N. Chile (Poeppig, 1835), Coquimbo (Nicolet, 1849), La Serena, Coquimbo (Ortmann, 1891), marshes near La Serena (Cunningham, 1871, 1871a), Rio Coquimbo near La Serena (Lenz, 1902), Rio Coquimbo (Porter, 1903), Rio de La Ligua, Aconcagua (Philippi, 1860, 1894), Rio Aconcagua, Valparaiso (Poeppig, 1836; Philippi, 1894), Valparaiso (Dana, 1852a). Heller (1862) remarks that the species originates from Brazil, this obviously is incorrect.

*Type:* Type locality is Chile. Type specimens probably are not extant.

*Remarks:* In 1852 Dana described a curious prawn from fresh-water of Chile, which he named *Cryphiops spinuloso-manus;* this species was remarkable by having the eyes deeply concealed beneath the carapace: "They are much more deeply covered than in Alpheus" (Dana, 1852, p. 594). An examination of Dana's figure of this remarkable specimen shows that the position of the eyes with regard to that of the antennulae and antennae is quite normal, and that these appendices too have their basal region covered by the carapace. This situation is so entirely abnormal and improbable, that I think it impossible that this is a natural

[10] In his 1891 article Ortmann states Ancon to be situated in Ecuador, in his 1897 paper, however, he rectifies this and pointed out that this locality lies in Peru.

position for these appendages. In my opinion the entire anterior portion of the head has been pressed backwards below the carapace by some exterior force. As I observed in my material, this is very easily done in this species. In accordance with this supposition is the fact that the eyes are quite normal and are provided with dark pigment and that the antennae and antennulae too are entirely normal in shape. When comparing Dana's description and figure of his only specimen of *Cryphiops spinuloso-manus,* which is a female, with females of *Bithynis caementarius* not one difference of any importance can be found, if we do not consider the position of the eyes, the antennulae and antennae. Also the locality, where *Cryphiops spinuloso-manus* is collected lies in the range of distribution of *Bithynis caementarius,* in fact no other Palaemonid prawn is known from fresh waters of Chile. I am therefore convinced that *Cryphiops spinuloso-manus* is nothing but a mutilated specimen of *Bithynis caementarius.* The genus *Cryphiops* was described in 1852 for the first time, while Philippi erected his genus, *Bithynis,* as late as 1860. The name, *Cryphiops,* therefore has priority over *Bithynis* and has to be used for the present genus, notwithstanding the fact that the name indicates a feature, which is not present in normal specimens of the genus.

Kemp (1925) in his key to the genera of Palaemoninae states *Cryphiops* to have the mandible without a palp. As Gordon (1935, p. 327) already remarked, this is a slip of the pen, as in Dana's description as well as in his figure the presence of a three-jointed palp is distinctly shown.

There are no grounds for considering the forms with and without lower rostral teeth (vars. *gaudichaudii* and *caementarius*) separate varieties. There are all transitions between an entire lower margin and a denticulate one, while no other differences between the two forms are known.

Molina's (1782) original description of this species agrees well with the present form; he is mistaken, however, in considering the species to be building chimneys. As Faxon (1898, p. 690) and Philippi (1899, p. 375) point out Molina apparently confused here the present species and a chimney building crayfish.

The rules of zoological nomenclature force the present species to have the most inappropriate name possible, the generic name *Cryphiops,* indicating a character (κρυφή. covered eyes), which it does not possess, the specific name *caementarius,* (= mason), indicating an ability which it does not have either.

## Genus TROGLOCUBANUS Holthuis, 1949

*Definition:* Rostrum present, little or well developed, with or without dorsal, and without ventral teeth. Carapace smooth, with antennal spine, which sometimes is very poorly developed or even absent, without branchiostegal or hepatic spines. Branchiostegal groove present.

Abdomen smooth, with the pleura tips rounded. Telson with two pairs of dorsal and two pairs of posterior spinules. Between the posterior spinules numerous feathered setae are present.

Eyes strongly reduced, bullet-shaped, without a trace of pigment.

Antennula like in *Palaemon*. Upper antennular flagellum with two rami, which are fused at the base.

Scaphocerite like in *Palaemon*. Antennal peduncle provided with an external spine at base of scaphocerite.

Mandible without mandibular palp, consisting of molar and incisor process. The other oral parts not differing from those of *Palaemon*.

The first legs slender and chelate. Second legs stronger, fingers long. Last three legs slender, with simple dactyli. Propodus of fifth leg with transverse rows of setae in the distal part of the posterior margin.

First pleopod with the endopod small and devoid of an appendix interna. All other pleopods with an appendix interna on the endopod. Male moreover with an appendix masculina at the endopod of the second pleopod.

Uropods normal. The final tooth of the external margin of the exopod is provided at its inner side with a movable spine, which at its inner side sometimes is provided again with an immovable tooth.

*Type species: Palaemonetes eigenmanni* Hay, 1903.

The genus consists of four species, all of which formerly were inserted in *Palaemonetes*. This position, however, proved to be untenable and a new genus had to be erected.

The most important difference between *Troglocubanus* and *Palaemonetes* is that the branchiostegal spine, which is very distinct in the latter genus is entirely absent in the former.

All four species of *Troglocubanus* are blind cave dwellers, which up till now only have been recorded from Cuba. They may be distinguished by the following characters:[11]

1. Rostrum without teeth or with a very small tooth near apex.
   Antennal spine absent . . . . . *inermis*
— Rostrum with dorsal teeth. Antennal spine present . . . . 2

[11] This key is adapted from Chace (1943, p. 31).

2. Rostrum with only one dorsal tooth, which is placed behind orbit. Lower margin of rostrum straight or concave . . . *calcis*
— Rostrum with at least two dorsal teeth, which partly are placed before posterior margin of orbit. Lower margin of rostrum convex . . . . . 3
3. Two or three dorsal teeth on rostrum. Rostrum not reaching beyond end of antennular peduncle . . . . . *gibarensis*
— Six to eight dorsal teeth on rostrum. Rostrum reaching beyond antennular peduncle . . . . . *eigenmanni*

## **Troglocubanus calcis** (Rathbun)

**Pl. 36, figs. a-j**

*Palaemonetes calcis* p.p. M. J. Rathbun, 1912, Bull. Mus. Comp. Zoöl. Harv., vol. 54, p. 451, pl. 1, figs. 1, 2, 3, 5.

*Palaemonetes calcis* Kemp, 1925, Rec. Indian Mus., vol. 27, p. 317; Spandl, 1926, Speläol. Monogr., vol. 11, p. 90; Chappuis, 1927, Die Binnengewässer, vol. 3, p. 87; Wolf, 1934, Anim. Cavern. Catal., vol. 3, p. 103; Chace, 1943, Proc. New Engl. Zool. Cl., vol. 22, p. 34, pl. 5; Holthuis, 1949, Proc. Kon. Nederl. Akad. Wetensch., vol. 52, p. 91.

*Troglocubanus calcis* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 11.

*Description:* The rostrum is slender and straight, it reaches beyond the antennular peduncle, but fails to reach the end of the scaphocerite. There is one tooth placed on the upper margin of the rostrum, this tooth stands on the carapace slightly behind the orbit. The upper margin of the rostrum proper, as well as the lower margin is unarmed. The rostrum regularly tapers towards the tip, the lower margin is straight. The carapace is smooth, it is provided with antennal spines only. The antennal spine stands on the anterior margin of the carapace, some distance below the rounded lower orbital angle. A distinct branchiostegal groove is present.

The abdomen is smooth. The pleurae of the first three segments are broadly rounded, those of the fourth and fifth segments are narrower. The fifth pleura ends in a minute point. The sixth segment is somewhat longer than the fifth and about 2/3 of the length of the telson. The telson has the anterior pair of dorsal spinules placed slightly behind its middle. The posterior dorsal spinules are situated closer to the anterior pair than to the posterior margin. The posterior margin is rounded and bears the usual two pairs of spinules; between the inner (= longer) spinules several hairs are present.

The eyes are ovate, but they end in a small acute tip. The cornea is strongly degenerated and possesses no pigment.

The stylocerite is short and blunt, it is pressed against the basal segment of the antennular peduncle and therefore difficult to see. The outer margin of the basal segment ends in a strong tooth, which overreaches the second segment of the peduncle. The anterior margin of the basal segment regularly slopes down from the anterolateral spine to the base of the second segment. The second segment is somewhat broader and much shorter than the third. The upper antennular flagellum has the fused part of the two rami consisting of 5 or 6 joints, the free part of the shorter ramus is composed of 15 or 16 joints and it is more than four times as long as the fused part.

The scaphocerite is broadly ovate, being about twice as long as broad. The outer margin is convex, the apex is broadly rounded and overreaches the final tooth. The antennal peduncle fails to reach the middle of the scaphocerite, a strong external tooth is present near the base of the scaphocerite.

The mandible has the incisor process heavy, ending in three teeth, the molar process ends in some blunt knobs. The maxillula has both laciniae slender, the palp is distinctly bilobed. The maxilla has the inner lacinia deeply bilobed, the two lobes are very elongate and slender, the palp and scaphognathite are normal in shape. The first maxilliped has the endites of coxa and basis separated by a distinct notch, the caridean lobe is well developed and rounded, the epipod is large and rounded. The second maxilliped has the usual shape, the epipod is provided with a large podobranch. The third maxilliped reaches about to the end of the scaphocerite. The last joint is slightly shorter than the penultimate, it is broadest at the base and tapers towards the apex. The penultimate segment is rather broad and is narrowed near the base. The antepenultimate segment is slightly less than twice as long as the ultimate, it is distinctly broadened near the apex. The exopod slightly overreaches the antepenultimate segment.

The first legs are slender, they reach with the chela beyond the scaphocerite. The fingers are almost 1.5 times as long as the palm. The carpus is 1.6 times as long as the chela and is about as long as the merus. The second legs are equal, they reach with the larger part of the carpus beyond the scaphocerite. The fingers are very long and slender, being 1.5 times as long as the palm. The cutting edge of the dactylus bears a small tooth in the extreme proximal part, no teeth are visible on the cutting edge of the fixed finger. The palm is swollen. The carpus is

slightly longer than the fingers, while the merus is about as long as the fingers. The ischium is as long as the palm. The third leg reaches with part of the propodus beyond the scaphocerite. The dactylus is short and simple. The propodus is four times as long as the dactylus, it bears several minute spinules on the posterior margin. The carpus measures 2/3 of the length of the propodus, while the merus is about as long as the latter joint. The ischium is almost half as long as the merus. The fifth leg is similar to the third, but is more slender: the propodus is more than five times as long as the dactylus, it possesses numerous transverse rows of setae in the distal part of the posterior margin.

The first pleopod of the male has the endopod elongate, without appendix interna. The second pleopod of the male has the appendix interna and appendix masculina of about the same size.

The uropods are normal in shape. The outer margin of the exopod ends in an immovable tooth, at the inner side of which there is a movable spine.

*Size:* The longest specimen known is 36.8 mm in length. I have seen no ovigerous females.

*Colour:* According to M. J. Rathbun the colour is whitish, but she did not state if this is the colour of the living animal.

*Material examined:* In the U. S. National Museum three cotypes of the present species are present.

*Distribution:* Up till now the species is known only from a pool in a cave between Madruga and Aguacate, Havana Province, Cuba.

*Type:* The type locality is mentioned above. The holotype and some cotypes are preserved in the Museum of Comparative Zoölogy at Harvard College, some other cotypes (including the specimen figured by M. J. Rathbun) in the U. S. National Museum.

*Remarks:* As Chace (1943) pointed out, the type material of *Palaemonetes calcis* Rathbun in the Museum of Comparative Zoölogy at Harvard is not homogeneous, but contains specimens of another species: *Troglocubanus inermis* (Chace). The same is true for the type material of *P. calcis* in the U. S. National Museum. Rathbun's description, however, is entirely based on specimens of the present species.

## Troglocubanus eigenmanni (Hay)

**Pl. 37, figs. a-f**

*Palaemonetes eigenmanni* Hay, 1903, Proc. U. S. Nat. Mus., vol. 26, p. 431, fig. 2.

*Palaemonetes eigenmanni* Pike, 1906, Biol. Bull. Woods Hole, vol. 11, p. 267, figs. 1-7.

*Palaemonetes eigenmanni* Eigenmann, 1909, Publ. Carnegie Inst., vol. 104, p. 202; M. J. Rathbun, 1912, Bull. Mus. Comp. Zool. Harvard, vol. 54, p. 453; Kemp, 1925, Rec. Indian Mus., vol. 27, p. 317; Spandl, 1926, Speläol. Monogr., vol. 11, p. 90.

*Palaemonetes Eigenmanni* Chappuis, 1927, Die Binnengewasser, vol. 3, p. 87.

*Palaemonetes eigenmanni* Wolf, 1934, Anim. Cavern. Catal., vol. 3, p. 103; Chace, 1943, Proc. New Engl. Zool. Cl., vol. 22, p. 34; Barbour, 1945, Naturalist Cuba, p. 192; Holthuis, 1949, Proc. Kon. Nederl. Akad. Wetensch., vol. 52, p. 91.

*Troglocubanus eigenmanni* Holthuis, 1950a, Siboga Exped., mon., 39a9, p. 11.

*Description:* The rostrum is slender and turned upwards at the apex, it reaches to or slightly beyond the scaphocerite. The upper margin bears 6 to 8 teeth, the first three of which are placed on the carapace behind the orbit. The distal teeth are much wider spaced than the proximals. The lower margin is convex and entirely without teeth. The carapace is smooth and provided with antennal spines only. These spines stand some distance below the rounded lower angle of the orbit and differ from those of *T. calcis* by being removed from the anterior margin of the carapace, reaching with the apex just to this margin. The branchiostegal groove is distinct.

The abdomen is smooth. The pleurae of the first three segments are broadly rounded, those of the fourth and fifth segments are narrower and more triangular, their tips, however, are rounded too. The fifth segment is about 2/3 as long as the sixth and half as long as the telson. The telson has the two pairs of dorsal spinules placed in about the middle and at 3/4 of its length. The posterior margin of the telson is rounded, there are about four hairs between the inner of the two pairs of posterior spines.

The eyes are like in *T. calcis*.

The antennular peduncle, too, shows the same characters as in that species. The upper antennular flagellum has the fused part of the two rami consisting of 4 or 5 joints, the free part of the shorter ramus consists of 12 to 17 joints and is more than four times as long as the fused part.

The scaphocerite is broad, it is about 2.5 times as long as its greatest breadth. The outer margin is about straight and ends in a small final tooth, which is distinctly overreached by the rounded anterior margin.

The antennal peduncle fails to reach the middle of the scaphocerite. A distinct spine is present near the external side of the base of the scaphocerite.

The mouthparts show no appreciable differences from those of *T. calcis*.

The first leg reaches with part of the carpus beyond the scaphocerite. The fingers are about 1.5 times as long as the palm. The carpus is 1.5 times as long as the chela, it is longer than the merus. The second legs are equal, they are stronger than the first pair and reach with the larger part of the carpus beyond the scaphocerite. Here too the fingers are 1.5 times as long as the palm. A small tooth is present in the proximal part of the cutting edge of the dactylus. The carpus is about as long as the chela, and about 1.2 times as long as the merus. The ischium is 3/4 of the length of the merus. The third leg reaches with part of the propodus beyond the scaphocerite. The dactylus is simple and slender. The propodus is about 3.5 times as long as the dactylus and it bears several spinules on the posterior margin. The carpus is somewhat shorter than the propodus. The merus is 1.3 times as long as the carpus. The fifth leg is longer and more slender than the third.

The pleopods and uropods are as in *T. calcis*.

*Size:* The largest specimen of this species seen by me measures 30 mm, Rathbun (1912) mentions a specimen of 32 mm. There are no ovigerous females in the present material.

*Material examined:* In the U. S. National Museum material of this species is present from: Ashton (three specimens) and San Cristobal (one specimen) both localities lying in Pinar del Rio Province, and a specimen from Güira de Melena in Havana Province. Both provinces are situated in Cuba.

*Distribution:* The species only is known from caves in W. Cuba. The records in literature are: Ashton!, Modesta, Jaiguan and San Isidro, all near Cañas, Pinar del Rio Province, Cuba (Hay, 1903), Cañas (Pike, 1906), Güira de Melena, Havana Province, Cuba (M. J. Rathbun, 1912), Alacranes, Matanzas Province (Chace, 1943).

*Type:* The type locality is Ashton near Cañas, Pinar del Rio Province, Cuba. The holotype and some of the paratypes are preserved in the U. S. National Museum (Cat. No. 26349), the other paratypes are in the collection of the University of Indiana.

## Troglocubanus gibarensis (Chace)

Pl. 38, figs. a-i

*Palaemonetes gibarensis* Chace, 1943, Proc. New Engl. Zool. Cl., vol. 22, p. 28, pl. 7; Holthuis, 1949, Proc. Kon. Nederl. Akad. Wetensch., vol. 52, p. 91.

*Troglocubanus gibarensis* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 11.

*Description:* Chace (1943) gives the following description of the species: "Carapace armed with a small antennal spine below the orbit, but without a branchiostegal spine. There is the usual faint, arched supra-branchial furrow and an oblique furrow running backward and downward from a point on the anterior margin below the antennal spine [= branchiostegal groove]. Rostrum reaching nearly as far as the end of the antennular peduncle, with subparallel margins proximally and tapering to a point distally, armed with two or three teeth above, one of which is behind the level of the hind margin of the orbit, and unarmed below; it is strengthened by a lateral keel on each side running from the posterior orbital margin to the tip. Abdomen smoothly rounded. The sixth somite is somewhat longer than high and at least one-half again as long as the fifth. Telson nearly one-half again as long as the sixth somite, armed with two pairs of dorsal spinules and two or three pairs of terminal spines, between which are six plumose setae; the anterior pair of dorsal spinules is placed about halfway from the base to the tip of the telson, and the posterior pair midway between the first pair and the tip.

"Eyes entirely without pigment, rounded distally and provided with a minute tubercle, just discernible in dorsal view at the outer distal angle. Inner antennular flagellum about as long as the carapace and half of the abdomen; outer flagellum fused for four segments, the free portion of the inner ramus made up of about fifteen segments, the outer branch about one and two-thirds times the length of the prawn. Antennal scale convex externally and evenly rounded distally; the outer spine protrudes but little beyond the outline of the scale. Antennal flagellum more than twice as long as the body of the animal. Third maxillipeds extend as far as the end of the antennal scale. Carpus of first pereiopods slightly longer than the merus and nearly half again as long as the chela. Second pereiopods long, extending beyond the antennal scale by the length of the chela and most of the carpus; carpus slightly longer than merus, but not more than two-thirds as long as the chela; palm slightly more than half as long as the slightly curved fingers. Last three pairs

of legs increasing in length from third to fifth; the dactyls are subparallel basally, then taper rather abruptly to a sharp point, thus forming an obtuse angle at about the mid-point of the outer margin as in *P. calcis*."

*Size:* The largest specimen in the collection studied by Dr. Chace is 25 mm long.

*Distribution:* No material of this species has been seen by me. The only record in literature is that of Chace (1943): Barrio de Cupeysillo, Termino de Gibara, Oriente Province, E. Cuba. The species was found in a deep well, entering an underground stream.

*Type:* The above cited locality is the type locality. The types (one holo- and 2 paratypes) are deposited in the Museum of Comparative Zoölogy at Harvard College, Cambridge, Mass.

### **Troglocubanus inermis** (Chace)

Pl. 39, figs. a-i

*Palaemonetes calcis* p.p. M. J. Rathbun, 1912, Bull. Mus. Comp. Zoöl. Harvard, vol. 54, p. 451, pl. 1, fig. 4.

*Palaemonetes inermis* Chace, 1943, Proc. New Engl. Zool. Cl., vol. 22, p. 26, pl. 6; Holthuis, 1949, Proc. Kon. Nederl. Akad. Wetensch., vol. 52, p. 91.

*Troglocubanus inermis* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 11.

*Description:* The rostrum is rather high and short, reaching about to the end of the antennular peduncle. There are no teeth on the rostrum generally, though some specimens (in my material two of the four specimens) have a small tooth on the dorsal edge near the tip of the rostrum. Both upper and lower margin of the rostrum are convex. The carapace is smooth, it bears no spines at all, the antennal as well as the branchiostegal spines are absent. The lower angle of the orbit is rounded, or more or less truncate. A distinct branchiostegal groove is present.

The abdomen is smooth. The pleurae of the first three segments are broadly rounded, those of the fourth and fifth segments are narrower, but they have the tips rounded too. The sixth segment is about 1.5 times as long as the fifth, it is somewhat shorter than the telson. The two pairs of dorsal spinules of the telson are very small and placed close together in the posterior half of the telson; the distance between the spines is distinctly smaller than the distance between the posterior pair of spines and the posterior margin of the telson. The posterior margin is rounded, and provided at each corner with a long and a short spinule. Between the inner (longer) posterior spinules numerous (8 to 13) hairs are present.

The eyes are oval in shape, they end in a narrow and sharp point. The cornea is strongly reduced and possesses no pigment at all.

The stylocerite is short and blunt, it is pressed against the antennular peduncle. The anterolateral spine of the basal segment of the antennular peduncle is well developed and reaches to the anterior margin of the second segment. The anterior margin of the first segment gradually slopes down from the end of the anterolateral spine to the base of the second segment. The third segment is longer and more slender than the second. The fused part of the two rami of the upper antennular flagellum consists of four or five segments, the free part of the shorter ramus is composed of about 12 to 17 joints and is much longer than the fused part.

The scaphocerite is broad, it is less than twice as long as broad. The outer margin is convex. The final tooth is distinctly overreached by the rounded anterior margin of the lamella. The antennal peduncle reaches almost to the middle of the scaphocerite. A distinct external spine is visible near the base of that scale.

The mandible has the incisor process much more slender than in *Troglocubanus calcis.* The inner lacinia of the maxillula is strongly broadened, while the upper lacinia too is larger than in *T. calcis.* The maxilla is very similar to that of *T. calcis,* but the lobes of the endite are shorter. The first and second maxillipeds are like those of the type species, only the last two joints of the second maxilliped are less slender there. The third maxilliped reaches about to the end of the antennal peduncle or even to the end of the scaphocerite. The last joint is as long as or slightly longer than the penultimate, which is about half as long as the antepenultimate joint. The antepenultimate joint is of the same breadth throughout its length. The exopod reaches slightly beyond the end of the antepenultimate segment.

The first legs reach with the chela beyond the scaphocerite. The chela is oval in shape. The fingers are nearly 1.5 times as long as the palm, their inner side is hollowed, so that the cutting edge lies more to the outside. The carpus is almost twice as long as the chela, and somewhat longer than the merus. The second legs are equal, they reach only with part of the fingers beyond the scaphocerite. The fingers are about thrice as long as the almost quadrangular palm, they are hollowed at the inner surface just like the first leg, furthermore they are curved. There are no teeth on the cutting edges. The carpus is about as long as the fingers and half the palm together. The merus is of about the same length as the carpus. The ischium is slightly shorter than the

merus. The third leg reaches about to the end of the scaphocerite. The propodus is slightly more than thrice as long as the dactylus, it bears some spinules on the posterior margin. The carpus is somewhat more than half as long as the propodus, while the merus is distinctly longer than the latter joint. The fifth leg is far more slender than the third and reaches beyond the scaphocerite. The propodus is almost five times as long as the dactylus.

The pleopods are normal in shape. The appendix masculina is longer than the appendix interna of the second pleopod of the male.

The uropods are normal, except for the fact that the movable spine, which is placed at the inner side of the final tooth of the outer margin of the exopod, at its inner side is flanked by an immovable tooth. In this respect the species differs from both *T. calcis* and *T. eigenmanni,* which have this movable spine without the immovable tooth at its inner side.

*Size:* The total length of my largest specimen is 22 mm. None of the specimens examined by me bears ova.

*Material examined:* Among the cotype material of *Palaemonetes calcis* Rathbun present in the U. S. National Museum, 4 specimens of the present species were found, they originated from a pool in a cave between Madruga and Aguacate, Havana Province, Cuba.

*Distribution:* The species is known only from the just cited locality, which is the type locality. It is recorded in literature from there by M. J. Rathbun (1912) and Chace (1943).

*Type:* The type locality is mentioned above. The holo- and paratypes are preserved in the Museum of Comparative Zoölogy at Harvard College.

## Genus **CREASERIA** Holthuis, 1950a

*Definition:* Rostrum well developed, compressed. Upper and lower margin with teeth. Carapace smooth, provided with antennal and branchiostegal spines. Branchiostegal spine on anterior margin of carapace. Branchiostegal groove absent.

Telson with 2 pairs of dorsal and 2 pairs of posterior teeth. Setae present between the posterior teeth.

Eyes poorly developed, without pigment.

Mandible with a two-jointed palp. All maxillipeds with exopods. Pleurobranchs on third maxilliped and all pereiopods.

First leg slender. Fingers longer than the palm. Second legs slightly more robust, equal, smooth. Last three legs, smooth, slender, dactylus

simple. Propodus of fifth leg with numerous transverse rows of setae in the distal part of the posterior margin.

Pleopods of the female normal, as in *Palaemon.* I unfortunately could not examine male specimens.

Uropods as in *Macrobrachium.*

*Type: Palaemon morleyi* Creaser, 1936.

The genus is closely related to *Palaemon,* but shows some very important differences, which have been pointed out in the key.

The type and only species is

### Creaseria morleyi (Creaser)

Pl. 40, figs. a-f

*Palaemon morleyi* Creaser, 1936, Publ. Carnegie Inst., n. 457, p. 126, figs. 25-30, tab. 1; Creaser, 1938, Publ. Carnegie Inst., n. 491, p. 163; Chace, 1943, Proc. New Engl. Zool. Cl., vol. 22, p. 33.
*Creaseria morleyi* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 6.

*Description:* The rostrum is straight and reaches to the end of the scaphocerite. The upper margin bears 7 to 10 teeth, 1 or 2 of which are placed behind the orbit. The lower margin bears 1 to 3 teeth. All teeth are little pronounced. The carapace is somewhat swollen and smooth.

The abdomen too is smooth. The pleura of the fifth segment ends in a distinct sharp tooth. The 6th segment is only slightly longer than the fifth. The telson bears 2 pairs of dorsal spines which are placed in about the middle and at ¾ of the length of the telson. The posterior margin is rounded and ends in a minute sharp tooth. There are 2 pairs of posterior spinules, the inner of which overreaches the tip of the telson. Numerous setae are present between the inner spines.

The eyes are strongly reduced and possess no pigment, they are bullet-shaped.

The antennulae have the basal segment broad, with a strong and pointed stylocerite, which reaches distinctly beyond the middle of the basal segment. The anterolateral spine is very strong, reaching beyond the second segment of the peduncle. The anterior margin of the segment gradually merges into the anterolateral spine. The third segment is somewhat longer than the 2nd. The inner antennular flagellum has the two rami fused for 6 joints. The free part of the shorter ramus is much longer than the fused part and consists of 25 joints.

The scaphocerite is broad, being twice as long as broad. The outer margin is convex. The final tooth just fails to reach the end of the lamella.

The first legs reach with the chela beyond the scaphocerite. The fingers are 1.5 times as long as the palm. The carpus is somewhat longer than the chela and about as long as the merus. All joints are smooth. The second legs are slender, though more robust than the first, they too are smooth. The fingers are about 1.5 times as long as the palm. The merus is shorter than the chela, but longer than the carpus. The fixed finger possesses a serrate tubercle in the proximal part of the cutting edge, the dactylus possesses there a distinct indentation (in juvenile specimens this tubercle and indentation are absent). The third leg reaches with part of the propodus beyond the scaphocerite. The propodus is more than thrice as long as the dactylus, twice as long as the carpus and as long as the merus. The fifth leg reaches with about half the propodus beyond the scaphocerite. The propodus is about 5 times as long as the dactylus, somewhat less than twice as long as the carpus and somewhat longer than the merus.

*Size:* According to Creaser (1936) the type is 33.5 mm long. The specimen in the U.S. National Museum measures 42 mm.

*Material examined:* In the U.S. National Museum a female paratype is present from Amil Cave, Yucatan, while I also examined the paratypes from the Amil and Balaam Canche Caves, which are deposited in the Museum of Zoology of the University of Michigan.

*Distribution:* The species is only known from caves in Yucatan, Mexico. The records in literature are: San Bulha Cave at Motul (Creaser, 1936), San Isidro and Amil! Caves near Merida, Balaam Canche Cave! near Chichen Itza (Creaser, 1936, 1938), Chac Mol Cave near Tohil, Hoctun Cave at Hoctun, Yunchen Cave at Libre Union, Gongora Cave at Oxkutzcab and Spukil Cave at Calcehtok (Creaser, 1938).

## Genus **LEANDER** E. Desmarest, 1849

*Definition:* The rostrum is well developed, compressed and provided with teeth. The carapace is armed with antennal and branchiostegal spines, the latter are placed some distance behind the anterior margin of the carapace. No branchiostegal groove is present.

The telson bears two dorsal and two posterior pairs of spines. Two very strong feathered setae are placed on the posterior margin between the inner spines.

The eyes have the cornea well developed and pigmented.

The mandible bears a two-jointed palp. All maxillipeds are provided with exopods. Pleurobranchs are present on the third maxilliped and all pereiopods.

The dactyli of the last three pereiopods are simple. No transverse rows of short hairs are present in the distal part of the posterior margin of the propodus of the fifth legs.

The first pleopod of the male has the endopod provided with a distinct appendix interna.

*Type species: Leander erraticus* E. Desmarest, 1849, a species considered at present identical with *Leander tenuicornis* (Say).

This genus is represented in American waters only by one species, namely the type of the genus:

### **Leander tenuicornis** (Say)

Pl. 41, figs. a-g; pl. 42, figs a-f

*Astacus locusta* Fabricius, 1781, Spec. Ins., vol. 1, p. 513 (non Pennant, 1777); Fabricius, 1787, Mant. Ins., vol. 1, p. 333.

*Cancer pennaceus* p.p. Gmelin, 1789, Linn. Syst. Nat., ed. 13, vol. 1, p. 2988.

*Astacus Locusta* Olivier, 1791, Encycl. méth. Hist. nat., vol. 6, p. 348; Petagna, 1792, Inst. Entom., p. 417.

*Astacus locusta* Fabricius, 1793, Ent. Syst., vol. 2, p. 486.

*Astacus Locusta* Weber, 1795, Nomencl. Ent., p. viii.

*Palaemon locusta* Fabricius, 1798, Suppl. Ent. Syst., p. 404.

? *Penaeus punctatissimus* Bosc, 1801, Hist. nat. Crust., vol. 2, p. 109, pl. 14, fig. 3.

? *Palaemon locusta* Bosc, 1801, Hist. nat. Crust., vol. 2, p. 105.

? *Penaeus punctatissimus* Latreille, 1802, Hist. nat. Crust. Ins., vol. 6, p. 248, pl. 54, fig. 1.

non *Palaemon locusta* Latreille, 1802, Hist. nat. Crust. Ins., vol. 6, p. 256.

?Without name Krusenstern, 1814, Atlas Reise um die Welt, pl. 22, fig. 1.

*Palaemon tenuicornis* Say, 1818, Journ. Acad. Nat. Sci. Phila., vol. 1, p. 249.

?*Penaeus adspersus* Tilesius, 1818, Ann. Wetterau. Ges. Naturk., vol. 4, p. 4, pl. 21a, fig. 1.

? *Penée ponctué* A. G. Desmarest, 1830, Bosc's Man. Hist. nat. Crust., ed. 2, vol. 2, pl. 14, fig. 3.

*Palemon natator* H. Milne Edwards, 1837, Hist. nat. Crust., vol. 2, p. 393.

*Palémon tenuirostre* H. Milne Edwards, 1837, Hist. nat. Crust., vol. 2, p. 395.

*Palaemon latirostris* De Haan, 1841, Fauna Japonica, Crust., atlas, pl. 45, fig. 12.

*Palaemon natator* Krauss, 1843, Südafr. Crust., p. 55.

*Palemon tenuicornis* De Kay, 1844, Nat. Hist. New York, Crust., p. 30.

*Palemon locusta* Gibbes, 1845, Proc. Boston Soc. Nat. Hist., vol. 2, p. 70.

*Palaemon natator* Goodsir, 1845, Ann. Mag. Nat. Hist., vol. 15, p. 74, pl. 7, fig. 3; White, 1847, List Crust. Brit. Mus., p. 77.

*Palaemon tenuicornis* White, 1847, List Crust. Brit. Mus., p. 78.

*Leander erraticus* E. Desmarest, 1849, Ann. Soc. entom. France, ser. 2, vol. 7, p. 92, fig.

*Palemon latirostris* De Haan, 1849, Fauna Japonica, Crust., p. 170.

*Palemon locusta* Gibbes, 1850a, Proc. Amer. Ass. Adv. Sci., vol. 3, p. 198.

*Palaemon Locusta* Hope, 1851, Catal. Crost. Ital., p. 17.

*Palaemon natator* Dana, 1852, U.S. Explor. Exped., vol. 13, p. 588; Dana, 1855, U.S. Explor. Exped., vol. 13, atlas, p. 12, pl. 38, fig. 11.

*Leander natator* Stimpson, 1860, Proc. Acad. Nat. Sci. Phila., 1860, p. 40.

*Palaemon natator* A. Milne Edwards, 1862, Maillard's Ile Réunion, Ann. F, p. 16; Heller, 1863, Crust. südl. Europ., p. 268, pl. 9, figs. 11, 12; Grube, 1864, Jber. Schles. Ges. vaterl. Cult., vol. 41, p. 62; Barcelo y Combis, 1875, An. Soc. Esp. Hist. nat., vol. 4, p. 65.

*Palaemon torensis* Paulson, 1875, Invest. Crust. Red Sea, p. 116, pl. 17, fig. 3.

*Leander natator* Miers, 1876, Catal. Crust. New Zeal., p. 86.

*Leander tenuicornis* Kingsley, 1878a, Bull. Essex Inst., vol. 10, p. 66; Smith, 1879, Trans. Connect. Acad. Arts Sci., vol. 5, p. 122.

*Palaemon natator* De Folin & Périer, 1881?, Les Fonds de la Mer, vol. 4, p. 172.

*Leander natator* De Man, 1881, Notes Leyden Mus., vol. 3, p. 143; Haswell, 1882, Catal. Aust. Crust., p. 195.

*Palaemon tenuirostris* Carus, 1885, Prodr. Faun. Medit., vol. 1, p. 474.

*Leander natator* Filhol, 1885, Bibl. Éc. haute Étud., vol. 30, pt. 2, p. 52; Filhol, 1886, Miss. Ile Campbell, Zool., vol. 3, pt. 2, p. 434.

*Leander tenuicornis* Perrier, 1886, Explor. sous-mar., p. 81.
? *Hippolyte tenuirostris* Perrier, 1886, Explor. sous-mar., p. 81, fig. 32.
*Palaemon natator* Buen, 1887, An. Soc. Esp. Hist. nat., vol. 16, p. 420.
*Leander natator* De Man, 1888, Arch. Naturgesch., vol. 53, pt. 1, p. 563.
*Palaemon natator* Bate, 1888, Rep. Voy. Challenger, Zool., vol. 24, p. 784, pl. 128, figs. 6, 7.
*Leander natator* Ortmann, 1890, Zool. Jb. Syst., vol. 5, p. 525.
*Palaemon natator* Bolivar, 1892, Act. Soc. Esp. Hist. nat., vol. 21, p. 131.
*Palaemon (Leander) erraticus* Thallwitz, 1892, Abh. Ber. zool. anthrop. Mus. Dresden, 1890-91, pt. 3, p. 8.
*Palaemon (Leander) latirostris* Thallwitz, 1892, Abh. Ber. zool. anthrop. Mus. Dresden, 1890-91, pt. 3, p. 10.
*Palaemon (Leander) natator* Thallwitz, 1892, Abh. Ber. zool. anthrop. Mus. Dresden, 1890-91, pt. 3, p. 11.
*Leander tenuicornis* Ortmann, 1893, Ergebn. Plankton Exped., vol. 2Gb, p. 48.
*Leander natator* Sharp, 1893, Proc. Acad. Nat. Sci. Phila., p. 120.
*Palaemon natator* Nutting, 1895, Bull. Lab. nat. Hist. State Univ. Iowa, vol. 3, p. 29.
*Leander paulensis* Ihering, 1897, Rev. Mus. Paulista, vol. 2, p. 422; Ortmann, 1897, Rev. Mus. Paulista, vol. 2, p. 192, pl. 1, fig. 14.
*Palaemon (Leander) tenuicomis* Kingsley, 1899, Amer. Nat., vol. 33, p. 718.
*Periclimenes parasiticus* Nobili, 1899, Ann. Mus. Stor. Nat. Genova, vol. 40, p. 235.
*Periclimenes tenuipes* p. p. Nobili, 1899, Ann. Mus. Stor. Nat. Genova, vol. 40, p. 235.
*Leander natator* Rankin, 1900, Ann. New York Acad. Sci., vol. 12, p. 538.
*Pandalus tenuicornus* Rankin, 1900, Ann. New York Acad. Sci., vol. 12, p. 544.
*Palaemon natator* Young, 1900, Stalk-eyed Crust. Brit. Guian., p. 482.
non *Leander paulensis* Moreira, 1901, Arch. Mus. Nac. Rio de Jan., vol. 11, p. 11.
*Palaemon (Leander) natator* Nobili, 1901a, Ann. Mus. zool. Univ. Napoli, n. ser., vol. 1, pt. 3, p. 6.
*Leander natator* Thompson, 1901, Catal. Crust. Mus. Dundee, p. 19.
*Palaemon affinis* p. p. Rathbun, 1902a, Bull. U. S. Fish Comm., vol. 20, pt. 2, p. 125.
*Palaemon paulensis* M. J. Rathbun, 1902a, Bull. U.S. Fish Comm., vol. 20, pt. 2, p. 125.

*Palaemon natator* Thomson, 1903, Trans. Linn. Soc. Lond. Zool., ser. 2, vol. 8, p. 450.

*Palaemon tenuirostris* Calvet, 1905, Trav. Inst. zool. Montpellier, ser. 2, vol. 15, p. 61.

*Leander natator* Nobili, 1906, Ann. Sci. nat. Zool., ser. 9, vol. 4, p. 74.

*Palaemon tenuicornis* Cary & Spaulding, 1909, Contrib. Fauna Louisiana coast, p. 10.

*Palaemon tenuirostris* Calvet, 1910, Trav. Inst. zool. Montpellier, ser. 2, vol. 20, pt. 4, pp. 12, 19.

*Palaemon tenuicornis* Fowler, 1912, Ann. Rep. New Jersey State Mus., 1911, p. 558.

*Palaemon natator* Murray & Hjort, 1912, Depths of the Ocean, p. 671.

*Palaemon tenuicornis* Sumner, Osburn & Cole, 1913, Bull. U.S. Bur. Fish., vol. 31, pp. 137, 663.

*Leander tenuicornis* Lenz & Strunck, 1914, Deutsche Süd-Polar Exped., vol. 15, p. 323; Stebbing, 1914, Trans. Roy. Soc. Edinb., vol. 50, p. 288.

*Leander natator* Balss, 1915, Denkschr. Akad. Wiss. Wien, vol. 91 suppl., p. 31; Bolivar, 1916, Bol. Soc. Esp. Hist. nat., vol. 16, p. 251; Buen, 1916, Bol. Soc. Esp. Hist. nat., vol. 16, p. 362.

*Palaemon tenuicornis* Hay & Shore, 1918, Bull. U.S. Bur. Fish., vol. 35, p. 392, pl. 27, fig. 6.

*Palaemon paulensis* Luederwaldt, 1919, Rev. Mus. Paulista, vol. 11, p. 430.

*Palaemon tenuicornis* M. J. Rathbun, 1919, Boeke's Rapp. Visscherij Curaçao, vol. 2, p. 323.

*Leander tenuicornis* Tattersall, 1921, Journ. Linn. Soc. Lond. Zool., vol. 34, p. 392; Verrill, 1922, Trans. Connect. Acad. Arts Sci., vol. 26, p. 143, pl. 43, fig. 4.

*Palaemon tenuicornis* Beebe, 1924, Galapagos, p. 431.

*Palaemon paulensis* Schmitt, 1924a, Bijdr. Dierk., vol. 23, p. 72.

*Palaemon tenuicornis* Schmitt, 1924a, Bijdr. Dierk., vol. 23, p. 72; Schmitt, 1924b, Zoologica, New York, vol. 5, p. 168.

*Leander tenuicornis* Kemp, 1925, Rec. Indian Mus., vol. 27, p. 302, fig. 11.

*Palaemon paulensis* Luederwaldt, 1929, Rev. Mus. Paulista, vol. 16, p. 53.

*Leander tenuicornis* Boone, 1930, Bull. Vanderbilt mar. Mus., vol. 3, p. 137, pl. 47.

*Palaemon tenuicornis* Cowles, 1930, Bull. U.S. Fish Comm., vol. 46, pp. 356, 358.

*Palaemon natator* Nouvel, 1932, Bull. Mus. Hist. nat. Paris, ser. 2, vol. 4, p. 409.

*Palaemon paulensis* Schmitt, 1935, Sci. Surv. Porto Rico, Virgin Isl., vol. 15, p. 160.

*Palaemon tenuicornis* Schmitt, 1935, Sci. Surv. Porto Rico, Virgin Isl., vol. 15, p. 161, fig. 26.

*Leander tenuicornis* Gurney, 1936, Proc. Zool. Soc. Lond., 1936, p. 619; Gurney, 1938, Sci. Rep. Great Barrier Reef Exped., vol. 6, p. 4, figs. 8-16; Gurney, 1939, Ann. Mag. Nat. Hist., ser. 11, vol. 3, p. 120, figs. 1, 2a.

*Leander natator* Maccagno, 1939, Boll. Mus. Zool. Anat. Comp. Torino, vol. 47, p. 439.

*Palaemon tenuicornis* Schmitt, 1939, Smithson. Misc. Coll., vol. 98, pt. 6, p. 28.

*Leander tenuicornis* Gurney & Lebour, 1941, Journ. Linn. Soc. Lond. Zool., vol. 41, p. 145.

*Palaemon tenuicornis* Anonymus, 1942, Annot. List Fauna Grand Isle Region, p. 6; Coventry, 1944, Monogr. Acad. Nat. Sci. Phila., vol. 6, p. 536.

*Leander tenuicornis* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 26, figs. 1, 2; Holthuis, 1950c, Fauna van Nederland, vol. 15, p. 64.

*Description:* The rostrum is well developed, it is high in the female, more slender in the male. It reaches about to the end of the scaphocerite. The upper margin is provided with 8 to 14 teeth, which are regularly divided over the entire rostrum, the first two of these teeth are placed behind the posterior limit of the orbit. The lower margin bears 5 to 7 teeth. Like in some other species of Palaemonidae a double row of setae is implanted along the lower margin of the rostrum, thereby concealing the lower teeth. The carapace is smooth, it is provided with antennal and branchiostegal spines. The branchiostegal spine is placed some distance behind the anterior margin of the carapace. No branchiostegal groove is present.

The abdomen is smooth. The first three pairs of pleurae are broadly rounded, the pleurae of the fourth and fifth abdominal segment are narrower and both end in a minute acute tooth. The sixth abdominal segment is slightly longer than the fifth and about 2/3 of the length of the telson. The telson is provided with two pairs of dorsal and two pairs of posterior spines. The dorsal spines are placed in about the middle and ¾ of the length of the telson. The inner of the two pairs of posterior spines is the longer and distinctly overreaches the acute tip of the telson. Between these inner spines a pair of strong feathered setae is present.

The eyes have the cornea well developed and rounded. There are two dark coloured bands visible on the cornea, especially in fresh material.

The basal segment of the antennula has the stylocerite large and pointed, it reaches distinctly beyond the middle of the basal segment. The anterolateral spine of this segment is very strong too, it reaches almost to the end of the second segment of the peduncle. The anterior margin of the basal segment between the anterolateral spine and the second segment is straight or only slightly convex. The second and third segments are shorter and narrower than the first. The upper flagellum has the fused portion of the two rami much shorter than the free part of the shorter ramus.

The scaphocerite is three to five times as long as broad. The outer margin is straight or slightly convex. The final tooth is strong and reaches about to the end of the lamella. The antennal peduncle fails to reach the middle of the scaphocerite. A strong external spine is present near the base of the scaphocerite.

The mandible has the incisor process ending in three large teeth, the molar process ends in some blunt knobs, a two-jointed palp is present. The maxillulla has both laciniae not very broad, the palp is distinctly bilobed. The maxilla has the inner lacinia deeply cleft in two narrow lobes, the palp is well developed, the scaphognathite is large and slender. All the maxillipeds are provided with well developed exopods. The first maxilliped has the basis and coxa separated by a distinct notch, the palp is slender, a distinct caridean lobe is present, the epipod is large and bilobed. The second maxilliped is of the usual shape, the epipod bears a large podobranch. The third maxilliped fails to reach the end of the scaphocerite. The last segment is somewhat more than half as long as the penultimate segment. The antepenultimate segment is slightly longer than the penultimate. The exopod reaches almost to the end of the antepenultimate segment. An arthrobranch and a pleurobranch are present.

A pleurobranch is present at the bases of all pereiopods. The first legs are slender, they reach about to the end of the scaphocerite. The fingers are distinctly longer than the palm. The second legs are more robust than the first, they are equal in size and shape. The fingers are longer than the palm, the latter is somewhat swollen. The cutting edge of the fingers is entire except for a small basal tooth in the males. The carpus is distinctly shorter than the chela, and about as long as the merus. The ischium is somewhat shorter than the merus. The second

legs reach with the chela beyond the scaphocerite. The last three legs are slender. The third leg fails to reach the end of the scaphocerite. The dactylus is simple and slender. The propodus is 2.5 times as long as the dactylus, it bears spines on its posterior margin. The carpus is about half as long as the propodus, while the merus has the same length as the latter joint. The fifth leg is distinctly more slender than the third. The propodus is thrice as long as the dactylus, it too bears posterior spinules. There are no transverse rows of hairs in the distal part of the posterior margin of the propodus.

The first pleopod of the male bears a well developed appendix interna on the endopod. Appendices internae furthermore are present on the second to fifth pleopods of both male and female, like in most other Palaemonidae. The second pleopod of the male bears an appendix masculina which is almost as long as the appendix interna.

The uropods are shaped as in *Macrobrachium* and *Palaemon*.

Females differ from the males by having the rostrum much higher, generally the males are smaller than the females.

*Size:* The species may attain a length of 47 mm. Ovigerous females of 26 mm have been reported (Kemp, 1925). The eggs are numerous and small, measuring 0.5 to 0.8 mm in diameter.

*Colour:* According to notes made by Dr. Waldo L. Schmitt on Tortugas, specimens of the present species collected near Tortugas were coloured "Bice green and oilgreen, or tawny olive and olive, with opaque spots." Kemp (1925, p. 304) gives the following account of the colour of living specimens from India: "In life the species is closely mottled with umber, sienna or rich red brown, the mottling tending towards an arrangement in longitudinal streaks. Sometimes there is an ill-defined pale mid-dorsal stripe. The second legs are often rather conspicuously banded with brown and pure white; the palm is dark brown, sometimes with a sprinkling of red chromatophores. The other appendages are banded with brown, with occasional touches of white. The eggs also are brown."

*Material examined:* The Allan Hancock Expedition 1939 collected material of this species from:

Panama (Atlantic coast): Caledonia Bay. 1-5 fms, hard sand, April 4, 1939, Sta. A7-39, 7-12 fms, mud, April 26, 1939, Sta. A53-39.

In the U.S. National Museum material of this species is present from off Massachusetts (Cape Cod, Woods Hole, Nantucket, Martha's Vineyard), off Virginia, Beaufort (North Carolina), off North and South Carolina, off Florida (St. Augustine, Cape Canaveral, Jupiter

Inlet, Miami, Cape Florida, Cutler Flats, Newfound Harbor Key, Marquesas Key, Key West, Tortugas, Marco Pass, Punta Rassa, Hog Island Key), Louisiana (Grand Isle, Cameron, Calcasieu Pass), Texas (Pass Cabello), Gulf of Mexico, Panama (Fox Bay near Colon), Colombia (Sabanilla, Santa Marta), Bermuda, Georges Bank, Bahamas (Abaco, Exuma Sound, off Nassau, between Cat and Eleuthera Islands, Samana Cay), E. and S. of Cuba, Jamaica (Montego Bay), N. of Porto Rico, N. of Culebra, St. Thomas, Curaçao, and various localities in the Atlantic Ocean off the Antilles. A jar with numerous specimens of this species is labelled "Galapagos Islands?" this, however, probably is incorrect; this is the more probable, since the lot in question also contained specimens of the Atlantic gulfweed crab *Planes minutus* (L.) (see Chace, 1951, p. 78).

In the Museum of the Academy of Natural Sciences at Philadelphia, Pa., 2 dry specimens of the present species are preserved as "*Palaemon Mexicanus* Guerin." They originate from Mexico and are from the Guérin collection. Guérin's name is a manuscript name, as far as I can ascertain it never was published. I also examined the (likewise dry preserved) specimens mentioned under Nos. 345 and 346 in Sharp's (1893, p. 120) list, under the name *Leander natator.*

The Rijksmuseum van Natuurlijke Historie, Leiden, Holland, possesses, apart from material of this species from the Malay Archipelago and Japan, specimens from Curaçao (Rifwater), the Sargassum Sea and the northern Atlantic Ocean (29°N, 38°W; 27°N, 42°10′W; 23°N, 35°W). The Zoological Museum in Amsterdam too possesses material from the Malay Archipelago, the Sargassum Sea and the northern Atlantic Ocean (30°N, 70°W; 26°32′N, 73°W); furthermore its collections contain specimens of this species from Gairaca, Santa Marta (Colombia) and from Curaçao (Spaansche Haven and Spaansche Water).

*Distribution:* The species is known from tropical and subtropical seas all over the world, except for the American west coast. It lives in floating *Sargassum,* but also occurs in shallow water near the seashore between seaweeds. The records in literature are:

Atlantic: Atlantic Ocean (? Bosc, 1801; Goodsir, 1845; White, 1847; Dana, 1852; Stimpson, 1860; Kingsley, 1878; Bate, 1888; Ortmann, 1890; Sharp, 1893), Sargassum Sea (De Folin & Périer, 1881; De Man, 1881; Ortmann, 1893), Gulf Stream (Smith, 1879; Nutting, 1895; Fowler, 1912), Florida Stream (Ortmann, 1893), Newfoundland Bank (Say, 1818; White, 1847), 41°25′N, 66°20′W (Smith,

1879), Vineyard Sound, Massachusetts (Sumner, Osburn & Cole, 1913), Menemsha Bight, Martha's Vineyard Island, Massachusetts (Sumner, Osburn & Cole, 1913), Bermuda (Smith, 1879; Rankin, 1900; Verrill, 1922; Gurney, 1939; Gurney & Lebour, 1941), Mouth of Chesapeake Bay (Cowles, 1930), Beaufort, N. Carolina (Hay & Shore, 1918), 30 miles E. of Palm Beach, Florida (Coventry, 1944), Punta Rassa and Marco, Florida (M. J. Rathbun, 1902a), Turtle Harbor, Florida (Boone, 1930), Grand Isle, Louisiana (Anonymous, 1942), Cameron, Louisiana (Cary & Spaulding, 1909), Stirrup Key, Bahamas (Coventry, 1944), Three Hogsty Key, San Salvador (Boone, 1930), 30 miles N.W. of Little Inagua Island and 50 miles N.W. of Great Inagua Island, Bahamas (Coventry, 1944), Antilles (Sharp, 1893), off Cuba (Schmitt, 1924b, Beebe, 1924; Boone, 1930), Porto Rico (M. J. Rathbun, 1902a; Schmitt, 1935), St. Thomas, Virgin Islands (Schmitt, 1935), Guadeloupe (E. Desmarest, 1849), Old Providence Island, Colombia (Schmitt, 1939), Curaçao (M. J. Rathbun, 1919; Schmitt, 1924a), Ilha São Sebàstião near São Paulo, Brazil (Ihering, 1897; Ortmann, 1897; Luederwaldt, 1919, 1929), Falkland Islands (Kemp, 1925), Genoa, Italy (Heller, 1863; Carus, 1885), Corsica, France (Heller, 1863; Carus, 1885), Cette, France (Calvet, 1905, 1910), Baleares, Spain (Barcelo y Combis, 1875; Buen, 1887, 1916; Bolivar, 1916), Ras-el-Zur, Tripolitania (Maccagno, 1939), ? Algiers (Ortmann, 1890), South of the Azores (Lenz & Strunck, 1914), Central Atlantic Ocean: 33°53′N, 32°27′W, 32°11′N, 34°10′W, and 29°54′N, 34°10′W (Stebbing, 1914), 27-30°N 35-40°W (Krauss, 1843), 24°26′N, 34°32′W, and 23°53′N, 53°06′W (Sharp, 1893), 23°N, 35°W (De Man, 1881).

Indo-westpacific: Indian Ocean (H. Milne Edwards, 1837), Red Sea (Paulson, 1875), Ain Musa and Tor, Gulf of Suez (Kemp, 1925), Ghardaqa, Gulf of Suez (Gurney, 1938), Mersa Wadi Lehama (Tattersall, 1921), Jidda, Arabia (Balss, 1915), Eritrea (Nobili, 1901a, 1906), Kamaran (Balss, 1915), Perim (Nobili, 1906; Balss, 1915), Jibuti (Nobili, 1906), Aden (Nobili, 1906), Réunion (A. Milne Edwards, 1862), Kilakarai, Apa Island, and Pamban, both in the Gulf of Manaar, S. India (Kemp, 1925), Ross Channel and North Bay, Andaman Islands (Kemp, 1925), Octavia Pt., Nancowry Harbour and Camorta Island, Nicobar Islands (Kemp, 1925), Japan! (De Haan, 1849; De Man, 1881), Kochi, Japan (Ortmann, 1890), Noordwachter Island, Java! (De Man, 1888), Waigeo, near N.W. New Guinea! (De Man, 1881), Australia (Haswell, 1882), New Zealand (Miers,

1876; Filhol, 1885; Thompson, 1903), South Island, New Zealand (Filhol, 1886). (For additional records on distribution see Holthuis, 1950a.)

*Type:* The type locality is Newfoundland Banks. The type specimens are preserved in the collection of the Academy of Natural Sciences at Philadelphia, Pa. (vid. Coventry, 1944). White (1847) lists in the catalogue of the Crustacea of the British Museum two specimens of *"Palaemon tenuicornis"* from Banks of Newfoundland, "Presented by Thomas Say, Esq." These specimens probably are syntypes.

*Remarks:* The fact that the present species has the mandibular palp two-jointed has already been observed by Tattersall (1921) and Gurney (1938). Dana's (1855) and Paulson's (1875) figures of a three-jointed palp in all probability are incorrect; this error probably is due to the fact that the last joint of the palp is very long.

Schmitt (1935) pointed to the close resemblance between *Leander tenuicornis* and *L. paulensis,* but nevertheless considered them to be distinct species. The differences which were used to separate the two forms are:

1. In *Leander tenuicornis* the fingers of the second legs are longer and the palm is much swollen, while in *L. paulensis* the fingers are of about the same length as the palm, which is thick but not swollen.

2. The final tooth of the scaphocerite in *L. tenuicornis* fails to reach the end of the lamella, in *L. paulensis* it overreaches the lamella.

3. The rostrum in *L. tenuicornis* bears 8 to 11, in *L. paulensis* 11 to 13 dorsal teeth.

In the specimens examined by me the length of the fingers of the second legs is rather variable, as is stated also by Kemp (1925) for his material; the palm of that leg, moreover, is more swollen in some specimens than in others. The relation between the length of the final tooth of the scaphocerite and that of the lamella equally proved to be too variable to be used for specific distinction in this case. The number of teeth of the upper margin of the rostrum in my material varies between 8 and 14, and there is no indication that a large number of teeth is connected with any of the other characters mentioned above. After examination of material in the U. S. National Museum, and in the Zoological Museum at Amsterdam, Holland, which was identified as *Palaemon paulensis,* and after comparing it with the large material of *Leander tenuicornis* at my disposal, I came to the conclusion that it is impossible to consider the two forms to be distinct species, or even varieties. *Palaemon paulensis* thus is synonymized here with *Leander*

*tenuicornis*. Schmitt (1935, p. 162) himself remarks also that in his material of *L. tenuicornis* some specimens were present, which "vary toward *P. paulensis* and in some degree are intermediate between that species and *P. tenuicornis*."

The specimens referred by Moreira (1901) to *Leander paulensis*, certainly do not belong to the present species as is shown by the rostral formulae of Moreira's material and by the fact that the fingers of the second chelae are stated by Moreira to be much shorter than the palm. There can be little doubt that Moreira's specimens in reality belong to *Palaemon northropi*.

The specimen from Arroyo, Porto Rico, identified by M. J. Rathbun (1902a) as *Palaemon affinis*, on examination proved to belong in the present species.

The present species was described for the first time by Fabricius (1781) under the name *Astacus locusta*. Fabricius's description runs as follows: "A[stacus] antennis posticis trifidis, thorace laeui, rostro porrecto supra serrato, subtus laeui, digitis elongatis filiformibus. Habitat ——— *Mus. Dom. Banks*. Statura praecedentis [*Astacus squilla*], at minor. Rostrum elongatum, supra serratum, subtus laeue. Thorax laeuis margine vtrinque vnidentato. Pedes antici elongati, filiformes. Manus ouatae, breues digitis elongatis, linearibus, acutis." In 1787 Fabricius identified the species with *Cancer pennaceus* of Linnaeus (1758), without, however, changing the name. *Cancer pennaceus* L. is no Palaemonid, but a Penaeid prawn, as is distinctly shown by Linnaeus's (1754) description in the Museum Adolphi Friderici, p. 87: "*Cancer macrourus, thorace cylindrico, rostro ensiformi margine superiore serrato. Testa* cylindrica, laevis, magnitudine astaci: Rostro ensiformi, compresso, margine superiore serrato. Os pinna utrinque pennacea, recurva. *Pedum* paria 5, teretia, cylindrica. *Chelae* tribus primis paribus angustae, aequales, laeves, parum uniformes, nec manus distinctae chelis majoribus. *Cauda* articulis 7, quorum postici supra carinati; ultimus subulatus, carina sulco excavata." That *Cancer pennaceus* is not identical with *Astacus locusta* is at once clear when one compares the statement of Linnaeus that his animal is as large as the crayfish and that of Fabricius that *A. locusta* is smaller than the prawn. In a later description of *Astacus locusta*, which is virtually the same as that of 1781, Fabricius (1793) gives the locality in which the species was collected: "Habitat in Oceano. Mus. Dom. Banks." Fabricius's description and also the locality he gives fits entirely for the present species. The only difference is the fact that in *Leander tenuicornis* the lower margin of the rostrum

bears several teeth, while Fabricius states that the margin is entire in his *A. locusta.* This difference, however, may be explained by that the hairs in the lower half of the rostrum entirely cover the lower rostral teeth. This was already found by Kemp (1925, p. 302) who remarks that the hairs "overlie the teeth and render them almost invisible, with the result that the species has more than once been described as having the lower border unarmed." Fabricius's name *locusta,* though being the first ever given to the present species, may not be used as it is invalid: *Astacus locusta* Fabricius (1781) namely is preoccupied by *Astacus locusta* Pennant (1777), a name given by the English author to *Cancer locusta* Linnaeus (1758), a species of Amphipoda, known at present as *Gammarus locusta* (L.).

Bosc (1801) gives a figure and a description of a prawn, which he names Pénée très-ponctué *(Penaeus punctatissimus)* and which he abundantly found "dans sa traversée d'Europe en Amérique - - - - - - - sur les fucus nageans." The figure is very poor, but makes it clear that we have not to do here with a Penaeid prawn. It is most probable in my opinion that the species in reality belongs to *Leander tenuicornis,* in favour of which supposition is the fact that the palms of the chelipeds are swollen and that the fingers are elongate. In Atlantic *Sargassum* three species of prawns are abundant: *Leander tenuicornis, Hippolyte coerulescens,* and *Latreutes fucorum.* The shape of the rostrum as figured by Bosc is totally different from that of the two latter species and shows most resemblance to that of *L. tenuicornis,* though differences may be observed. It is possible, however, that these differences are due to incorrectnesses in the figure. Bosc's description, at least with regard to the shape of the rostrum, that of the antenna and the situation of the eyes, probably is made after the figure, so that it is of no great help for the identification. Summarizing we may conclude that *Penaeus punctatissimus* differs strongly from all macruran Crustacea living on *Sargassum,* except for *Leander tenuicornis,* and that the differences shown may be due to errors in Bosc's figure. The poorness of Bosc's description and figure make certain identification not possible, so that it is better to disregard Bosc's name, which should be the oldest valid name for the present species, and to use the well known name of Say.

Tilesius (1818) figures a species, which he names *Penaeus adspersus* and which was found on high sea. The figure, which also is inserted in Krusenstern's (1814) Atlas without, however, being explained there, shows a remarkable resemblance to Bosc's figure of *Penaeus punctatissimus.* This resemblance is so strong, that it does not seem improbable

that Tilesius's figure is made after that of Bosc, the more as Tilesius gives *Penaeus punctatissimus* as a synonym for his species. Tilesius, however, corrected Bosc's figure in several points; so for instance the lower margin of the rostrum is figured serrate in the 1818 figure, while moreover there are shown three pairs of walking legs behind the large ~~scale~~ chelae instead of two.

Examination of the Pontoniinae described by Nobili (1899) showed that the specimen identified by him with *Periclimenes parasiticus* Borr., and part of the material brought by him to *Periclimenes tenuipes* Borr. actually are *Leander tenuicornis*. This material, which is preserved in the Museo Civico di Storia Naturale in Genoa, Italy, originates from Beagle Bay, Papua.

## Genus **PALAEMON** Weber, 1795

*Definition:* Rostrum well developed, toothed. Carapace smooth, with antennal and branchiostegal spines. Branchiostegal groove present.

Abdomen smooth. Telson with 2 pairs of dorsal and 2 pairs of posterior spines. Posterior margin of telson pointed. Two feathered setae between the inner posterior spines.

The mandible possesses a 2 or 3 jointed palp. The other oral parts and branchial formula as in *Macrobrachium*.

First pereiopods slender, smooth. Second legs equal, somewhat stronger than first, smooth. Last 3 legs slender. Dactylus simple. Generally a row of spines along the posterior margin of the propodus. Propodus of fifth leg with numerous transverse rows of hair in the distal part of its posterior margin.

*Type species: Cancer Squilla* Linnaeus, 1758, a species from the eastern Atlantic.

Pleopods and uropods as in *Macrobrachium*.

In the American fauna this genus is represented by the three ~~known~~ subgenera, namely *Palaemon* s.s., *Palaeander* and *Nematopalaemon*. The differences between these subgenera have already been given in the key (p. 2).

Nine species of the genus are known at present from American waters, five of these inhabit the west coast, four are found on the east coast.

The species may be distinguished as follows:

1. Rostrum with an elevated basal crest on dorsal margin. This crest formed by 3 to 5 teeth. No branchiostegal groove. Dactyli

of last three legs very elongate and slender, being longer than propodus and carpus combined. Subgenus *Nematopalaemon*. Only species . . . . . *Schmitti*

— Rostrum without an elevated basal crest. A distinct branchiostegal groove present. Dactyli of last three legs never more than about half as long as propodus . . . . . 2

2. Mandible with a 3-jointed palp. Only 1 tooth of upper margin of rostrum (seldom 2) placed behind posterior margin or orbit . . . . . Subgenus *Palaemon s.s.* 3

— Mandibular palp 2-jointed. Three teeth of upper margin of rostrum placed behind posterior margin of orbit (3rd tooth sometimes just over that margin). Apex of rostrum with subapical tooth. Lower margin with 3 to 7 teeth. Carpus of second leg about as long as chela. Eastern . . Subgenus *Palaeander* 8

3. Rostrum ending in a sharp point, without subapical teeth. Lower margin of rostrum with 2 to 4 teeth. Western . . . . . 4

— Rostrum with 1 or more subapical teeth. Lower margin with 5 to 16 teeth . . . . . 6

4. Carpus of second leg shorter than palm. Upper margin of rostrum about straight, never convex. Tip of rostrum not conspicuously sword-like lengthened . . . . . *ritteri*

— Carpus of second leg longer than palm . . . . . 5

5. Upper margin of rostrum convex. Rostrum rather short, tip not conspicuously lengthened. Second legs reaching distinctly beyond scaphocerite . . . . . *peruanus*

— Upper margin of rostrum about straight. Rostrum slender, ending in an elongate sword-like untoothed apex. Second legs at most reaching to end of scaphocerite . . . . . *gladiator*

6. Telson gradually tapering towards a sharp point posteriorly, no distinct posterior margin present. Posterior spines of telson far overreached by the tip. Western . . . . . 7

— Telson ending in a distinct posterior margin, which in the middle is provided with a small sharp point. This point is overreached by the middle pair of posterior spines. Eastern. *pandaliformis*

7. Lower margin of rostrum with 9 to 12 teeth. Last joint of third maxilliped as long as penultimate joint. Second legs less slender than first, with fingers as long as palm, and carpus distinctly less than twice as long as chela. . . . . *gracilis*

— Lower margin of rostrum with 12 to 16 (seldom 11) teeth. Last joint of third maxilliped 0.7 times as long as penultimate. Second legs as slender as first, fingers shorter than palm, carpus twice as long as chela. . . . . *hancocki*

8. Rostrum high, lower margin with 3 or 4 teeth. Fingers of second legs 2/3 of length of palm or shorter. . . . . *northropi*
— Rostrum slender, lower margin with 5 to 7 teeth. Fingers of second legs more than 2/3 of length of palm. . . *floridanus*

## NEMATOPALAEMON Holthuis, 1950a

This new subgenus of which only one species is represented in American waters, is characterized by the following characteristics:

1. The rostrum is very long and slender, and has the basal dorsal teeth placed on an elevated basal crest.

2. No branchiostegal groove is present on the carapace.

3. The pleurae of the fourth and fifth abdominal segments have the tips produced posteriorly and broadly rounded.

4. The mandibular palp is three-jointed.

5. The dactyli of the last three pairs of legs are excessively long and thin, being longer than the propodus and carpus combined.

6. The pleopods are much elongated.

The type of this subgenus is *Leander tenuipes* Henderson, 1893, from the indo-westpacific region.

The subgenus contains three species: *Palaemon tenuipes* (Henderson) from the indo-westpacific region, *Palaemon hastatus* Aurivillius from West Africa and the present form.

### Palaemon (Nematopalaemon) schmitti Holthuis

Pl. 43, figs. a-l

*Palaemon schmitti* Holthuis, 1950, Proc. Kon. Nederl. Akad. Wetensch., vol. 53, p. 97.

*Palaemon (Nematopalaemon) schmitti* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 9.

*Palaemon schmitti* Holthuis, 1950b, Zool. Meded., vol. 31, p. 36.

*Description:* The rostrum is very long and slender, it is distinctly longer than the carapace. The ultimate part of the rostrum is directed somewhat upwards. A basal crest of three or four (generally four and seldom five) teeth is present on the dorsal margin. Of these teeth one or two are placed behind the orbit, while a small notch is visible some distance behind the first tooth. The rest of the upper margin is unarmed, except for a small subapical tooth. The lower margin bears seven to nine, generally eight teeth, which are rather small and are regularly divided over the ultimate 2/3 of the lower margin. The carapace is

smooth and is provided with antennal and branchiostegal spines. No branchiostegal groove is present. A short carina extends backwards from the branchiostegal spine. The abdomen is smooth. The pleurae of the first four segments are truncated and have the distal margin slightly emarginate. The fifth segment has the pleurae posteriorly produced into an elongate lobe, which has the apex rounded. The sixth segment has the pleurae small and pointed, also the posterolateral angles are pointed. The sixth segment is somewhat less than twice as long as the fifth. The telson is a little longer than the sixth segment. The dorsal surface of the telson bears two pairs of spinules. These spinules are very small; the anterior pair is placed in about the middle of the telson, the posterior pair is situated halfway between the anterior pair and the posterior margin of the telson. The posterior margin of the telson ends in a median point and bears at each side of this point two spines and a seta: the outer spines are very small the inner are larger.

The eyes are well developed.

The basal segment of the antennular peduncle is large. The stylocerite is slender and pointed, it reaches about to the middle of the basal segment. On the upper surface the stylocerite bears a carina, which dorsally forms a large anteriorly pointed tooth. The anterolateral angle of the basal segment bears a distinct spine, which overreaches the anterior margin of the segment. The second segment is very short, being distinctly shorter and narrower than the third. The upper antennular flagellum has the two rami fused for about five joints. The shorter ramus has the free part consisting of about eight indistinct joints, it is longer than the fused portion.

The scaphocerite is slender, it reaches distinctly beyond the antennular peduncle, but fails by far to attain the end of the rostrum. It is four times as long as broad. The outer margin is about straight and ends in a distinct final tooth, which is overreached by the lamella. The antennal peduncle by far fails to reach the middle of the scaphocerite. An external spine is present near the base of the scaphocerite.

The mandible has a well developed three-jointed palp, the incisor process ends in some teeth, the molar process in some blunt knobs. The maxillula has the inner lacinia slender, the palp is distinctly bifid. The maxilla has the endite deeply cleft, the scaphognathite is well developed and not very broad. Exopods are present on all maxillipeds. The first maxilliped has the coxa and basis separated by a distinct notch, the palp is well developed, the exopod has the caridean lobe rather broad, the epipod is indistinctly bilobed. The second maxilliped is nor-

mal in shape, a podobranch is present on the epipod. The third maxilliped fails to reach the end of the scaphocerite. It is very slender. The last joint is slightly shorter than the penultimate and about 0.7 times as long as the antepenultimate. The exopod fails by far to reach the end of the antepenultimate segment.

The first pereiopod reaches with the tips of the fingers beyond the scaphocerite. The fingers are 1.5 times as long as the palm. The palm is 4/3 as long as the chela and slightly shorter than the merus. The ischium is about 3/5 of the length of the merus. The second legs are stronger than the first, they are equal and reach with the chela, sometimes with the carpus, beyond the scaphocerite. The fingers are long and slender, being twice to almost twice as long as the palm, their tips are crossing. No teeth are visible on the cutting edges. The palm is slightly swollen. The carpus measures 2/3 of the length of the palm. The merus is about thrice as long as the carpus, it is swollen in the proximal part. The ischium is almost half as long as the merus. The last three legs are extremely long and slender. The third leg reaches with part of the propodus beyond the scaphocerite. The dactylus is enormously long and slender, being at least as long as propodus and carpus combined (as in none of my specimens the dactylus is undamaged, I am not able to give the exact length of this joint). The propodus is twice as long as the carpus and slightly shorter than the merus. The fourth and fifth legs are still more slender than the third. The carpus, merus and ischium are about of the same size as in the third leg, but the propodus and the dactylus are much longer. Transverse rows of short hairs are visible in the distal part of the posterior margin of the fifth legs. No spinules are visible on any of the propodi of the last three legs.

The endopod of the first pleopod of the male is ovate, with the inner margin about straight. No appendix interna is present. The second pleopods of the male have the appendix masculina slightly shorter than the appendix interna. The first pleopods, when extended anteriorly, reach about to the posterior limit of the orbits.

The uropods are elongate ovate. The outer margin of the exopod is concave and ends in a strong tooth, which at its inner side is provided with a slender movable spinule.

*Size:* My specimens vary in length between 40 and 70 mm. Ovigerous females are 55 to 70 mm long. The eggs are numerous and small, measuring 0.4 to 0.6 mm in diameter.

*Material examined:* In the Rijksmuseum van Natuurlijke Historie at Leiden, Holland, material of this species is present from: Shrimp traps in the mouth of the Surinam River near Resolutie, Surinam (December 22, 1942, D. C. Geijskes coll.), mouth of Warappa Creek near Matappica, north bank of Commewijne River, just E. of Paramaribo, Surinam (December 11, 1942, D. C. Geijskes coll.), shore of the Surinam River near Paramaribo, Surinam (December, 1949, D. C. Geijskes coll.). Specimens from the first mentioned lot have been presented by the Leiden Museum to the U. S. National Museum, Washington, D. C.

*Type:* Holotype is a specimen from the first mentioned lot (Surinam River near Resolutie). It is preserved in the Leiden Museum, where also the larger part of the paratypes is stored. The rest of the paratypes is in the possession of the U. S. National Museum.

*Remarks:* The present species is most closely related to *Palaemon (Nematopalaemon) tenuipes* (Henderson) from India and *Palaemon (Nematopalaemon) hastatus* Aurivillius from West Africa. The three species are characterized by the enormous prolongation of the dactyli of the last three legs, and differ in that respect from all other species of *Palaemon. Palaemon (Nematopalaemon) schmitti* differs from *P. tenuipes* by having the rostrum longer, with less dorsal and more ventral teeth. The rostral formula of *P. schmitti* is $\frac{3\text{-}4 + 1}{7\text{-}9}$ of *P. tenuipes* it is $\frac{4\text{-}6 + 1}{2\text{-}6}$ (Kemp gives 5 to 7 teeth for the basal crest, as he includes the little notch behind the first tooth as a regular tooth). Furthermore, the last joint of the third maxilliped in *P. tenuipes* is relatively shorter than that in *P. schmitti.* Also the sixth abdominal segment in *P. schmitti* is longer than that in *P. tenuipes,* being more than 2/3 of the length of the carapace. *Palaemon schmitti* differs from the West African *P. hastatus* in the rostral formula too. This formula in *P. hastatus* namely is $\frac{7\text{-}11 + 1}{3\text{-}6}$. The carpus of the second legs in *P. hastatus* furthermore is relatively longer than in the American species.

## Subgenus **PALAEMON** Weber, 1795

The characters in which this subgenus differs from the other subgenera of the genus *Palaemon* are:

1. The rostrum never is provided with an elevated basal crest of dorsal teeth.

2. The branchiostegal groove always is distinct.

3. The pleurae of the fifth abdominal segment generally end in a small tooth or sharp point.

4. The mandible is provided with a three-jointed palp.

5. The dactyli of the last three pairs of legs never are excessively long, always being less than half as long as the propodus.

6. The pleopods never are conspicuously elongated.

### Palaemon (Palaemon) ritteri Holmes

Pl. 44, figs. a-g

*Palaemon Ritteri* Holmes, 1895, Proc. Calif. Acad. Sci., ser. 2, vol. 4, p. 579, pl. 21, figs. 29-35.

*Palaemon ritteri* Kingsley, 1899, Amer. Nat., vol. 33, p. 37.

*Palaemon Ritteri* Holmes, 1900, Occ. Pap. Calif. Acad. Sci., vol. 7, p. 216.

*Leander Ritteri* Nobili, 1901, Boll. Mus. Zool. Anat. comp. Torino, vol. 16, n. 415, p. 4.

*Palaemon ritteri* M. J. Rathbun, 1904, Harriman Alaska Exped., vol. 10, p. 29.

non *Palaemon ritteri* ? M. J. Rathbun, 1910, Proc. U. S. Nat. Mus., vol. 38, p. 561, pl. 53, fig. 1.

*Palaemon ritteri* Schmitt, 1921, Univ. Calif. Publ. Zool., vol. 23, p. 35, fig. 21; Schmitt, 1924, Proc. Calif. Acad. Sci., ser. 4, vol. 13, p. 386.

*Palaemon ritteri* p.p. Schmitt, 1924, Zoologica, New York, vol. 5, p. 168.

*Palaemon ritteri* Sivertsen, 1934, Nyt. Mag. Naturvid., vol. 74, p. 4; Chace, 1937, Zoologica, New York, vol. 22, p. 131; Hult, 1938, Ark. Zool., vol. 30A, pt. 5, p. 6.

non *Palaemon ritteri* Schmitt, 1939, Smithson. Misc. Coll., vol. 98, n. 6, p. 25.

*Palaemon ritteri* Steinbeck and Ricketts, 1941, Sea of Cortez, p. 446.

*Palaemon (Palaemon) ritteri* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 8.

*Description:* The rostrum is rather high, it reaches to or beyond the scaphocerite. The upper margin is straight and bears 8 to 10 (generally 8 or 9) teeth, the first or first 2 of which are placed on the carapace, the 3rd being placed generally over the orbital margin. The other teeth are divided regularly over the rostrum, except for a distinct unarmed space before the apex. The lower margin bears 3 teeth (seldom 4), here, too, the distal part is unarmed. The tip of the rostrum is sharp and pointed, without subapical spines. The branchiostegal spine is placed on the anterior margin of the carapace.

The 6th abdominal segment is somewhat more than 1.5 times as long as the fifth, and almost as long as the telson. The dorsal spines of the telson are placed at ½ and ¾ of its length. Of the 2 pairs of posterior spines the inner are longest and overreach the median point of the posterior margin of the telson, 2 feathered setae are placed between the inner spines.

The eyes have 2 bands of dark pigment over the cornea.

The basal segment of the antennula has the anterior margin convex. The anterolateral tooth is distinct, failing to reach beyond the middle of the 2nd segment, but overreaching the anterior margin of the basal segment. The 2 rami of the inner flagellum are fused for about 4 to 6 joints. The free part of the shorter ramus consists of 15 to 26 joints and is much more than twice as long as the fused part.

The scaphocerite is about thrice as long as broad. The lamella distinctly overreaches the final tooth.

The first legs distinctly fail to reach the end of the scaphocerite. The fingers are about as long as the palm. The carpus is 1.5 times as long as the chela and slightly longer than the merus. The second legs reach about to the end of the scaphocerite. The fingers measure about 3/5 to 4/5 of the length of the palm. The dactylus bears in the proximal part of its cutting edge 2 very small teeth, the cutting edge of the fixed finger bears one similar tooth, which is situated between the 2 upper teeth. The carpus is about as long as the fingers and about 3/5 of the length of the merus. The third leg reaches to or just beyond the end of the scaphocerite, in younger specimens it is relatively shorter, failing to reach the end of that scale. The propodus is 2.5 to almost 3 times as long as the dactylus, twice as long as the carpus and almost as long as the merus. The fifth leg reaches about almost to the end of the scaphocerite, in young specimens to the middle of this scale. The propodus is fully thrice as long as the dactylus, about twice as long as the carpus and slightly longer than the merus.

The pleopods and uropods are normal in shape.

*Size:* The largest specimen seen by me is 40 mm long. A late larva, which to all probability has to be assigned to the present species is 14 mm long. Ovigerous females are 24 to 37 mm long in my material. The eggs are numerous and small, being 0.4 to 0.7 mm in diameter.

*Colour:* The colour notes made of a specimen of 40 mm from Charles Island, Galapagos (Allan Hancock Expedition, 1934) runs as follows: "Body with somewhat oblique dark bars of brownish on each somite, almost in the same straight line, these bars are placed rather close together."

*Material examined:* The Allan Hancock Expeditions 1933 to 1937 and 1940 collected more than 500 specimens of this species. The localities are:

Gulf of California, Mexico: Angel de la Guardia Island, Puerto Refugio. Shore, rock, Mar. 20, 1937, Sta. 707-37; Turner's Island, S. of Tiburon Island. Shore, rocky reef, Jan. 24, 1940, Sta. 1042-40; Mangles Anchorage. Shore, rock, Feb. 28, 1936, Sta. 527-36; Agua Verde Bay, San Marcial Reef. Shore, Mar. 10, 1937, Sta. 659-37; San Francisco Island, North Bay. Shore, rock, sand, Feb. 25, 1936, Sta. 518-36. Channel N. of Island, coral, 22 fms, Mar. 8, 1937, Sta. 647-37; Cabeza Ballena, E. of Cape San Lucas. Shore, rock, tidepools, Mar. 4, 1937, Sta. 623-37.

Sonora, Mexico: Tepoca Bay. Shore, rock, reef, Feb. 3, 1940, Sta. 1076-40. Shore, rock, reef, Feb. 4, 1940, Sta. 1077-40.

Panama: Secas Islands. Shore, rock, coral cove, Feb. 4, 1935, Sta. 446b-35. Shore, tide flats, coral, Feb. 6, 1935, Sta. 454-35. 5-20 fms, mud, sand, Feb. 6, 1935, Sta. 458-35.

Colombia: Cupica Bay. Shore, rock, Jan. 26, 1935, Sta. 427-35.

Ecuador: Santa Elena Bay. S. of La Libertad, shore, rock, Jan. 20, 1933, Sta. 16-33. Near south shore, 5-7 fms, rock, shells, gorgonids, Feb. 9, 1934, Sta. 210-34; S. of Santa Elena Point. Shore, rock, Jan. 18, 1933, Sta. 10-33. Manta Bay. Shore, rock, sand, Jan. 19, 1935, Sta. 400-35. W. of Manta, reef with breakers, Jan. 20, 1935, Sta. 403-35.

Cocos Island (Costa Rica): Wafer Bay. Off Treasure Camp Flat, shore, rock, Mar. 1, 1933, Sta. 105-33. Shore, rock, Mar. 2, 1933, Sta. 107-33.

Galapagos Islands (Ecuador): Tower Island, Darwin Bay, Seal Beach No. 1. Shallow water, rock, Feb. 24, 1933, Sta. 96-33. Shore, rock, Feb. 26, 1933, Sta. 101-33; Tower Island, Darwin Bay, Lagoon Beach. Shore, Feb. 22, 1933, Sta. 93-33; Albemarle Island, Cartago Bay. Anchorage, collected with electric light, Feb. 12, 1933, Sta. 72-33. North Beach, last large beach to north, at about the end of the bay proper, rock, sand, mangroves, Feb. 13, 1933, Sta. 73-33; James Island, James Bay. Shore, rock, sand, under and about large boulders, Feb. 12, 1933, Sta. 71-33. James Island, Sulivan Bay. Shore, rock, Dec. 12, 1934, Sta. 343-35; South Seymour Island, Iguana Beach, west shore. Rock, sand, fiddler crabs, Feb. 19, 1933, Sta. 88-33. Rock, sand, Jan. 22, 1934, Sta. 174-34; Indefatigable Island, Conway Bay, small island

in bay. Shore, rock, Feb. 17, 1933, Sta. 82-33; Indefatigable Island, Academy Bay. From up estuary near dam, where mullets were caught, and from shallow waters around rocks near cannery, Feb. 3, 1933, Sta. 49-33; Charles Island, Black Beach. Shore, rock, Jan. 27, 1933, Sta. 33-33. Shore, rock, Jan. 19, 1934, Sta. 166-34.

In the United States National Museum material of this species is present from: Lower California, Mexico (San Bartolomé Bay, Magdalena Bay, La Paz Harbour, Carmen Island, Puerto Refugio on Angel de la Guardia Island, San Felipe, S. end of Tiburon Island), Panama (Chamé Point; Balboa; Panama City; Taboga Island), Ecuador (Salinas), Peru (Paita), Cocos Island, Galapagos Islands (James Island; S. Seymour Island; Indefatigable Island; Eden Island near Indefatigable Island; Chatham Island; Charles Island; Hood Island). Furthermore specimens of this species are present, which bear the labels: Colon Reef, Colon, Panama (Mar. 12, 1912, S. E. Meek & S. F. Hildebrand coll.), and Jacuque Point, Gulf of Venezuela (Jan. 26, 1925). If these labels are correct, then the species occurs also on the Atlantic coast of Central and South America.

In the Turin Museum I examined the specimens reported by Nobili (1901) from Santa Elena Bay, Ecuador.

*Distribution:* The present species is found along the shores of W. America from San Diego (California) to Paita (Peru) and the Cocos and Galapagos Islands. The records in literature are: San Diego, California (Holmes, 1895, 1900), San Bartolomé Bay, west coast of Lower California! (M. J. Rathbun, 1904), Magdalena Bay, west coast of Lower California! (M. J. Rathbun, 1904! Chace, 1937), La Paz Harbour, Gulf of California! (M. J. Rathbun, 1904), Carmen Island, Gulf of California! (M. J. Rathbun, 1904! Schmitt, 1924), Santa Inez Bay, Gulf of California (Chace, 1939), Puerto Refugio, Angel de la Guardia Island, Gulf of California! (Steinbeck and Ricketts, 1941), S. end of Tiburon Island, Gulf of California! (Steinbeck and Ricketts, 1941), Santa Elena Bay, Ecuador! (Nobili, 1901), Galapagos (Hult, 1938), Tower Island, S. Seymour Island! and Eden Island! Galapagos (Schmitt, 1924b), Post Office Bay, Charles Island, Galapagos (Sivertsen, 1934).

*Type:* Type locality is San Diego. The type specimen in all probability is no longer extant.

*Remarks:* The species is most closely related to the next. The differences will be pointed out there. The specimens mentioned by Schmitt

(1939) as belonging to this species proved to be a separate, though closely related form. Also the specimen reported upon by Miss Rathbun (1910) as being probably *Palaemon ritteri* certainly does not belong to this species.

*Larval stages:* The larvae at my disposal show a striking resemblance to the fifth stage *Palaemon longirostris* as figured by Gurney (1924, fig. 6). The rostrum is higher, with the more sharply upturned top rapidly narrowing in a sharp point. The 3 teeth on the carapace are placed different: the posterior, which is the smallest, stands much closer to the posterior margin of the carapace, the second is placed in or slightly behind the middle, it is larger than the first and smaller than the third tooth, which stands just over the posterior orbital margin. The fourth leg is provided with an exopod. My specimens agree with all other characters mentioned by Gurney for *"Leander longirostris."* The 2 rami of the inner antennular flagellum are already distinctly visible. In some of the specimens traces of the final denticulation of the rostrum already are visible before the anterior tooth.

*Size:* 16 mm.

The 10 specimens at my disposal were collected by the Allan Hancock Expeditions, 1933, 1934, and 1935, at the following localities:

N. Colombia: Cupica Bay. Anchorage, caught with electric light, Jan. 26, 1935, Sta. 428-35.

Ecuador: Off La Libertad. Anchorage, caught with electric light, Jan. 17, 1933, Sta. 8-33. Anchorage, caught with electric light, Jan. 20, 1933, Sta. 17-33.

Cocos Island (Costa Rica): Chatham Bay. Taken with dipnet from log over ship's side, together with *Plagusia* specimens and young fish, Feb. 28, 1933.

Galapagos Islands (Ecuador): Albemarle Island, Tagus Cove. Anchorage, caught with electric light, Jan. 13, 1934, Sta. 151-34.

Another *Palaemon* larva was collected together with the previous form at Cupica Bay, N. Colombia. It differs from the previous in the following characters: The rostrum is shorter, higher and straighter. It largely fails to reach the end of the scaphocerite. There are only 2 teeth on the dorsal margin of the carapace, a very small one placed in the middle of the carapace and a larger somewhat before the posterior orbital margin. Length 15 mm.

In all probability the first mentioned form is one of the stages of *Palaemon ritteri* Holmes, the identity of the 2nd form is not known.

## Palaemon (Palaemon) gladiator Holthuis

Pl. 44, figs. h-l

*Palaemon* sp. M. J. Rathbun, 1902, Proc. Wash. Acad. Sci., vol. 4, p. 291.

*Palaemon ritteri* p.p. Schmitt, 1924, Zoologica, New York, vol. 5, p. 168.

*Palaemon ritteri* Schmitt, 1939, Smithson. Misc. Coll., vol. 98, n. 6, p. 25 (non Holmes, 1895).

*Palaemon gladiator* Holthuis, 1950, Proc. Kon. Nederl. Akad. Wetensch., vol. 53, p. 96.

*Palaemon (Palaemon) gladiator* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 7.

*Description:* The rostrum is slender, reaching slightly beyond the scaphocerite. The basal part is straight, the tip is directed upwards. The upper margin bears 8 or 9 teeth (seldom 7), the first 2 of which are placed behind the orbital margin, the third standing over the orbit. The extreme ½ to ⅓ of the length of the rostrum is devoid of teeth, on the upper as well as on the lower margin, the apex thereby being sword-like in shape. The lower margin bears three (seldom 2 or 4) teeth, the anterior of which is placed slightly before the anterior tooth of the upper margin. The rostrum shows some resemblance to that of the indo-westpacific *Palaemon semmelinki* (De Man). The carapace is smooth, provided with antennal and branchiostegal spines and a branchiostegal groove. The branchiostegal spine is placed on the anterior margin of the carapace.

The abdomen is smooth. The fifth segment has the pleura ending in a rather indistinct angle. The sixth segment is almost twice as long as the fifth, and slightly longer than the telson. The dorsal surface of the telson bears 2 pairs of spinules, one in the middle and one at ¾ of its length. The posterior margin ends in an acute median point, which at each side is flanked by 2 spines, the inner of which overreaches the tip. Between these inner spines 2 feathered setae are present.

The eyes are well developed. None of my specimens bears 2 bands of pigment over the cornea, as is the case in many of my specimens of *P. ritteri.*

The stylocerite reaches about to the middle of the length of the basal segment at the antennular peduncle. The anterior margin of this segment is rounded and overreaches slightly, or reaches as far forward as, the anterolateral spine. The third segment is longer and narrower than the second. The fused part of the 2 rami of the inner antennular fla-

gellum consists of 6 to 10 joints, the free part, which is 1.5 times to almost twice as long as the fused part, consists of 13-19 joints.

The scaphocerite is 3 to 3.5 times as long as broad, the outer margin is slightly concave. The final tooth is distinctly overreached by the lamella.

The oral parts are normal. The mandible bears a three-jointed palp.

The first legs reach slightly beyond the antennular peduncle, but fail to reach to the end of the scaphocerite. The fingers are as long as the palm. The carpus is somewhat less than twice as long as the chela and slightly longer than the merus. The second legs are only very little stronger than the first legs and reach almost to the tip of the final tooth of the scaphocerite in the female, in the male they even reach less far forwards. The fingers measure about ⅔ to ¾ of the length of the palm. Only faint teeth are visible on the cutting edges. The palm is cylindrical, not swollen. The carpus is elongate being slightly shorter than the chela, but longer than the palm and half the length of the fingers combined. The merus is about as long as the carpus and somewhat longer than the ischium. The third legs reach to the end of the antennular peduncle. The propodus is about thrice as long as the dactylus, about twice as long as the carpus and somewhat shorter than the merus. The ischium is half as long as the merus. The fifth pereiopod reaches about as far forwards as the third. The propodus is about four times as long as the dactylus, twice as long as the carpus, as long as the merus and twice as long as the ischium. Spinules are present along the posterior margin of the propodus of all last three legs, while the fifth leg has the usual transverse rows of setae in the distal part of that margin. In the male the legs reach less far forwards.

Pleopods and uropods are normal.

The above description is made after an ovigerous female, while the differences with the males are mentioned. Juvenile specimens have the 6th abdominal segment relatively longer, the fused part of the 2 rami of the inner antennular flagellum is distinctly longer than the free part. Furthermore the legs reach less far forwards.

*Size:* The largest male specimen seen by me measures 30 mm. Ovigerous females are 27 to 35 mm long. The eggs are numerous and small and measure 0.5 to 0.7 mm.

*Material examined:* The Allan Hancock Expeditions 1933 and 1934 collected 28 specimens of this species in the following localities:

Galapagos Islands (Ecuador): Tower Island, Darwin Bay, Seal Beach No. 1. Shallow water, coral, Feb. 22, 1933, Sta. 94-33, 1 speci-

men; Narborough Island, N.E. point opposite Tagus Cove on Albemarle Island. Shore, mangroves, Jan. 14, 1934, Sta. 153-34, 17 specimens; Indefatigable Island, Academy Bay. Shore, rock, from up estuary near dam where mullets were caught, Feb. 3, 1933, Sta. 49-33, 10 specimens (5 ovigerous females).

Furthermore the collection of the Allan Hancock Foundation possesses the following material of this species:

Narborough Island, Galapagos, dipnet from deck, May 28, 1932, *Zaca* Expedition, 1 specimen; Academy Bay, Indefatigable Island, Galapagos, May 11, 1932, *Zaca* Expedition, 29 specimens (6 ovigerous females).

In the collections of the U. S. National Museum specimens of this new species are present from:

Clipperton Island, Lagoon, Nov. 23, 1898, Hopkins Stanford Galapagos Expedition, 1898-1899. 1 specimen.

Narborough Island, Galapagos, shore, east side, opposite Tagus Cove on Albemarle Island, July 25, 1938, W. L. Schmitt coll., Franklin D. Roosevelt Presidential Cruise, 1938, 4 specimens.

*Distribution:* The species seems to be confined to the Galapagos Islands and Clipperton Island. On the former group it was collected together with *Palaemon ritteri,* while it was lacking in all *ritteri* material from the mainland seen by me.

*Type:* Holotype (U.S.N.M. Cat. No. 90964) is the largest ovigerous female from Indefatigable Island (Allan Hancock Expedition, 1933). All type material is deposited in the U. S. National Museum, except part of the Allan Hancock material which is preserved in the collection of the Allan Hancock Foundation, Los Angeles.

*Remarks:* The species is closely related to *Palaemon ritteri,* but may be distinguished from that form by having the rostrum more slender and ending in a long unarmed sword-like apex, furthermore the sixth abdominal segment is much longer, the anterolateral spine of the basal segment of the antennular peduncle is much smaller, the free portion of the shorter ramus of the antennular flagellum is less than twice as long as the fused portion (in *Palaemon ritteri* it is much more than twice as long), the carpus of the second leg is much longer than the palm (in *P. ritteri* it is distinctly shorter than the palm), and the last three legs are more slender. These differences prove to be constant in my material and even juvenile specimens may be readily recognized. The species first was mentioned in literature by M. J. Rathbun (1902) as *Palaemon* sp. from Clipperton Island. Rathbun mentions some of the differences be-

tween the present species and *P. ritteri.* I examined the specimen, which at present is preserved in the U. S. National Museum and found it identical with the present new species. Schmitt (1924), discusses Rathbun's specimen; he thought the strange shape of the rostrum to be an abnormality, and the other differences to be only due to variation. In 1939 Schmitt in his enumeration of the Crustacea Decapoda collected during the 1938 Presidential Cruise mentions 4 specimens of *Palaemon ritteri* from Narborough Island, Galapagos, which on examination (the material is preserved in the U. S. National Museum) showed to belong to *Palaemon gladiator* n. sp. The fact that both Rathbun and Schmitt did not recognize their material to belong to a species different from *Palaemon ritteri,* in all probability is due to the small number of specimens of this new form at their disposal. By the large amount of material collected by the Allan Hancock Expedition in addition to which I studied the material of the U. S. National Museum made it possible for me to distinguish these 2 forms as distinct species.

### **Palaemon (Palaemon) peruanus** Holthuis

Pl. 45, figs. a-e

*Palaemon ritteri?* M. J. Rathbun, 1910, Proc. U. S. Nat. Mus., vol. 38, p. 561, pl. 53, fig. 1.

*Palaemon ritteri* p.p. Schmitt, 1924, Zoologica, New York, vol. 5, p. 169.

*Palaemon peruanus* Holthuis, 1950, Proc. Kon. Nederl. Akad. Wetensch., vol. 53, p. 97.

*Palaemon (Palaemon) peruanus* Holthuis, 1950a, Siboga Exped., mon., 39a9, p. 8.

*Description:* The rostrum is rather high and straight, reaching almost to the end of the scaphocerite. The upper margin is convex and bears 9 teeth, which are rather regularly divided over the upper margin, the first 2 are placed on the carapace behind the orbit. The apex of the rostrum is sharp and simple, it bears no subapical teeth. The lower margin bears 2 teeth.[12] The carapace is smooth and is provided with antennal and branchiostegal spines and a branchiostegal groove. The branchiostegal spine is placed on the anterior margin of the carapace.

The abdomen is smooth. The pleura of the fifth segment ends in an indistinct angle. The sixth segment is 1.5 times as long as the fifth, and as long as the telson. The spines on the telson are similarly arranged as in the previous species.

[12] Rathbun (1910) erroneously states the specimen to have 3 ventral teeth.

The eyes are well developed.

The stylocerite reaches almost to the middle of the basal segment of the antennular peduncle. The anterolateral spine is distinct, but is far overreached by the strongly convex anterior margin of the basal segment. The third segment is somewhat longer and slightly narrower than the second. The inner antennular flagellum has the two rami fused for 7 joints, the free portion consists of 20 joints, which, however, are rather indistinct in my material.' The free part is much more than twice as long as the fused portion.

The scaphocerite is about thrice as long as broad. The final tooth is distinct and is far overreached by the lamella, the outer margin is somewhat concave.

The first legs reach to the end of the scaphocerite. The fingers are as long as the palm, the carpus is 7/6 as long as the chela. The merus is almost as long as the carpus. The second legs reach with the chela beyond the scaphocerite. The fingers are 4/5 as long as the palm, their cutting edges are provided with 2 small teeth in the proximal part. The palm is slightly swollen. The carpus is slightly longer than the palm and half the length of the fingers combined. The merus is as long as the carpus. The ischium is somewhat shorter than the carpus. The third leg reaches with a small part of the propodus beyond the scaphocerite. The propodus is somewhat less than thrice as long as the dactylus, less than twice as long as the carpus and somewhat shorter than the merus. The fifth leg reaches as far forwards as the third, the relations between the lengths of the joints are not essentially different from those in the third leg.

The pleopods and uropods of my only male specimen are normal.

*Size:* The only specimen measures 23 mm.

*Material examined:* The specimen seen by me comes from salt creeks at La Palisada near Tumbes, N. Peru (Feb. 12, 1908; R. E. Coker coll.), and is preserved in the U. S. National Museum (Cat. No. 40504).

*Remarks:* The specimen has been reported upon and figured by M. J. Rathbun (1910) who referred it with some doubt to *Palaemon ritteri.* Schmitt (1924) gives some additional details of the specimen.

The specimen certainly is closely related to *Palaemon ritteri,* but nevertheless it is different, as is shown by the elongate carpus of the second legs. The specimen in some ways is intermediate between *P. ritteri* and *P. gladiator.* The rostrum shows most resemblance to that of *P. ritteri,* though it is shorter and has the upper margin convex, the teeth moreover are placed closer to the tip. The 6th abdominal segment is just like

in *P. ritteri.* It has the anterior margin of the basal segment of the antennular peduncle produced much farther forwards than in either *P. ritteri* or *P. gladiator,* resembling however in this respect most *P. gladiator.* The antennular flagellum looks most like that in *P. ritteri.* The fingers of the 2nd legs are distinctly longer than in either of the 2 other species, the carpus resembling that in *P. gladiator.* The legs of the present specimen reach much farther forwards than in either *P. ritteri* or *gladiator.*

This evidence makes it pretty sure that the present specimen represents a new species. Though I hesitate to found a new species on a single specimen I think it the best way to do it here, as the specimen has twice been mentioned in literature and moreover has been figured.

### Palaemon (Palaemon) gracilis (Smith)

Pl. 45, figs. f-l

*Leander gracilis* Smith, 1871, Rep. Peabody Acad. Sci., 1869, p. 97; Kingsley, 1878a, Bull. Essex Inst., vol. 10, p. 66.

*Palaemon (Leander) gracilis* Thallwitz, 1892, Abh. Ber. zool. anthrop. Mus. Dresden, 1890-91, pt. 3, p. 8.

*Palaemon Lamarrei* Nobili, 1897, Boll. Mus. Zool. Anat. Comp. Torino, vol. 12, n. 280, p. 5. (non H. Milne Edwards, 1837.)

*Leander gracilis* Kemp, 1925, Rec. Indian Mus., vol. 27, p. 290.

*Palaemon (Palaemon) gracilis* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 7.

*Description:* The rostrum is very long and slender, it reaches far beyond the scaphocerite and has the ultimate half curved upwards. The upper margin bears 5 to 7 (generally 6) teeth in the proximal half, the ultimate half, except for two or three subapical teeth is entire. The first of the dorsal teeth is placed behind the orbit on the carapace proper, the second is placed over the orbit. The lower margin of the rostrum is provided with 9-12 teeth which give the lower margin an evenly serrate appearance, the distance between the ultimate tooth and the apex of the rostrum being somewhat larger than that between the teeth themselves. The carapace is smooth. The branchiostegal spine is placed on the anterior margin.

The abdomen is smooth. The pleura of the fifth segment is produced posteriorly and ends in a rounded top. The sixth segment is about twice as long as the fifth and as long as the telson. The telson has the anterior pair of dorsal spinules placed some distance behind the middle of its length. The posterior pair of spinules lies slightly closer to the an-

terior pair than to the posterior point of the telson. The telson gradually tapers in a sharp tip, there is no distinct posterior margin. The posterior spines only may be seen as small prickles in the posterior part of the lateral margin, they are far overreached by the apex of the telson.

The eyes are normal in shape. No pigment bands are visible in my material.

The stylocerite is very small, it fails to reach the middle of the basal segment of the antennular peduncle. On its dorsal surface it bears a high and rounded crest. The anterior margin of this segment is strongly produced forward and reaches almost to the end of the second segment of the peduncle, and far overreaches the anterolateral spine. The second and third segments of the peduncle are of about the same breadth, but the third is longer than the second. The 2 rami of the inner antennular flagellum are fused for 6 to 10 joints, the free portion is composed of 28 to 44 joints and is at least thrice as long as the fused part.

The scaphocerite is thrice as long as broad. The lamella distinctly overreaches the final tooth. The outer margin is straight.

The mandible bears a 3 jointed palp.

The third maxilliped reaches about to the end of the antennular peduncle. The ultimate joint is as long as the penultimate and 4/5 to 5/8 of the length of the antepenultimate.

The first leg fails to reach to the end of the final tooth of the scaphocerite. The fingers are slightly longer than the palm, they are rather high and compressed. The carpus is about 2.5 to 2.6 times as long as the chela. The merus is 4/5 of the length of the carpus. The second legs reach with part of the chela beyond the scaphocerite, they are a little more robust than the first pair. The fingers are as long as the palm. No teeth are present on the cutting edges. The fingers are hollowed on the inner surface. The carpus is long and slender being 1.8 times as long as the chela. The merus is 0.6 times as long as the carpus and about as long as the ischium. I found no difference in the shape and development of the 2nd legs in the males and females. The third legs reach with the dactylus to the end of the scaphocerite. The propodus is twice as long as the dactylus, 1.5 times as long as the carpus and somewhat shorter than the merus. The fourth and fifth legs are much more slender, and reach with part of the propodus beyond the scaphocerite. The fifth legs overreach the scaphocerite with somewhat less than half the propodus. The propodus of the fifth leg is almost four times as long as the dactylus, slightly less than twice as long as the carpus and somewhat longer than the merus.

The pleopods and uropods are of the usual shape. The uropods are elongate, especially the posterior part being conspicuously long. The outer margin of the exopod of the uropods ends in a distinct tooth, which at its inner side bears an extremely small movable spine.

*Size:* The largest male seen by me is 55 mm long. The only ovigerous female in my material is 40 mm long. Smith states his ovigerous female to be 43.2 mm in length.

*Material examined:* In the collection of the U. S. National Museum material from the following localities is represented: Nicaragua (Realejo), Panama (Rio Chorrera near Chorrera; Miraflores; stream between Campana and La Venta; Rio Juan Diaz; El Capitan; Rio Culebra; Rio Calabre; Rio Lara, Darien).

*Distribution:* The species is known to inhabit fresh waters of western America from Nicaragua to S. Panama. The records in literature are: Estero at Realejo, W. Nicaragua (Smith, 1871), Rio Lara, Darien, S. Panama! (Nobili, 1897).

*Type:* The type locality is "Estero at Realejo, W. Nicaragua." The type was preserved in the Peabody Museum. (Vid. also the remark on p. 56).

*Remarks:* Two specimens of the material described by Nobili (1897) under the name *Palaemon Lamarrei* H. Milne Edwards from Darien were presented by the Turin Museum to the U. S. National Museum, where I examined them. As already indicated by a label in the jar by Dr. Waldo L. Schmitt the specimens do not belong to *P. Lamarrei* ( = M. *amazonicum*) but to *Palaemon gracilis.*

The species is very closely related to the next, the differences between the 2 forms will be dealt with there. Furthermore *Palaemon gracilis* shows some resemblance to *Palaemon pandaliformis* from the West Indies, but may at once be distinguished by the shape of the telson and by the higher number of ventral rostral teeth.

## Palaemon (Palaemon) hancocki Holthuis

Pl. 46, figs. a-f

*Palaemon hancocki* Holthuis, 1950, Proc. Kon. Nederl. Akad. Wetensch., vol. 53, p. 97.

*Palaemon (Palaemon) hancocki* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 7.

*Description:* Like in *P. gracilis* the rostrum is very long and slender, reaching distinctly beyond the scaphocerite and having the ultimate half curved upwards. The proximal half of the upper margin of the rostrum

is provided with 5 to 7, generally 6, teeth, the first of which is placed slightly behind the orbit. The teeth generally are placed wider apart than in *P. gracilis*. The ultimate half of the upper margin is entire, save for 2 or 3 subapical spines. The lower margin is provided with about 12 to 16 (seldom 11) teeth which are placed close together. The distance between the last tooth and the apex of the rostrum is distinctly larger than that between the teeth themselves. The carapace, abdomen and telson are just the same as in *P. gracilis*.

The eyes, antennulae and antennae too show no appreciable differences with the previous species. The mandible is provided with a 3-jointed palp. The third maxilliped has the last joint much shorter than the penultimate, measuring about 0.7 of its length. The antepenultimate joint is almost twice as long as the ultimate.

The first legs reach almost to the end of the scaphocerite. They are similar to those of *P. gracilis*. The second legs are extremely slender, and reach with the entire chela, sometimes even with a part of the carpus, beyond the scaphocerite. They are as slender as the first legs. The fingers are 0.7 times as long as the palm. The inner surface of the fingers is hollowed, but in the present species it is not so distinct as in *P. gracilis*. No teeth are visible on the cutting edges. The carpus is very long and slender, it is twice as long as the chela and 1.8 times as long as the merus. The last three legs have the relations between the joints almost like in *P. gracilis,* and they reach as far forwards; the dactyli, however, are relatively shorter, the propodus of the third leg being more than twice, that of the fifth leg more than 4 times as long as the dactylus.

The pleopods and uropods show no appreciable differences with those of *Palaemon gracilis*.

*Size:* The specimens at my disposal are 36 to 67 mm long. The ovigerous females measure 60 to 65 mm. The eggs are numerous and small, being 0.6 to 0.8 mm in diameter.

*Material examined:* The Allan Hancock 1934 Expedition collected a large ovigerous female from:

Ecuador: Guayas River, dipped from water plants, Feb. 6, 1934.

The United States National Museum possesses about 40 specimens of this species, which originate from:

Colombia: Buenaventura, Nov. 18, 1934, R. Mensing coll.

Ecuador: Exact locality unknown, J. N. Rose coll. Part of the material bears the label "Camotes, J. N. Rose coll." I could not find this locality, which presumably is situated in W. South America.

*Distribution:* The species is a fresh-water form, like *P. gracilis.* Its range, however, seems to be more southern than that species as it is known only from Colombia and Ecuador.

*Type:* Holotype (U.S.N.M. Cat. No. 90965) is the ovigerous female from Guayas, collected by the Allan Hancock Expedition. The other specimens are paratypes. All are deposited in the U. S. National Museum.

*Remarks:* The species is closely related to *Palaemon gracilis,* showing in many characteristics a surprising resemblance to that species. The two forms may, however, easily be distinguished by the following characters:

1. *P. gracilis* possesses 9 to 12 ventral teeth on the rostrum, *P. hancocki* 12 to 16 (seldom 11).

2. The last joint of the third maxilliped in *P. hancocki* is shorter than that in *P. gracilis.*

3. The second legs in *P. hancocki* are much more slender than in *P. gracilis,* they reach farther anteriorly, the fingers are shorter than the palm, and the carpus is longer, being twice as long as the chela.

4. *Palaemon hancocki* gets much larger than *P. gracilis.*

These differences prove to be constant in my material, which consists of about 40 specimens of *P. hancocki,* and more than 50 specimens of *P. gracilis.*

It is a great pleasure to me to name this species for Captain Allan Hancock.

### Palaemon (Palaemon) pandaliformis (Stimpson)

Pl. 46, figs. g-l

*Leander pandaliformis* Stimpson, 1871, Ann. Lyc. New York, vol. 10, p. 130; Kingsley, 1878, Bull. Essex Inst., vol. 10, p. 66.

*Leander Potitinga* Müller, 1880, Zool. Anz., vol. 3, p. 153 (nom. nud.); Müller, 1892, Arch. Mus. Nac. Rio de Jan., vol. 8, p. 181.

*Palaemon (Leander) pandaliformis* Thallwitz, 1892, Abh. Ber. Zool. Anthrop. Mus. Dresden, 1890-91, pt. 3, p. 12.

*Palaemon (Leander) potitinga* Thallwitz, 1892, Abh. Ber. Zool. Anthrop. Mus. Dresden, 1890-91, pt. 3, p. 12.

*Leander potitinga* Ortmann, 1897, Rev. Mus. Paulista, vol. 2, p. 193, pl. 1, fig. 13; Von Ihering, 1897, Rev. Mus. Paulista, vol. 2, p. 422.

*Leander petitinga* Rankin, 1898, Ann. New York Acad. Sci., vol. 11, p. 246.

*Leander potitinga* Moreira, 1901, Arch. Mus. Nac. Rio de Jan., vol. 11, p. 12.

*Palaemonetes cubensis* Hay, 1903, Proc. U. S. Nat. Mus., vol. 26, p. 433, fig. 3; M. J. Rathbun, 1912, Bull. Mus. Comp. Zoöl. Harvard, vol. 54, p. 454.

*Palaemon potitinga* Luederwaldt, 1919, Rev. Mus. Paulista, vol. 11, p. 430.

*Leander potitinga* Luederwaldt, 1919a, Rev. Mus. Paulista, vol. 11, pp. 386, 387.

*Leander potitinga* Sollaud, 1923, Bull. Biol. France Belg., vol. 57, p. 545, fig. 10.

non *Palaemonetes cubensis* Sollaud, 1923, Bull. Biol. France Belg., vol. 57, p. 577, fig. 20.

*Leander pandaliformis* Kemp, 1925, Rec. Indian Mus., vol. 27, p. 290.

*Leander potitinga* Kemp, 1925, Rec. Indian Mus., vol. 27, p. 290.

*Leander cubensis* Kemp, 1925, Rec. Indian Mus., vol. 27, p. 291.

*Leander potitinga* Roux, 1928, Rev. Suisse Zool., vol. 35, p. 46; Brooks, 1931, Ann. Carnegie Mus., vol. 20, p. 166.

*Palaemon cubensis* Schmitt, 1935, Sci. Surv. Porto Rico, Virgin Isl., vol. 15, p. 160.

*Palaemon potitinga* Sawaya, 1946, Zoologia, São Paulo, vol. 11, p. 397, pl. 1, fig. 5; pl. 3, fig. 6.

*Palaemon (Palaemon) pandaliformis* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 7.

*Description:* The rostrum is slender, reaching distinctly beyond the scaphocerite, and having the ultimate part slightly directed upwards. It bears 5 to 7 (seldom 8) teeth in the proximal 3/5 of its length. The first of these teeth is placed behind the orbit, it is smaller than the other teeth. The ultimate 2/5 of the upper margin is entire save for 1 or 2 (seldom 3) subapical teeth. The lower margin bears 5 to 8 (generally 6, seldom 9, and only in young specimens 4) teeth. The carapace has the branchiostegal spine placed on the anterior margin.

The pleurae of the fifth abdominal segment are rather narrowly produced posteriorly and end in a rounded top. The sixth segment is almost twice as long as the fifth and as long as the telson. The anterior pair of dorsal spines is placed somewhat behind the middle of the telson. The posterior pair sometimes is situated midway between the posterior margin of the telson and the anterior pair, sometimes it is closer to the anterior pair or closer to the posterior margin. The posterior margin

of the telson is distinct, ending in a sharp median point, which is flanked by the usual 2 pairs of spines and 1 pair of feathered setae. The inner spines distinctly overreach the median point of the telson.

The eyes are well developed. In my material the cornea bears no dark pigment bands.

The stylocerite is short and fails to reach the middle of the basal segment of the antennular peduncle, it bears a dorsal carina, which is not much pronounced. The anterior margin of the basal segment is strongly convex and reaches almost to the base of the third segment of the antennular peduncle. The anterolateral tooth of the basal segment is small, and far overreached by the anterior margin. The second and third segments are of about the same length, the second being a little broader than the third. The inner flagellum has the 2 rami fused for 8 to 10 joints. The free portion of the shorter ramus consists of about 26 to 30 joints and is more than thrice as long as the fused portion.

The scaphocerite is about thrice as long as broad. The outer margin is straight. The lamella distinctly overreaches the final tooth.

The mandible bears a three-jointed palp. The third maxilliped fails to reach to the end of the antennular peduncle. The last joint is 0.7 times as long as the penultimate.

The first leg reaches almost to the end of the scaphocerite. The fingers are slightly longer than the palm, they are compressed and rather high. The carpus is 2 to 2.3 times as long as the chela and 1.3 times as long as the merus. The second legs reach with half the carpus or less beyond the scaphocerite. They are very slender, being only slightly less slender than the first pair. The fingers are 2/3 to 3/5 of the length of the palm. The cutting edge of the dactylus bears 1 small tooth in its proximal third, the cutting edge of the fixed finger is entire. The inner surface of the fingers is hollowed. The carpus is 1.8 times to twice as long as the chela. The merus is about 0.6 times as long as the carpus and 5/6 as long as the ischium. The third legs reach to the end of the scaphocerite or slightly beyond it. The propodus is more than twice as long as the dactylus, 1.3 to 1.6 times as long as the carpus and distinctly shorter than the merus. The fifth leg reaches with about 1/3 of the propodus or less beyond the scaphocerite. The propodus is about 3.5 times as long as the dactylus, twice as long as the carpus and somewhat longer than the merus.

The pleopods and uropods are normal in shape.

In juvenile specimens the legs generally reach less far forwards. The rostrum is relatively shorter and bears less ventral teeth (4 or 5 only), while the carpus of the second legs is not so strongly lengthened, being only 1.5 times as long as the chela.

*Size:* The largest male seen by me measures 33 mm. Sawaya (1946) mentions a male of 38 mm. Ovigerous females seen by me range between 33 and 42 mm in length (in Sawaya's material between 30 and 43 mm). The eggs are numerous and small being 0.6 to 0.9 mm in diameter. Ovigerous females were found in the months January, February and June (Porto Rico).

*Material examined:* The Allan Hancock 1939 Expedition collected the present species from:

British West Indies: Trinidad, West Manzanilla. Shore, estuary behind sand bar, April 18, 1939, Sta. A36-39.

In the U. S. National Museum a large material of this species is present from the following localities: Guatemala (Lake Ysobal), Nicaragua (Escondido River near Bluefields), Panama (Barro Colorado Island in Gatun Lake), Venezuela (near Barcelona), Brazil (Espirito Santo State: Lagoa nova at Rio Doce; São Paulo State: Ilha São Sebastião, Santos and Cubatâo), Cuba (Palacio, Zaza del Medio), Porto Rico (Guanica, Rio la Plata, Rio Piedras, East Luquillo), Virgin Islands (St. Croix), Barbados (Hastings). I examined material of this species in the American Museum of Natural History at New York, it originated from Santo Domingo (Cabral and Lago Rincon).

*Distribution:* This species is known from fresh and brackish water of the West Indies and from the mainland of Central and South America from Guatemala to S.E. Brazil. The records in literature are: Tacaniqua Lake, El Mene, Falcon Province, Venezuela (Roux, 1928), ? Northern Brazil (Moreira, 1901), Lagoa Juparana, Espirito Santo State, Brazil (Sawaya, 1946), Mauá, Bahia do Rio de Janeiro, Rio de Janeiro State (Moreira, 1901), Ilha Grande, Rio de Janeiro State (Sawaya, 1946), São Sebastião, São Paulo State (Sawaya, 1946), Santos (Luederwaldt, 1919, 1919a; Sawaya, 1946), Rio Ribeira de Iguapé, São Paulo State (Sawaya, 1946), Blumenau, Santa Catharina State, Brazil (Müller, 1880, 1892; Ortmann, 1897; Von Ihering, 1897; Brooks, 1931), Palacio, Cuba! (Hay, 1903), Arroyo de la Cruz, Pinar del Rio Province and Laguna Los Cañas, Marti, Matanzas Province, Cuba (M. J. Rathbun, 1912), Guanica, Porto Rico! (Schmitt, 1935), Barbados or Trinidad (Stimpson, 1871).

*Type:* The type locality is Barbados or Trinidad. The type specimens could not be found in the collection of the U. S. National Museum, they probably have been destroyed in the 1871 fire of Chicago, when all the material and manuscripts of Dr. Stimpson, the director of the Chicago Academy of Sciences at that time were lost. The types of *Leander potitinga* are preserved in the Museu Paulista at São Paulo and in the Carnegie Museum in Pittsburgh. Those of *Palaemonetes cubensis* are in the U. S. National Museum (Cat. No. 26350).

*Remarks:* Kemp (1925) in his key to the species of *"Leander"* distinguished *L. pandaliformis, L. potitinga* and *L. cubensis* as 3 distinct species, as is done by most other authors. Schmitt, 1935, already pointed out that Kemp's remark that no dorsal spinules are present on the telson of *P. cubensis* is incorrect, and that there are in reality 2 pairs, just like in other species of *Palaemon.* This character was used by Kemp to distinguish *P. cubensis* from the other 2 forms mentioned above. Schmitt further pointed to some inaccuracies in Hay's figure namely that the branchiostegal spine is placed on the anterior margin of the carapace. Hay described the species as a *Palaemonetes,* overlooking the mandibular palp. Kemp, examined a type specimen of Hay's species and found a palp, which according to him was 2-jointed. I also reexamined Hay's type material and found the palp 3-jointed, though in some specimens it was poorly developed. In the other Cuban and Porto Rican material as well as in that of Panama and Brazil, the palp also is distinctly three-jointed. Comparing the Cuban and Porto Rican specimens, which were inserted in the collection of the U. S. National Museum under the name *P. cubensis,* with specimens of *P. potitinga* from Brazil, not the least difference could be found. Some of the Panama specimens had the number of lower rostral teeth rather high, 6 to 8 (seldom 9), but these numbers were sometimes also observed in specimens from other localities. Kemp (1925) separated *Leander pandaliformis* Stimpson from *L. potitinga* on account of the longer carpus of the second legs in Stimpson's species. This character, however, proves to be variable in the present species, as is shown in a large amount of material from one locality seen by me, in which the length of the carpus varies between being 1.8 times and twice as long as the chela. The number of dorsal and ventral teeth of the rostrum in Stimpson's specimens is rather high, but it also is found in numerous specimens which distinctly belong to the present species. As Stimpson's form in all other respects closely agrees with the present material I have no hesitation in considering it to be identical with *P. potitinga* and *Palaemon cubensis.*

The specimens brought by Sollaud (1923) to *Palaemonetes cubensis,* are true *Palaemonetes* and doubtless belong to *P. carteri* Gordon (vid. p. 218).

The present species shows some resemblance to *Palaemon gracilis* from the American West coast, but may immediately be recognized by the shape of the tip of the telson.

## Subgenus **PALAEANDER** Holthuis, 1950a

This new subgenus is very close to *Palaemon* s.s. In fact the only constant difference is the fact that the mandible bears a two-jointed palp. This character, however, is very constant and therefore considered here to be of subgeneric value. The American representatives may furthermore be separated from the species of the subgenus *Palaemon* s.s. by having three (seldom two) teeth of the rostrum behind the orbit.

*Type:* Type of this subgenus is *Palaemon elegans* Rathke, 1837, a species from the eastern Atlantic.

### **Palaemon (Palaeander) northropi** (Rankin)

Pl. 47, figs. a-l

*Palaemon vulgaris* Jones, 1859, The Naturalist in Bermuda, p. 129. (non Say, 1818.)

*Palaemon affinis* Heilprin, 1888, Proc. Acad. Nat. Sci. Phila., 1888, p. 322; (non H. Milne Edwards, 1837); Heilprin, 1889, Bermuda Isl., p. 151.

*Leander affinis* Ortmann, 1893, Ergebn. Plankton Exped., vol. 2Gb, p. 47.

*Leander northropi* Rankin, 1898, Ann. New York Acad. Sci., vol. 11, p. 245, pl. 30, fig. 4.

*Leander affinis* Rankin, 1900, Ann. New York Acad. Sci., vol. 12, p. 539.

*Palaemon brachylabis* M. J. Rathbun, 1900a, Proc. Wash. Acad. Sci., vol. 2, p. 154, pl. 8, fig. 10.

*Palaemon paulensis* Moreira, 1901, Arch. Mus. Nac. Rio de Jan., vol. 11, p. 11.

*Palaemon affinis* p.p. M. J. Rathbun, 1902a, Bull. U. S. Fish Comm., vol. 20, pt. 2, p. 125.

*Leander affinis* Verrill, 1922, Trans. Conn. Acad. Arts Sci., vol. 26, p. 142, pl. 48, fig. 4 (non pl. 43, fig. 3 and pl. 47, fig. 7).

*Palaemon affinis* Schmitt, 1924a, Bijdr. Dierk., vol. 23, p. 72.

*Leander northropi* Kemp, 1925, Rec. Indian Mus., vol. 27, p. 292.

*Leander affinis* Boone, 1927, Bull. Bingham Oceanogr. Coll., vol. 1, pt. 2, p. 113.

*Palaemon affinis* Schmitt, 1935, Sci. Surv. Porto Rico, Virgin Isl., vol. 15, p. 160.

*Leander affinis* Gurney, 1936, Proc. Zool. Soc. Lond., 1936, p. 619; Gurney and Lebour, 1941, Journ. Linn. Soc. Lond. Zool., vol. 41, p. 146.

*Palaemon brachylabis* Sawaya, 1946, Zoologia, São Paulo, vol. 11, p. 398, pl. 2, figs. 7, 8.

*Palaemon (Palaeander) northropi* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 9.

*Description:* The rostrum is rather high in the middle and slender in the ultimate portion; it is curved upward and reaches distinctly beyond the scaphocerite. The upper margin is provided with 7 to 10, mostly with 9 teeth, the first three of which are situated behind the posterior margin of the orbit (sometimes the third tooth is placed just over the orbital margin). The first six teeth are placed rather close together, the following are separated by much larger intervals. The last tooth is placed close to the apex, giving it thereby a bifid appearance. The upper margin of the rostrum is entire for a rather long distance before the bifid apex. The lower margin of the rostrum is provided with three or four strong teeth. The carapace is smooth. An antennal and a branchiostegal spine are present. The antennal spine is strong and is placed some distance below the rounded lower angle of the orbit. The branchiostegal spine is almost as strong as the antennal, it is placed on the anterior margin of the carapace, which is curved backwards at the level of the branchiostegal spine.

The abdomen is smooth. The pleurae of the first three segments are broadly rounded, those of the fourth and fifth are narrower. The pleura of the fourth segment ends in a blunt angle, that of the fifth in a minute sharp tooth. The sixth abdominal segment is somewhat more than 1.5 times as long as the fifth. The telson is somewhat longer than the sixth abdominal segment, it is elongate triangular in shape and possesses two dorsal pairs of spinules, which are situated in the middle and at ¾ of its length. The posterior margin bears two pairs of spines, the inner of which is the longer and far overreaches the median point of the posterior margin. Two feathered setae are placed between the inner spines.

The eyes are well developed.

The basal segment of the antennular peduncle is broad. The stylocerite is slender and pointed, it reaches about to the middle of the basal segment. The outer margin of the basal segment is straight or slightly

convex and ends in a distinct anterolateral spine. This anterolateral spine reaches about to the middle of the second segment of the peduncle; the anterior margin of the basal segment is convex, but does not reach beyond the anterolateral spine. The third segment of the peduncle is longer and more slender than the second. The upper antennular flagellum has the two rami fused for 10 to 14 joints, the free part of the shorter ramus consists of 11 to 14 joints. The free portion generally is somewhat shorter than the fused, sometimes as long as, or even slightly longer than it.

The scaphocerite is about thrice as long as broad, the outer margin is about straight or somewhat convex, the final tooth is strong and directed slightly outwards, it almost reaches the end of the lamella. The antero-internal angle of the lamella is rather acute.

The oral parts show the typical shape of the genus *Palaemon,* subgenus *Palaeander*. The mandible bearing a two-jointed palp. The third maxilliped reaches somewhat beyond the end of the antennal peduncle, it has the last joint distinctly shorter than the penultimate.

The first pereiopod almost reaches the end of the scaphocerite. The fingers are about as long as the palm. The carpus is 1.7 times to twice as long as the chela. The merus is slightly shorter than the carpus. The second pereiopod reaches with the entire chela beyond the tip of the scaphocerite (in one specimen, a female of 36 mm, both second legs fail to reach the end of the scaphocerite). The fingers measure 2/3 to almost 1/2 of the length of the palm. The cutting edge of the dactylus bears a small tooth in the proximal part, the rest of the cutting edges is entire; the cutting edge of the fixed finger shows no teeth at all. The carpus is slender, it is about as long as the chela. The merus measures about 3/4 to 7/8 of the length of the carpus, the ischium is 2/3 as long as the merus. The following three pereiopods are slender and of about similar shape. The third pereiopod reaches about to the end of the scaphocerite, sometimes reaching slightly beyond, sometimes failing to reach so far. The propodus is 2.7 to 3 times as long as the dactylus, its posterior margin is provided with about four scattered spines. The carpus is slightly more than half as long as the propodus. The merus is somewhat longer and broader than the propodus. The ischium is half as long as the merus. The fifth pereiopod reaches about as far forwards as the third. Here the propodus is thrice as long as the dactylus, its posterior margin is provided with some very small scattered spines. The carpus is half as long as the propodus. The merus is as long as the propodus and 2.5 times as long the the ischium.

The pleopods and uropods are normal in shape.

The juveniles have the legs shorter. The fingers of the second leg are longer in relation to the palm than in the adults, the carpus too is relatively longer.

*Colour:* The specimen of the Allan Hancock Expedition 1939 is accompanied with the following note about its colour in life: The body is translucent white, with a few transverse bands of dark brown or black markings on the edges of the abdominal somites. A few oblique-vertical lines of the same colour are on each side of the carapace. A specimen from Fort Jefferson, Tortugas, had the colour in life noted as follows: The body is quite transparent. The carapace is obliquely and longitudinally lined with narrow lines of seal brown. The abdomen is crossbanded with similarly coloured narrow lines. The shorter free part of the upper antennular flagellum is closely speckled with orange ochraceous, just like the distal margins of the joints of the pereiopods, including the distal margin of the palm of the second leg near the base of the fixed finger. The stalks of the pleopods have a spot of seal brown colour near the distal end. A spot of orange ochraceous is present at the base of the uropods and last pleopods, while the sixth abdominal segment near the base of the uropods also shows this colour. The eggs are sage green; they in reality are pea green, but the black eyes give them a much darker appearance at a little distance.

*Size:* The largest male seen by me measures 33 mm. Ovigerous females observed were of a length of 29 to 38 mm. The eggs are numerous and small, being 0.6 to 0.8 mm in diameter.

*Material examined:* The Allan Hancock 1939 Expedition collected this species from:

Venezuela: Cubagua Island. Shore, coral rock, April 14, 1939, Sta. A25-39. In the collection of the U. S. National Museum material of this species is present from the following localities: Bermudas, Florida (Fort Pierce, St. Lucie Co.; Jupiter Inlet, Palm Beach Co.; Miami Beach, Biscayne Bay, Dade Co.; Key Largo and Tortugas, Monroe Co.), Cuba (off Cape San Antonio, Los Arroyes), Jamaica (Montego Bay), Haiti (Miragoâne), San Domingo (Samaná), Porto Rico (Boqueron Bay, Hucares, Fajardo), Virgin Islands (St. Croix), Curaçao (Spaansche Water), Panama (Coco Solo near Colon), Parahyba State, Brazil (Rio Parahyba do Norte), Rio de Janeiro State (Ilha Pinheiro and Porto da Inhauma, both in Rio de Janeiro Bay), Santa Catherina State, S.E. Brazil (Itajahy, and Florianopolis), Uruguay (Piriapolis). Furthermore I examined a specimen from Caracas Bay, Curaçao in the collection of the Zoological Museum at Amsterdam.

*Distribution:* This littoral marine species is known from the E. American littoral region between Bermuda and Uruguay. The records in literature are: Bermudas (Jones, 1859; Heilprin, 1888, 1889; Ortmann, 1893; Verrill, 1922; Gurney, 1936; Gurney and Lebour, 1941), Castle Harbor, Bermudas (Rankin, 1900), Nassau, New Providence, Bahama Islands (Rankin, 1898), Glover Reef off British Honduras (Boone, 1927), San Juan, Porto Rico (Schmitt, 1935), Boqueron Bay! Hucares! and Fajardo! Porto Rico (M. J. Rathbun, 1902a), Spaansch Water! and Caracas Bay! Curaçao (Schmitt, 1924a), Rio Parahyba do Norte, N. Brazil! (M. J. Rathbun, 1900a), Mamanguape, Parahyba State, Brazil (M. J. Rathbun, 1900a), Boa Viagem, Rio de Janeiro State (Moreira, 1901), Ilha Grande, Rio de Janeiro State (Sawaya, 1946), S. Vincente, São Paulo State, Brazil (Sawaya, 1946).

*Type:* The type locality is Nassau, New Providence, Bahama Islands.

*Remarks:* Jones (1859) mentions *Palaemon vulgaris* from Bermuda, but as already pointed out by Rankin (1900), his specimens belong to the present species. Heilprin (1888) was the second to record the present species. He could not find any differences with *P. affinis* and therefore he identified it with that species. Up to the present time the name *affinis* has generally been used for the present form. In the meantime, however, the species twice has been described as new, namely in 1898 by Rankin as *Leander northropi* and in 1900 by M. J. Rathbun as *Palaemon brachylabis*. Examination of material (among which Rathbun's types) convinced me that both *Leander northropi* and *Palaemon brachylabis* are identical with *P. affinis* Heilprin (non H. M. Edwards). *Palaemon northropi* as the present form has to be named is quite distinct from *P. affinis,* which inhabits the coasts of New Zealand. The differences are:

1. The rostrum of *P. northropi* is longer and more slender. The unarmed distal portion is relatively longer than in *P. affinis.*

2. The free part of the shorter ramus of the upper antennular flagellum in *P. northropi* generally is shorter than the fused part, in *P. affinis* it is longer than the fused part.

3. The mandibular palp in *P. northropi* is two-, that of *P. affinis* three-jointed.

4. *P. northropi* is smaller and more slender than *P. affinis.*

5. *P. northropi* is a form of the American east coast, *P. affinis* is a species of New Zealand waters.

Moreira (1901) gives some remarks on specimens, which he identified with *Palaemon paulensis,* a species considered here to be identical with *Leander tenuicornis.* Considering the fact that Moreira's specimens

have the fingers of the second legs much shorter than the palm, and that the rostrum has much less teeth than in any known specimen of *Leander tenuicornis,* it is certain that his material does not belong to that species. There is very little doubt that the specimens in reality belong to *Palaemon northropi.*

The specimen recorded by M. J. Rathbun (1902a) from Arroyo proved on examination to be *Leander tenuicornis.* The specimen from Puerto Real is so small that it could not be identified with certainty.

### **Palaemon (Palaeander) floridanus** Chace

Pl. 48, figs. a-j

*Palaemon floridanus* Chace, 1942, Proc. New Engl. Zool. Cl., vol. 19, p. 80, pl. 23.

*Palaemon (Palaeander) floridanus* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 8.

*Description:* The rostrum is slender and strongly curved upwards. It reaches distinctly beyond the end of the scaphocerite. The upper margin bears 7 to 9 teeth in the proximal part and 2 or 3 subapical teeth. There generally is a distinct unarmed region behind the subapical teeth. The posterior teeth in the proximal region are placed somewhat closer together than the anterior. The first three teeth of the upper margin of the rostrum are placed behind the orbit, the third sometimes is placed over the posterior margin of the orbit. The lower margin of the rostrum is provided with 5 to 9 teeth, which are about equally divided over that margin. On the whole the rostrum is distinctly more slender than in *Palaemon northropi* and is less deep, it furthermore narrows more gradually towards the top. The carapace is like that in *P. northropi,* the branchiostegal spine is placed on the anterior margin of the carapace.

The abdomen is smooth. The pleura of the fifth segment ends in a distinct small spine. The sixth segment is almost twice as long as the fifth and is 0.7 times as long as the telson. The telson bears two dorsal pairs of spines, one in its middle and one at ¾ of its length. The posterior margin of the telson is distinct and ends in a sharp median point. The usual two pairs of spinules are present. The inner of these pairs overreaches the tip of the telson. Two feathered setae are present between the inner spines.

The eyes are well developed.

The peduncle of the antennula is similar in shape to that of *Palaemon northropi.* The upper antennular flagellum has two rami fused for 9 to 11 joints. The free part of the shorter ramus consists of 13 to 15 joints and is 1.2 to 1.7 times as long as the fused portion.

The scaphocerite is about 3.5 times as long as broad. The outer margin is straight and ends in the strong final tooth, which reaches almost to the end of the lamella. The antero-internal angle of the lamella is rather sharp.

The oral parts are as in the previous species. The mandibular palp is two-jointed.

The first legs reach to the end of the scaphocerite. The fingers are about as long as the palm. The carpus is twice as long as the chela and about 7/6 of the length of the merus. The second legs are much stronger than the first, they are equal in shape and reach with the chela and a small part of the carpus beyond the scaphocerite. The fingers are long and slender, being 0.7 to 0.9 times as long as the palm. The cutting edges of the fingers bear each one small denticle in the extreme proximal part; the denticle of the dactylus is placed slightly in advance of that of the fixed finger. The palm is slightly inflated. The carpus is as long as the length of the palm and half the length of the fingers combined, it is 9/8 of the length of the merus. The ischium is somewhat more than half as long as the merus. The third leg reaches to the end of the scaphocerite. The propodus is about 2.5 to 2.7 times as long as the dactylus, twice as long as the carpus and shorter than the merus. The fifth leg reaches with part of the dactylus beyond the scaphocerite. The propodus is slightly more than thrice as long as the dactylus, twice as long as the carpus, and somewhat longer than the merus.

The pleopods and uropods are normal in shape. The movable spine at the inner side of the final tooth of the outer margin of the uropodal exopod is well developed.

In young specimens the legs reach less far forwards than in the older ones.

*Size:* The largest male seen by me is 31 mm long. Females may attain a size of 50 mm, ovigerous females of 31 to 35 mm long are present in my material. The eggs are numerous and small, they are 0.4 to 0.7 mm in diameter.

*Colour:* Rather fresh specimens from Cedar Keys still showed traces of the original colouration. Some 5 longitudinal lines of pigment are visible in the anterior part of the carapace; in the posterolateral region of the carapace some oblique lines are present. The abdominal segments show transverse lines of pigment. The first segment has three such lines, the first and last of which reach almost to the tip of the pleura. The second and third segment each have 4 or 5 lines, the last of which, running along the posterior margin is much longer than the

others. The fourth and fifth segment each have a line along the posterior margin, while a short second line may be seen in the middle of the segment. Most of the articulations between the joints of the thoracic legs are coloured yellow in my material. The above lines are coloured orange red in my spirit material, but in the living animal they probably are brown or black.

*Material examined:* In the U. S. National Museum specimens of this species are present from: Fort Pierce, St. Lucie Co.; Big Gasparilla, Charlotte Co.; Lemon and Sarasota Bays, Sarasota Co.; Clearwater Harbor and Tarpon Springs, Pinellas Co.; Cedar Keys, Levy Co. All localities in Florida. Except for the specimen from Fort Pierce, which was found in a vial containing two specimens of *Palaemon northropi,* all material seen by me originates from the west coast of Florida.

*Distribution:* The species occurs in seawater along the west coast of Florida (with one record from the east coast, vid. above). The only record in literature is that of Chace (1942) from: Captiva Island, Lee Co., W. Florida.

*Type:* The type locality is Captiva Island, W. Florida. The types are present in the Museum of Comparative Zoölogy at Cambridge, Mass.

*Remarks:* This curious form was described for the first time as late as 1942. It is closely related to *Palaemon northropi,* from which species it differs, as is already pointed out by Chace, by the shape of the rostrum, which is more slender and which bears more ventral teeth, by the second legs, which have the fingers distinctly longer, and by the more slender and longer dactyli of the third pereiopods. The differences in the mandible pointed out by Chace proved on examination of my relatively large amount of material to be not constant. In my material of *Palaemon floridanus* the last joint of the palp is as straight as in *Palaemon northropi,* while I also could find no differences in the relation between the length of the two joints in both species. Also the character mentioned by Chace that the fifth pereiopod in *P. floridanus* should not reach beyond the scaphocerite showed to be not constant in my material: in old specimens the fifth leg reaches with part of the dactylus beyond the scaphocerite, just like in *Palaemon northropi.*

## Genus **PALAEMONETES** Heller, 1869

*Definition:* The rostrum is well developed, and provided with teeth. The carapace is smooth, with the antennal and branchiostegal spines well developed. A branchiostegal groove is present.

The abdomen is smooth, the pleurae of the first four segments are rounded at the tip. The telson bears 2 pairs of dorsal and 2 pairs of posterior spines. Between the inner posterior spines 2 or more hairs are present.

The eyes are well developed or have the cornea strongly reduced.

The antennular peduncle has the basal joint broad, provided with a stylocerite and an anterolateral spine, the anterior margin is rounded. The 2nd and 3rd segments are shorter than the first. The upper antennular flagellum consists of 2 rami, which in the basal part are fused for a shorter or longer distance.

The antenna has the scaphocerite well developed, the outer margin ends in a distinct tooth. A spine is present at the outside of the antennal peduncle near the base of the scaphocerite.

The mandible consists of an incisor and a molar process. No palp is present. The other oral parts are not essentially different from those of *Palaemon.*

The first pereiopods are slender, with chelae. The second pereiopods are chelate, equal, slender, but generally stronger than the first pair. The last 3 pereiopods are slender. The dactylus is simple. The propodus bears posterior spines, in the fifth leg moreover it is provided in the distal part of its posterior margin with transverse rows of setae, which are placed close together.

The first pleopods have the endopod without an appendix interna. This appendix occurs in all other pleopods, while the second pleopods of the male moreover are provided with an appendix masculina, which is stronger than the appendix interna.

The uropods have the same shape as in *Palaemon* and *Macrobrachium.*

The type species is *Palaemon varians* Leach, 1814, from the Eastern Atlantic.

The genus shows very close resemblance to *Palaemon,* in fact the only difference of importance is that in *Palaemon* the mandible possesses a palp, while this palp is absent in *Palaemonetes.*

At present 11 species of *Palaemonetes* are known from America, only two of which are Western species. One of the species is so aberrant, that it was thought necessary to create a new subgenus for it.

The American species may be distinguished as follows:

1. Eyes without pigment, cornea degenerated. First and second pairs of pereiopods not very different in shape and size. Exopod of uropods with outer margin ending in a tooth, which bears no movable spine at its inner side. Subterranean fresh-water. Texas. Subgenus *Alaocaris.* Only species . . *antrorum*

— Eyes with dark pigment, cornea well developed, globular. Second pereiopods much stronger and longer than first pair. Exopod of uropods with outer margin ending in a tooth, which at its inner side is provided with a movable spine. Subgenus *Palaemonetes* s.s. . . . . 2

2. Fused part of the two rami of upper antennular flagellum distinctly longer than free part . . . . . 3

— Fused part of the two rami of upper antennular flagellum shorter than or as long as free part . . . . . 4

3. Branchiostegal spine situated on anterior margin of carapace, just below branchiostegal groove. Posterior pair of dorsal spines of telson placed midway between the anterior pair and posterior margin of telson. Fresh-water. Eastern U. S. A. . . . . *paludosus*

— Branchiostegal spine distinctly removed from anterior margin of carapace and situated some distance below branchiostegal groove. Posterior pair of dorsal spines of telson placed very close to posterior margin, and more close to that margin than to anterior pair of spines, often lying in one row with posterior spines. Fresh-water. Central U. S. A., central Canada, N. E. Mexico . . . . . *kadiakensis*

4. Carpus of second legs longer than chela. Eggs often large and few . . . . . 5

— Carpus of second legs shorter than chela. Eggs numerous and small . . . . . 7

5. Lower margin of rostrum with 2 or 3 teeth. Rostrum rather high and straight . . . . . 6

— Lower margin of rostrum with 4 to 7 teeth. Rostrum slender, often curved upwards. Branchiostegal spine removed a small distance from anterior margin of carapace. Fresh-water. Venezuela; British, Dutch and French Guiana . . *carteri*

6. Branchiostegal spine removed a considerable distance from anterior margin of carapace, even failing to reach with its tip beyond that margin. Fresh-water. Bolivia . . *ivonicus*

— Branchiostegal spine placed on anterior margin of carapace. Fresh-water. S. Brazil, Uruguay, Argentina . *argentinus*

7. Anterior margin of basal segment of antennula strongly produced forwards and far overreaching the anterolateral spine. Western . . . . . *hiltoni*

— Anterior margin of basal segment of the antennula, though being convex not reaching so far forwards, and not overreaching anterolateral spine. . . . . 8

8. Carpus of second leg in adult female shorter than palm, in males only very slightly (1.1 times) longer or shorter than palm. Dactylus of second leg with 2, fixed finger with 1 tooth on cutting edge. Rostrum with first 2 teeth of dorsal margin behind orbit. Dorsal rostral teeth reaching up to apex. Lower margin with 3 to 5 teeth . . . . . 9

— Carpus of second chela in adult female much longer than palm (1.3 to 1.5 times), in males carpus is almost as long as whole chela. Dactylus of second leg with one or no teeth, fixed finger without teeth on cutting edge. Rostrum with only one dorsal tooth situated behind the orbit. Eastern . . . . . 10

9. Rostrum with 11-13 dorsal teeth. Upper margin straight, though midrib curved. Rostrum very deep. Third leg reaching with part of propodus beyond scaphocerite. Western . . . . . *schmitti*

— Rostrum with 8-11 dorsal teeth. Upper margin concave, tip of rostrum gradually curved upwards. Rostrum less deep than in *P. schmitti.* Third leg just reaching to or failing to reach the end of the scaphocerite. Eastern . . . *vulgaris*

10. Dorsal teeth of rostrum reaching up to apex, which often is bifid. Lower margin with 4 or 5, seldom 3, teeth. Dactylus of second leg with one distinct tooth on cutting edge, cutting edge of fixed finger entire . . . . . *intermedius*

— Dorsal margin of rostrum with an unarmed stretch before tip; tip thereby dagger shaped. Lower margin of rostrum with 2 to 4, generally 3 teeth, ultimate part unarmed like upper margin. Dactylus as well as fixed finger of second leg without teeth on the cutting edge . . . . . *pugio*

## Subgenus ALAOCARIS Holthuis, 1949

The present new subgenus is erected for *Palaemonetes antrorum* Benedict and is characterized by the following features:

The rostrum is compressed, serrate on the upper margin. The carapace bears an antennal and a branchiostegal spine, a branchiostegal groove is present. The telson bears 2 dorsal and 2 posterior pairs of spines, between the latter 2 feathered setae are present.

The eyes are strongly degenerated and contain no pigment.

The mandible bears no palp, also the other mouth parts are like in *Palaemonetes* s.s., just like the branchial formula.

The first and second pereiopods are very similar in shape and size. The last three legs have a shape similar to those of the species of *Palaemonetes* s.s.

The pleopods, except the first pair are provided with an appendix interna, while in the male, moreover an appendix masculina is present. The uropods differ from those of *Palaemonetes* s.s. by missing the movable spine at the inner side of the final tooth of the external margin of the exopod.

*Type:* The type and only species is *Palaemonetes antrorum* Benedict.

### Palaemonetes (Alaocaris) antrorum Benedict

Pl. 49, figs. a-m; pl. 50, figs. a-h; pl. 51, figs. a-d

*Palaemonetes antrorum* Benedict, 1896, Proc. U. S. Nat. Mus., vol. 18, p. 615; Kingsley, 1899, Amer. Nat., vol. 33, p. 718; Eigenmann, 1900, Proc. Amer. Ass. Adv. Sci., vol. 49, pp. 228, 230; Neher, 1902, Proc. Indiana Acad. Sci., 1902, p. 96, figs. 2-7; Ulrich, 1902, Trans. Amer. Micr. Soc., vol. 23, p. 93, pl. 17; Kemp, 1925, Rec. Indian Mus., vol. 27, p. 317; Spandl, 1926, Speläol. Monogr., vol. 11, p. 90; Chappuis, 1927, Die Binnengew., vol. 3, p. 87; Chace, 1943, Proc. New Engl. Zool. Cl., vol. 22, p. 34.

*Palaemonetes (Alaocaris) antrorum* Holthuis, 1949, Proc. Kon. Nederl. Akad. Wetensch., vol. 52, p. 89, fig. 1a-e; 1950a, Siboga Exped., mon. 39a9, p. 11.

*Description:* The rostrum is compressed and rather high. It is short, and reaches to or slightly beyond the base of the third segment of the antennular peduncle, ending abruptly in a sharp point. The upper margin bears 8 to 12, rather irregularly placed small teeth, 3 of which are placed behind the orbit. The lower margin bears no teeth at all, only some hairs are present there. The antennal spine is small, but slender, needle-shaped and distinct. The branchiostegal spine is removed a considerable distance from the anterior margin of the carapace, and lies somewhat below the distinct branchiostegal groove. The integument of the carapace is rather soft.

The abdomen is normal in shape, though the pleurae are relatively short. The sixth segment is twice as long as the fifth and slightly longer than the telson. The anterior of the 2 dorsal pairs of spinules is placed

distinctly behind the middle of the telson, while the posterior pair is situated very close to the posterior margin of the telson, often reaching with the tip over the base of the outer posterior spinules. The posterior margin of the telson bears the usual 2 pairs of spinules, between which 2 feathered setae are present.

The eyes are bullet-shaped, the cornea is entirely degenerated, and shows no pigment.

The antennular peduncle has the stylocerite slender and sharp. The anterolateral spine of the basal segment is small and reaches about to the rounded anterior margin of the segment. The upper antennnular flagellum has the 2 rami united for about 4 to 6 joints. The free portion of the shorter ramus consists of 12 to 17 joints and is about 3 to 4 times as long as the fused part.

The scaphocerite is somewhat about 2.5 times as long as broad. The outer margin is straight. The final tooth is far overreached by the lamella.

The oral parts are typical.

The first leg reaches with the fingers beyond the scaphocerite. The chela is rather plump, in some specimens it is more elongate than in others. The fingers are twice to more than twice as long as the very short palm. The cutting edges close over their whole length and are entire; they are seemingly pectinate, however, by the presence of a row of very short hairs just below the edge at the outer side. The inner surface of the fingers is hollowed, so that the cutting edge is removed to the outside. The palm is somewhat swollen, it is higher than long. The carpus is about 1.6 times as long as the chela. The merus is 0.9 times as long as the carpus and the ischium is half as long as the carpus. The second leg reaches to the end of the scaphocerite or reaches with the chela beyond it. It differs extremely little from the first legs, being only slightly longer. The chela is slightly larger and has the fingers relatively a little longer than in the first legs, but the shape is the same. The carpus is 1.5 times as long as the chela and 1.6 times as long as the merus. The ischium is almost as long as the merus. The third leg reaches with part of the propodus beyond the scaphocerite. The propodus is somewhat less than 4 times as long as the dactylus, 1.3 times as long as the carpus and slightly shorter than the merus. The fifth leg reaches with about half the length of the propodus beyond the scaphocerite. The propodus is 6 times as long as the dactylus, 1.6 times as long as the carpus, and 1.2 times as long as the merus.

The pleopods and uropods are normal in shape. The endopod of the first pleopod, both in my male as well as in my female specimens is more or less twisted. Furthermore the external margin of the uropodal exopod has the final tooth without a movable spinule at its inner side.

*Size:* The largest specimens seen by me measure up to 18 mm. No ovigerous females were among the material examined.

*Material examined:* The United States National Museum possesses a large amount of material of this species from an artesian well at San Marcos, Texas (collected February and March, 1896 and March, 1902), furthermore 1 specimen is present from Ezell's Cave, San Marcos, Texas (collected March, 1937).

*Distribution:* The species is only known from subterranean waters at San Marcos, Texas. The only original records in literature are Benedict (1896), Eigenmann (1900), Neher (1902) and Ulrich (1902).

*Type:* The type locality is the artesian well at San Marcos, Texas. The type specimens are preserved in the collection of the U. S. National Museum (Cat. No. 19326), and were examined by me.

*Remarks:* The species in many respects is so different from other species of *Palaemonetes* especially in the shape of the eyes, the first 2 legs and the uropods, that I hesitated at first to place it in the present genus. It was thought necessary to place it in a new subgenus as the differences in my opinion are not sufficient to erect a new genus for it. So *Palaemonetes antrorum* is the only blind species of the genus, since the 4 other blind species *(P. calcis, P. eigenmanni, P. gibarensis* and *P. inermis)* formerly placed in *Palaemonetes* are now removed to a separate genus *Troglocubanus. P. antrorum* differs from the 4 *Troglocubanus* species, among other characters, by possessing a distinct branchiostegal spine.

The fact that no ovigerous females could be found in the very extensive material of this species, which is present in the U. S. National Museum, probably is due to the fact that all this material was collected in the early spring (February, March). Neher (1902) reports on material collected in September; his material contained young specimens of about 5 mm length. The species thus possibly is breeding in summer or late spring.

With a considerable amount of doubt I assign two specimens from Ezell's Cave, San Marcos, Texas (April 2, 1933, C. S. Smith coll.) to the present species. The specimens, which are 16 and 18 mm long, show numerous differences with all other specimens of *Palaemonetes antrorum*

seen by me. The rostrum is shorter and bears less teeth (in one specimen there are four, in the other about 7 teeth), the first of which stands on the carapace behind the orbit. The antennal spine is absent in one of the specimens, in the other it is visible as a minute sharp spine. The telson is quite different and has the shape of that of a larval Palaemonid: the posterior margin is widened and bears 5 pairs of spines, the external of which are short, the following pair is long and the three inner pairs are of intermediate size. There are two pairs of dorsal spinules, placed on the lateral margins of the telson. The eyes, antennulae, and antennae show no important difference with those of *Palaemonetes antrorum.* The mouth parts, however, are totally aberrant. The mandible resembles that of *P. antrorum* in the absence of a palp and in the shape of the molar process, the incisor process, however, is reduced to a short and blunt triangular structure at the dorsal side of the molar process. The maxillula has the inner lacinia enormously broadened, while the upper lacinia too is larger than that of the typical form. The maxilla shows no essential differences with that of *P. antrorum.* The first maxilliped is very large and has the endites enormously enlarged and produced forwards. The second maxilliped too is excessively large and has the last two joints very elongate. The third maxilliped and all the legs are much more slender than in *P. antrorum.* The third maxilliped reaches to the end of the scaphocerite, the relation between the lengths of the various joints is about as in *P. antrorum.* Both the first and second pereiopods reach with the chela beyond the end of the scaphocerite. These two legs are much alike; all the joints are more slender than in *P. antrorum.* The fingers of both these legs are somewhat less than twice as long as the palm, the carpus is almost twice as long as the chela. The third leg reaches with part of the propodus, the fifth even with half the carpus beyond the scaphocerite. The second pleopods have no appendix masculina.

Considering the fact that the telson shows juvenile characters, I do not feel justified in describing the present two specimens as belonging to a new species, as they may not be full grown specimens of *Palaemonetes antrorum.* Against the latter supposition, however, pleads the fact that the specimens are as large as the largest specimens of *Palaemonetes antrorum* seen by me. Furthermore the maxillula, the first and second maxillipeds are much larger than those of the adult specimens of *P. antrorum,* while the third maxillipeds and all the legs are much longer. I have, however, too little material at my disposal to be able to form a definite opinion about the systematic and ontogenetic status of these two specimens. Dr. C. S. Smith, professor of Biology, Southwest Texas State

Teachers College, San Marcos, Texas, who collected this very interesting material in 1933, was so kind to inform me, that at present it is not possible to get material from Ezell's Cave any more, the locality from where the specimens were obtained, because this cave is falling in and is too dangerous to be entered. A specimen of *Palaemonetes* collected in Ezell's Cave on March 25, 1937 (O. Sanders coll.) proved to be perfectly identical with the adult specimens of *Palaemonetes antrorum* from the artesian well at San Marcos. A thorough investigation of the life history of *Palaemonetes antrorum* will be of great value.

## Subgenus **PALAEMONETES** Heller

This subgenus, containing all known species except *Palaemonetes (Alaocaris) antrorum,* differs from the subgenus *Alaocaris* by having:

1. The eyes well developed, with the cornea globular and pigmented.
2. The lower margin of the rostrum provided with teeth.
3. The second legs much stronger than the first.
4. The outer margin of the uropodal exopod ending in a tooth, which at its inner side is provided with a movable spine.

Ten species are known at present from American waters.

### Palaemonetes (Palaemonetes) paludosus (Gibbes)[13]

Pl. 51, figs. e-j

*Hippolyte caroliniana* Gibbes, 1948, Tuomey's Rep. Geol. S. Carolina, App., p. xvi (nom. nud.).

*Hippolyte paludosa* Gibbes, 1850a, Proc. Amer. Ass. Adv. Sci., vol. 3, p. 197.

*Palaemonetes exilipes* Stimpson, 1871, Ann. Lyc. New York, vol. 10, p. 130.

*Palaemonopsis exilipes* Stimpson, 1871, Ann. Lyc. Nat. Hist. New York, vol. 10, p. 130.

*Palaemonetes exilipes* p.p. Smith, 1874, Rep. U. S. Fish Comm., vol. 2, p. 641 (non pl. 1, fig. 1).

*Palaemonetes paludosa* p.p. Kingsley, 1878a, Bull. Essex Inst., vol. 10, p. 65.

*Palaemonetes paludosa* p.p. Kingsley, 1878b, Proc. Acad. Nat. Sci. Phila., 1878, p. 97.

*Hippolysmata paludosa* Howard, 1883, South Carolina, p. 294.

[13] Many specimens referred in literature to the present species belong in reality to the next (vid. p. 212).

*Palaemonetes exilipes* p.p. R. Rathbun, 1883, Bull. U. S. Fish Comm., vol. 2, p. 144; R. Rathbun, 1884, Fish. Fish. Industr. U. S., vol. 1, p. 819.

*Palaemonetes exilipes* Ives, 1891, Proc. Acad. Nat. Sci. Phila., 1891, p. 194.

*Palaemon (Palaemonetes) exilipes* Thallwitz, 1892, Abh. Ber. Zool. Anthrop. Mus. Dresden, 1890-91, pt. 3, p. 8.

*Palaemon (Palaemonetes) paludosus* Thallwitz, 1892, Abh. Ber. Zool. Anthrop. Mus. Dresden, 1890-91, pt. 3, p. 12.

*Palaemonetes paludosa* p.p. Sharp, 1893, Proc. Acad. Nat. Sci. Phila., 1893, p. 124; Kingsley, 1899, Amer. Nat., vol. 33, p. 718 (non fig. 56).

*Palaemonetes exilipes* Coulon, 1907, Bull. Soc. Étud. Sci. Nat. Elbeuf, 1907, p. 191; Worth, 1908, Bull. U. S. Bur. Fish., vol. 28, p. 853; Hay & Shore, 1918, Bull. U. S. Bur. Fish. vol. 35, p. 393, pl. 27, fig. 3.

*Palaemonetes exilipes* p.p. Ortmann, 1918, Ward & Whipple's Fresh Water Biology, p. 845 (non fig. 1312); Kendall, 1923, Rep. U. S. Fish Comm., 1922, pt. 2, p. 14 (non fig. 9); Kemp, 1925, Rec. Indian Mus., vol. 27, p. 316.

*Palaemonetes exilipes* Stiles & Hassall, 1927, Hygienic Lab. Bull., n. 148, p. 216.

*Palaemonetes paludosa* Stiles & Hassall, 1927, Hygienic Lab. Bull., n. 148, p. 216.

*Palaemonetes exilipes* p.p. Creaser, 1931, Pap. Michigan Acad. Sci., vol. 13, p. 272, fig. 39.

*Palaemonetes exilipes* p.p. Creaser, 1933, Aquarium, Phila., vol. 1, p. 261.

*Palaemonetes exilipes* Pearse, 1936, Journ. Elisha Mitchell Sci. Soc., vol. 52, p. 195; Coker, 1938, Journ. Elisha Mitchell Sci. Soc., vol. 54, p. 83; Lunz, 1939, Science, N. Y., n. ser., vol. 81, p. 436; Burkenroad, 1947, Amer. Nat., vol. 81, p. 397.

*Palaemonetes (Palaemonetes) paludosus* Holthuis, 1949, Proc. Kon. Nederl. Akad. Wetensch., vol. 52, p. 91, fig. 1 f-i; 1950a, Siboga Exped. mon. 39a9, p. 10.

*Description:* The rostrum is rather slender, reaching about to or somewhat beyond the end of the scaphocerite. The upper margin is somewhat concave and the tip is directed upwards. There are 6 to 8 teeth on the upper margin, seldom 5 or 9. The first of these teeth, seldom the first 2, are placed behind the orbit. The distal teeth are more widely spaced than the proximals. The lower margin bears 3 or 4, seldom 1

or 2, teeth. The branchiostegal spine is placed on the anterior margin of the carapace, just below the point where the branchiostegal groove reaches the anterior margin. In all Florida specimens there is no space between the base of the spine and the margin of the carapace, while in specimens from New Jersey to Georgia the spine is slightly removed from the margin, pointing, however, with more than half its length beyond it. These specimens moreover can immediately be separated from *P. kadiakensis* by having the branchiostegal spine placed just below the branchiostegal groove and not quite a distance below it as in the latter species.

The 6th abdominal segment is somewhat less than twice as long as the fifth and is slightly shorter than the telson. The anterior pair of dorsal spines lies in or somewhat behind the middle of the telson, the posterior pair lies about midway between the anterior pair and the posterior margin of the telson. The posterior margin as usual ends in a distinct median point, and is provided with 2 pairs of spines and 2 feathered setae.

The eyes are well developed. The cornea is globular and well pigmented.

The basal segment of the antennular peduncle has the stylocerite small and slender, it reaches to, or just fails to reach the middle of the segment. The anterolateral spine of the basal segment is strong, but nevertheless is somewhat overreached by the strongly forwards produced anterior margin of the segment. The last 2 segments of the peduncle are rather slender, are of about equal length and together they are about as long as the basal segment. The upper flagellum has the 2 rami fused for 16 to 29 joints, the free part consists of 4 to 9 joints, being less than ⅓ as long as the fused part.

The scaphocerite is about thrice as long as broad, it is of about the same breadth over its entire length. The lamella distinctly overreaches the final tooth.

The first legs just fail to reach the end of the scaphocerite, sometimes they fall largely short of it. The fingers are about as long as the palm. The carpus is 2½ times as long as the chela and 5/4 times as long as the merus. The second legs are distinctly larger and stronger than the first. They reach with the whole or part of the chela beyond the scaphocerite. The fingers measure ¾ of the length of the palm. The cutting edges of the fingers are unarmed, but the fingers are slightly gaping at the base. The carpus is about 1½ times as long as the chela and 1½ to 1¾ as long as the merus. The ischium is as long as the merus. The

third pereiopod just falls short of the tip of the final tooth of the scaphocerite. The propodus is slightly more than twice as long as the slender dactylus, twice as long as the carpus and slightly shorter than the merus. The fifth leg reaches with part of the dactylus beyond the scaphocerite. The propodus is about thrice as long as the dactylus, twice as long as the carpus and distinctly longer than the merus.

The pleopods and uropods are normal in shape. The outer margin of the uropodal exopod ends in an immovable tooth, which at its inner side is provided with a movable spine.

*Size:* The largest specimen seen by me measured 46 mm. Ovigerous females measured 30 to 44 mm. The eggs are rather few and large, they are 0.9 to 1.4 mm in diameter.

*Colour:* In life the animals are nearly transparent (Hay & Shore, 1918).

*Material examined:* In the collection of the Allan Hancock Foundation at Los Angeles specimens of this species are present from:

Florida: Large Balancing Canal, W. of Boca Raton, June, 1943.

In the United States National Museum material of this species is present from the following localities: New Jersey (Newton Creek, Gloucester, Camden Co.), Maryland (near Gayton, Caroline Co.; Patuxent River at Arundel, Prince George Co.; Laplata, Waldorf and near Bryantown, Charles Co.; St. George Island, St. Mary Co.; Girdletree, Worcester Co.), District of Columbia (Shaw Ponds at Kenilworth), Virginia (Dogue Creek, Fairfax Co.; Newport News, Warwick Co.; near Richmond; Taylor Millpond, Greensville Co.; Saunders, Nansemond Co.), North Carolina (Halifax and Hales Point, Halifax Co.; Edenton, Chowan Co.; Mattamuskeet Lake, Hyde Co.; Lakeview, Moore Co.; Beaufort and Morehead City, Carteret Co.; Wilmington, New Hanover Co.; Salmon Creek), South Carolina (between Bayboro and Homewood, Horry Co.; Hopkins, Richland Co.; Summerton, Clarendon Co.; Santee River, Williamsburg Co.; Orangeburg, Whitehouse Church and Fourhole Swamp, Orangeburg Co.), Georgia (Augusta, Richmond Co.; Buckhead Creek near Millen, Screven Co.; Okefenoke Swamp, Charlton Co.), Florida (Silver Lake, Calhoun Co.; Wakulla, Wakulla Co.; Withlacoochee River; Gainesville, Alachua Co.; Palatka, Satsuma and Crescent City, Putnam Co.; Manatee Springs, Levy Co.; McIntosh and Silver Springs, near Lake George, Marion Co.; Homosassa Springs, Citrus Co.; Eustis, Lake Co.; Sanford, Lake Jessup, near Orlando, Lake Butler and Englewood, Orange Co.; Knights, Hillsborough Co.; near Lake Kissimee, Osceola Co.; Indian River; Georgi-

ana, Brevard Co.; Myakka River, Sarasota Co.; Felda, Hendry Co.; near Miami, Dade Co.; Everglades), Mississippi (Grand Plains Bayou), Louisiana (Morgan City, St. Mary Parish; Lake Salvador, St. Charles Parish; Amesville, Jefferson Parish; New Orleans, Orleans Parish; Chalmette, St. Bernard Parish), Oklahoma (Clear Lake, McCurtain Co.), Texas (San Marcos, Hays Co.; Wallace Lake, Chambers Co.).

*Distribution:* The species is common in fresh-waters E. of the Alleghenies, from New Jersey to Florida. It seems to have been introduced in some localities west of this mountain range. The records in literature are: Maryland (Creaser, 1931), District of Columbia (Creaser, 1931), Virginia (Creaser, 1931), near Chapel Hill, Orange Co., North Carolina (Coker, 1938), Northampton Co., N. C. (Worth, 1908), Halifax, Halifax Co., N. C.! (Coker, 1938), Hales Point, Halifax Co., N. C.! (Hay & Shore, 1918; Coker, 1938!), Edenton, Chowan Co., N. C.! (Hay & Shore, 1918; Coker, 1938!), Lake Mattamuskeet, Hyde Co., N. C.! (Hay & Shore, 1918; Coker, 1938!), near Beaufort, Carteret Co., N. C.! (Pearse, 1936), Lakeview, Moore Co., N. C.! (Coker, 1938), Sampson Co., N. C. (Worth, 1908), Whitelake, Bladen Co., N. C. (Coker, 1938), Wilmington, New Hanover Co., N. C.! (Coker, 1938), Salmon Creek, North Carolina! (Coker, 1938), South Carolina (Gibbes, 1848; Howard, 1883), Summerton, Clarendon Co., S. C.! (Coker, 1938), Orangeburg, Orangeburg Co., S. C.! (Coker, 1938), Summerville, Berkeley Co., S. C. (Stimpson, 1871), St. Andrews, Charleston Co., South Carolina (Gibbes, 1850a), Ohopee River, Emanuel Co., Georgia (Creaser, 1931), Florida (Smith, 1874), Lake Okeechobee, Fla. (Ives, 1891; Sharp, 1893), Lake Hicpochee, De Soto Co., Fla. (Ives, 1891; Sharp, 1893), Caloosahatchie River, Lee Co., Fla. (Ives, 1891; Sharp, 1893).

*Type:* The type locality of this species is St. Andrews, Charleston Co., South Carolina. The type specimens were preserved in the collection of Dr. Gibbes. Their existence at present is very doubtful, inasmuch as they in 1850 "were not quite perfect, having lost some of their feet and antennae." (Gibbes, 1850a, p. 197.)

*Remarks:* The present species very often is named *Palaemonetes exilipes* Stimpson. The specimens described by Stimpson (1871) under this name from Somerville, S. C., certainly belong to the present species, but the name *exilipes* may not be used, because Gibbes's (1850a) name is older. Gibbes's specimens which were collected in fresh-water near Charleston, S. C., were more or less damaged, but the description,

though short, is such that it is not possible that his specimens are something else than *Palaemonetes exilipes*. That he brought the species to *Hippolyte,* probably is due to the loss of several legs in his material. As *Palaemonetes* is masculine, the name *paludosa* must be changed in *paludosus.*

The fresh-water species of *Palaemonetes* occurring west of the Alleghanies a long time has been considered cospecific with *P. paludosus.* It is, however, distinct as is pointed out on p. 217.

The records of the present species from Louisiana, Texas and Oklahoma (in the latter locality the species was found together with *P. kadiakensis*), probably is due to shipment of the species from east to west, as it is considered an important fish food. Worth (1908) mentions a large and successful shipment of living *Palaemonetes* from Halifax, N. C., to Neosho, Mo.

### Palaemonetes (Palaemonetes) kadiakensis M. J. Rathbun

Pl. 51, figs. k-n; pl. 52, figs. a, b

*Palaemonetes exilipes* p.p. Smith, 1874, Rep. U. S. Fish Comm., vol. 2, p. 641, pl. 1, fig. 1.

*Palaemonetes exilipes* Forbes, 1876, Bull. Illinois Mus. Nat. Hist., vol. 1, p. 5. (non Stimpson, 1871.)

*Palaemonetes paludosa* p.p. Kingsley, 1878, Proc. Acad. Nat. Sci. Phila., 1878, p. 97; Kingsley, 1878, Bull. Essex Inst., vol. 10, p. 65.

*Palaemonetes exilipes* Hay, 1882, Amer. Nat., vol. 16, p. 144.

*Palaemonetes exilipes* p.p. R. Rathbun, 1883, Bull. U. S. Fish Comm., vol. 2, p. 144; R. Rathbun, 1884, Fish. Fish Industr. U. S., vol. 1, p. 819.

*Palaemonetes paludosa* Underwood, 1886, Bull. Illinois Lab. Nat. Hist., vol. 2, p. 374; Herrick, 1887, Mem. Denison Sci. Ass., vol. 1, pt. 1, p. 46, pl. 5, fig. 5. (non *Hippolyte paludosa* Gibbes, 1850.)

*Palaemonetes exilipes* Evermann, 1892, Bull. U. S. Fish Comm., vol. 11, p. 90.

*Palaemonetes paludosa* p.p. Sharp, 1893, Proc. Acad. Nat. Sci. Phila., 1893, p. 124; Kingsley, 1899, Amer. Nat., vol. 33, p. 718, fig. 56.

*Palaemonetes exilipes* Neher, 1902, Proc. Indiana Acad. Sci., 1901, p. 98, fig. 1.

*Palaemonetes kadiakensis* M. J. Rathbun, 1902b, Proc. U. S. Nat. Mus., vol. 24, p. 93; M. J. Rathbun, 1904, Harriman Alaska Exped., vol. 10, p. 30, fig. 9.

*Palaemonetes exilipes* Herms, 1907, Ohio Nat., vol. 7, p. 73, figs. 1, 2; Pearse, 1910, Rep. Michigan Acad. Sci., vol. 12, p. 74; Forbes & Richardson, 1913, Bull. Illinois Lab. Nat. Hist., vol. 9, pp. 531, 536, 543; Pearse, 1913, Occ. Pap. Mus. Zool. Univ. Michigan, n. 1, p. 4.

*Palaemonetes paludosus* Shelford, 1913, Bull. Geog. Soc. Chicago, vol. 5, p. 129, fig. 78.

*Palaemonetes paludosa* Huntsman, 1915, contr. Canad. Biol., 1911-1914, pt. 2, p. 154, fig. 7.

*Palaemonetes kadiakensis* Williamson, 1915, Nord. Plankt., vol. 18, p. 409.

*Palaemonetes exilipes* p.p. Ortmann, 1918, Ward and Whipple's Fresh Water Biology, p. 845, fig. 1312; Kendall, 1923, Rep. U. S. Fish Comm., 1922, pt. 2, p. 14, fig. 9; Kemp, 1925, Rec. Indian Mus., vol. 27, p. 316.

*Palaemonetes kadiakensis* Kemp, 1925, Rec. Indian Mus., vol. 27, p. 316.

*Palaemonetes exilipes* Richardson, 1925, Bull. Nat. Hist. Surv. Illinois, vol. 15, p. 420.

*Palaemonetes paludosa* Johansen, 1929, Canad. Field Nat., vol. 43, p. 104.

*Palaemonetes exilipes* p.p. Creaser, 1931, Pap. Michigan Acad. Sci., vol. 13, p. 272, fig. 39.

*Palaemonetes exilipes* Creaser, 1932, Trans. Wisc. Acad. Sci. Arts Lett., vol. 27, p. 333, fig. 13.

*Palaemonetes exilipes* p.p. Creaser, 1933, Aquarium, Phila., vol. 1, p. 261, fig.

*Palaemonetes exilipes* Creaser and Ortenburger, 1933, Pub. Univ. Oklahoma Biol. Surv., vol. 5, p. 45, fig. 19.

*Palaemonetes exilipes* Geiser, 1933, Field Lab., vol. 2, p. 30; Geiser, 1933a, Abstr. Pap. Ann. Meeting N. Texas Biol. Soc., April 22, 1933, p. 7.

*Palaemonetes paludosa* Meehean, 1936, Trans. Amer. Micr. Soc., vol. 55, p. 433, text fig. 7, pls. 54, 55; Meehean, 1936a, Proc. Louisiana Acad. Sci., vol. 3, p. 47.

*Palaemon exilipes* Anonymous, 1942, Annot. List Fauna Grand Isle Region, p. 6.

*Palaemonetes exilipes* Reeves, 1942, Journ. Alabama Acad. Sci., vol. 14, p. 57.

*Palaemonetes paludosa* Hoff, 1944, Rep. Reelfoot Lake Biol. Sta., vol. 8, p. 26.

*Palaemonetes (Palaemonetes) kadiakensis* Holthuis, 1949, Proc. Kon. Nederl. Akad. Wetensch., vol. 52, p. 92, fig. 1 j-1; 1950a, Siboga Exped., mon. 39a9, p. 10.

*Description:* The rostrum is straight, rather high in specimens from northern localities, generally more slender in southern specimens. It reaches about to the end of the scaphocerite, reaching sometimes slightly beyond that scale and falling sometimes slightly short of it. The upper margin is somewhat convex and bears 6 to 8, generally 7, teeth (in abnormal specimens 5, 9 or 10 may be found. The first of these teeth is placed behind the orbit on the carapace proper. The teeth are separated by equal distances, only the distance between the last tooth and the tip of the rostrum generally is larger than that between the teeth themselves. The lower surface bears generally 2, sometimes 3 (in southern forms 3 teeth more often are observed than in the northern) teeth (in abnormal specimens none, 1 or 4 lower teeth may occur). The carapace is provided with antennal and branchiostegal spines. The branchiostegal spine lies a distinct distance below the branchiostegal groove and is distinctly removed from the anterior margin of the carapace, generally reaching with the tip to, or slightly beyond that margin.

The abdominal segments are as in *P. paludosus.* The telson has the anterior pair of dorsal spines placed distinctly behind the middle of its length, while the posterior pair is placed very close to the posterior margin, generally so close that it looks as if there are 3 pairs of posterior spines. The 2 posterior spines are as in *P. paludosus,* and 2 feathered setae are present between the inner spines.

The eyes and antennulae as in *P. paludosus.* The anterior margin of the basal segment of the antennula sometimes (most often in southern specimens) is strongly produced anteriorly, overreaching thereby the middle of the 2nd segment, but all transitions to the normal shape occur. Like in *P. paludosus* the shorter of the 2 rami of the upper flagellum has the fused part more (often much more) than thrice as long as the free part. The number of fused joints varies between 11 and 23, that of the free joints between 3 and 8, the higher numbers generally being found in specimens from the southern part of the range of distribution of the species.

The scaphocerite does not differ essentially from that of the preceding species.

The oral parts have the typical form.

The pereiopods do not differ essentially from those of *Palaemonetes paludosus.* Also the pleopods and uropods are of the usual shape.

*Size:* Meehean (1936) states his largest specimen to be 53 mm in length, though generally the specimens are smaller. Ovigerous females were found to be 23 to 49 mm long.

*Material examined:* In the U. S. National Museum material of this species is present from: New York (Tonawanda, Erie Co.; Braddock Bay, Monroe Co.; Sodus Bay, Wayne Co.), Ohio (Perrysburg, Wood Co.; Maumee Basin; Put-in-Bay, Ottawa Co.; Fremont, Sandusky Co.; Sandusky Bay; Flat Creek, N. of Delphos, Camp Creek and Spencerville, Allen Co.; Wabash River and 12 Mile Creek, Mercer Co.; 12 Mile Creek, Lake St. Marys and Auglaize River near Wapakoneta, Auglaize Co.; De Haven Pond, Shelby Co.; Brush Creek, Scioto Co.), Indiana (Shelby, Lake Co.; Lake Maxinkuckee, Marshall Co.; Tippecanoe River; Little River, W. of Aboite, Huntington Co.; Pigeon Creek near Evansville, Vanderburgh Co.), Michigan (Lake Superior; Lake Huron; Mouth of St. Joseph River, Berrien Co.; Port Huron, St. Clair Co.; Detroit and Ecorse, Wayne Co.), Illinois (Kankakee, Kankakee Co.; Quincy, Adams Co.; Horseshoe Lake near Moellenbrocks near Collinsville, Madison Co.; Olney, Richland Co.; Mt. Carmel, Wabash Co.; Bottoms, Union Co.; Cairo, Alexander Co.), Iowa (Keokuk, Lee Co.), Kentucky (Clinton, Hickman Co.; Lynngrove, Graves Co.; Shady Grove, Crittenden Co.; Owensboro, Davies Co.; S. of Island, Muhlenberg Co.; Woodbury, Butler Co.), Florida (Jackson Lake, Leon Co.; Waldo and Gainesville, Alachua Co.), Alabama (Harris Station, Limestone Co.; Wheeler, Lawrence Co.; Tuscaloosa, Tuscaloosa Co.; Selma, Dallas Co.; Auburn, Lee Co.), Mississippi (Friarpoint, Coahoma Co.; Tupelo, Lee Co.; West Point, Clay Co.; Itta Bena and Browning, Leflore Co.; Inverness and Lake Shakelford, Sunflower Co.; Greenville and Leland, Washington Co.; Belzoni, Humphreys Co.; Yazoo City, Yazoo Co.; Canton, Madison Co.; Carthage, Leake Co.; Vicksburg, Warren Co.; Rawles Springs and Hattiesburg, Forrest Co.), Louisiana (Campti, Nachitoches Parish; Opelousas, St. Landry Parish; Fordoche, Pointe Coupee Parish; Baton Rouge, East Baton Rouge Parish; Erwinville, West Baton Rouge Parish; Tickfaw, Tangipahoa Parish; Bogalusa, Washington Parish; Bayou Lacombe and Talisheek, St. Tammany Parish; Kraemer, Lafourche Parish; New Orleans, Orleans Parish; Fallen Switch), Arkansas (Phillips Bay, Lawrence Co.; St. Francis River; Newport, Jackson Co.; Higginson, White Co.; Conway, Faulkner Co.), Oklahoma (Clear Lake, McCurtain Co.), Texas (near Dallas, Dallas Co.; Chandler, Henderson Co.; near Palestine, Anderson Co.; Beaumont, Jefferson Co.; near Houston, Harris Co.; Schulenburg, Fayette Co.;

Eaglelake, Colorado Co.; Guthrie Lake and Carancahua Creek, Jackson Co.; Garcitas Creek and Bridhams Lake, Victoria Co.; Pleasantown, Atacosa Co.; Laredo, Webb Co.; Corpus Christi, Nueces Co.).

*Distribution:* The species inhabits the fresh-waters of the central part of the U. S. A., namely, the shores of Lakes Ontario, Erie and Michigan, the Mississippi basin and the basins of several rivers emptying east and west of the Mississippi in the Gulf of Mexico. It furthermore is known from S. Canada and N. E. Mexico. The records in literature are: Hamilton, Ontario, Canada (Johansen, 1929), Welland River, Ont. (Huntsman, 1915), Rondeau Harbor, Ont. (Pearse, 1913), Detroit River, Ontario, Canada (Huntsman, 1915), New York State (Creaser, 1931), Erie, Erie Co., Pennsylvania (Pearse, 1913), Put-in-Bay, South Bass Island, Lake Erie, Ottawa Co., Ohio (Pearse, 1913), Sandusky Bay, Ohio! (Smith, 1874!; Herms, 1907; Pearse, 1913; Huntsman, 1915), Wyandotte Cave, Crawford Co., Indiana (Sharp, 1893), Ecorse, Wayne Co., Michigan! (Smith, 1874), Oldport and Newport, Monroe Co., Michigan (Creaser, 1931), Wisconsin (Creaser, 1931), near Hudson, St. Croix Co., near Maiden, Pierce Co., near Alma, Buffalo Co., and near Prairie du Chien, Crawford Co., Wisconsin (Creaser, 1932), Iowa (Creaser, 1931), Illinois River, Illinois (Forbes, 1876), Springvalley and Depue Lake, Bureau Co., and between Henry and Chillicothe, Marshall Co., Ill. (Forbes and Richardson, 1913), Pekin, Tazewell Co., Ill. (Forbes, 1876), between Liverpool, Fulton Co. and Havana, Mason Co., Illinois (Richardson, 1925), Kentucky (Creaser, 1931), Reelfoot Lake, Obion Co., Tennessee (Hoff, 1944), Memphis, Shelby Co., Tennessee (Hay, 1882), Tuscaloosa, Tuscaloosa Co., Alabama (Herrick, 1887), Tuscaloosa Co., Alabama (Reeves, 1942), Tombigbee and Moxubee Rivers, Mississippi (Hay, 1882), Jackson, Hinds Co., and Enterprise, Clarke Co., Mississippi (Hay, 1882), Louisiana (Creaser, 1931), Natchitoches, Natchitoches Parish, La. (Meehean, 1936), Grand Isle, Jefferson Parish, Louisiana (Anonymous, 1942), Missouri (Creaser, 1933), Arkansas (Creaser, 1931), Oklahoma (Creaser, 1931), Poteau River, Leflore Co., Oklahoma (Creaser & Ortenburger, 1933), Kaimichi River, Pittsburgh Co., Oklahoma (Creaser & Ortenburger, 1933), Dallas, Dallas Co., Texas! (Geiser, 1933), near Palestine, Anderson Co.!, Magnolia Pt. near Palestine, Anderson Co.!, and near Houston, Harris Co.!, Tex. (Evermann, 1892), San Marcos, Hays Co., Tex. (Neher, 1902), Corpus Christi, Nueces Co., Texas! (Evermann, 1892), Nuevo Leon State, Mexico (Creaser, 1932), ? Kodiak Island, Alaska (M. J. Rathbun, 1902b, 1904).

*Type:* The type locality is Kodiak Island, Alaska.[14] The type specimens are in the collection of the United States National Museum (Cat. No. 6246).

*Remarks:* Up till now the fresh-water specimens of *Palaemonetes* from Central and Eastern U. S. A. were considered to be one species, though some authors (e.g., Smith, 1874) noticed differences between those specimens. Now it is clear that we have to do with 2 well marked species, one occurring east of the Alleghanies, from New Jersey to Florida, the other occupying the region west of this mountain range from New York, Ontario and Wisconsin in the north to Alabama, Texas and N. E. Mexico in the south. The differences, though being rather small, are constant. Within the species some characters are varying, often being constant in one locality. These characters, however, are so unimportant, and the differences being so slight and not very constant, that no value can be attached to them.

The name generally used for both forms is *Palaemonetes exilipes,* though various authors employed the name *P. paludosa* (an error for *P. paludosus*). As already pointed out the type of specimens of both *Palaemonetes exilipes* Stimpson and *Hippolyte paludosa* Gibbes originated from S. Carolina, thus both belonging to the eastern species, which consequently has to be named *Palaemonetes paludosus* (Gibbes), Gibbes's name being the older.

In 1902 M. J. Rathbun gave a preliminary description of *Palaemonetes kadiakensis,* of which species a more complete description and a figure were published in 1904 by the same author. Kemp (1925, p. 317) already remarked that he was unable to distinguish between *P. kadiakensis* and *P. exilipes.* Comparing the type specimens of *P. kadiakensis* with specimens of the two forms of fresh-water *Palaemonetes* from the U. S. A., I found them completely identical with the form from the central U. S. A. So nothing could be done except to consider them as belonging to the same species. The name *kadiakensis* is the first valid name, employed for specimens of the western form, so that that name has to be used for the species. In my opinion it is very probable that the type specimens of *P. kadiakensis* were wrongly labelled and do not originate from Alaska at all. Since Rathbun's record the species has not been rediscovered in Alaska. It seems very strange, too, that the species should occur "under stones at low water," certainly an unusual habitat for a *Palaemonetes.* The more so as the habitat of

[14] The correctness of this type locality is very doubtful, vid. p. 212.

this species is described by Herms (1907) as being, "clear, shallow water ranging in depth from one to perhaps four or five feet, with vegetation and sandy bottom."

In some places in the region which is inhabited by the present species, the closely related *Palaemonetes paludosus* may occur. In the U. S. National Museum for instance, specimens of the latter species are present from Louisiana (neighbourhood of New Orleans and Morgan City), Texas (San Marcos) and Oklahoma. At first sight this seems very strange, but when we keep in mind that both species are used as a fish food and for that reason are transported over great distances, this anomaly in the distribution may be explained. So Worth (1908) mentions a shipment of 3300 specimens of *Palaemonetes paludosus* from "Halifax, N. C., for delivery at Washington, D. C., 200 miles distant," and other shipments "from the same place [Halifax, N. C.] to the Neosho, Mo., station," which under proper circumstances were very successful.

### Palaemonetes (Palaemonetes) carteri Gordon

Pl. 52, figs. c-o; pl. 53, figs. a-c

*Palaemonetes cubensis* Sollaud, 1923, Bull. Biol. France Belg., vol. 57, p. 577, fig. 20 (non Hay, 1903).

*Palaemonetes carteri* Gordon, 1935a, Journ. Linn. Soc. Lond. Zool., vol. 39, p. 324, fig. 12; Holthuis, 1948, Proc. Kon. Nederl. Akad. Wetensch., vol. 51, p. 1113; 1950a, Siboga Exped., mon. 39a9, p. 10; 1950b, Zool. Meded., vol. 31, p. 32.

*Description:* The rostrum is slender, being distinctly curved upwards in the distal part. It reaches to or slightly beyond the tip of the scaphocerite. The proximal half of the upper margin bears 5 to 8 teeth, the first of which is situated mostly behind the posterior limit of the orbit, seldom all teeth are placed on the rostrum proper. The first tooth is somewhat smaller than the others. One or two subapical teeth are placed close to the apex. There is a large unarmed space between these subapical teeth and the proximal rostral teeth. The lower margin bears 3 to 7 teeth, mostly 5 or 6; these teeth are placed in the distal half of the rostrum. The branchiostegal spine is almost as strong as the antennal, it is slightly remote from the anterior margin of the carapace; this margin, however, is overreached by the tip of the branchiostegal spine. The branchiostegal groove is situated some distance dorsally of the branchiostegal spine.

The abdomen is smooth. The apex of the pleura of the fifth segment is pointed. The sixth segment is 1.6 times to twice as long as the fifth. The telson is somewhat longer than the sixth abdominal segment. The dorsal surface of the telson bears two pairs of spinules, the anterior of which is placed in the middle of the telson, the posterior is situated about midway between the anterior pair and the posterior margin of the telson. This posterior margin ends in a sharp median point, which is flanked at each side by two spines and a feathered seta. The outer spine is much shorter than the inner, the feathered setae are placed between the inner spines.

The eyes are well developed and possess black pigment.

The basal segment has the stylocerite slender and pointed, it fails to reach the middle of the basal segment. The outer margin of the basal segment is almost straight and ends in a strong anterolateral tooth, which reaches beyond the middle of the second segment of the antennular peduncle. The anterior margin of the basal segment is strongly convex and even overreaches the anterolateral tooth. The second segment of the antennular peduncle is about as broad as, but distinctly shorter than the third. Together these two segments are more than half as long as the basal segment. The fused part of the upper antennular flagellum consists of 5 to 8 joints, the free part of the shorter ramus of 7 to 20 joints, being thereby about 2.5 to 5 times as long as the fused portion.

The scaphocerite reaches far beyond the antennular peduncle, but fails or almost fails to reach the end of the rostrum. It is about thrice as long as broad. The outer margin is straight or slightly concave and ends in a strong final tooth, which, however, is distinctly overreached by the lamella.

The oral parts are quite typical.

The first pereiopod reaches to or almost to the end of the scaphocerite. The chela is rather broad, the fingers are longer than the palm. The carpus is almost twice as long as the chela. The merus is somewhat shorter than the carpus, while the ischium is about half as long as the merus. The second pereiopods are slender, they reach with the chela and sometimes with a small part of the carpus beyond the scaphocerite. The fingers measure about ⅔ of the length of the palm; the fixed finger as well as the dactylus possess one small tooth in the middle of their cutting edges, the tooth of the dactylus is placed slightly anteriorly of that of the fixed finger. The rest of the cutting edges is entire, but the part proximal of the teeth is concave, so that when the fingers are closed a distinct gap is visible between the proximal parts of the fingers.

The carpus is about 1.5 to almost twice as long as the chela, it is distinctly broadened in the distal part. The merus is about as long as the chela, and distinctly shorter than the ischium. The last three pereiopods are slender, the third is shortest, it slightly overreaches the antennular peduncle, but greatly falls short of the tip of the scaphocerite. The dactylus measures about 2/5 of the length of the propodus. The propodus is slender and provided with some 5 spines at the posterior margin. The carpus is about half as long as the propodus. The merus is about as long as the propodus and the ischium is about as long as the carpus. The fifth pereiopod is the most slender, it reaches with part of or with the entire dactylus beyond the scaphocerite. The propodus is somewhat more than thrice as long as the dactylus. The carpus is about half as long as the propodus. The merus is somewhat shorter than the propodus, the ischium is somewhat shorter than the carpus.

The pleopods and uropods are normal in shape. The outer margin of the exopod of the uropod ends in a tooth, which at its inner side is provided with a movable spine.

*Size:* The specimens seen by me measured 16 to 35 mm. The males generally are smaller than the females, they are up to 28 mm long. The eggs are large and few, the diameter is 1.0 to 1.65 mm.

*Colour:* In life the animals are perfectly colourless and transparent, except for a dark mass which lies in the thorax around the stomach. (Holthuis, 1950b, p. 34.)

Some specimens of this species were brought alive from Surinam to Holland together with tropical aquarium fishes. The material was studied by me in Leiden and the following colour pattern was noted: The body is colourless transparent, with the intestine shining through. Rather many scattered small red chromatophores are visible on the body when examined with a strong lense. The chromatophores are rather regularly distributed over the body. On the carapace, however, some more or less distinct bands of a darker colour are visible; here the chromatophores are placed closer together than on the rest of the carapace. A horizontal red band runs on each side of the carapace from the antennal spine backwards. Below this band there are two short vertical bands: one in and one slightly before the middle of the carapace. Furthermore a short horizontal band is visible just below the posterior part of the large horizontal band. Also some whitish chromatorphores are visible on the body. A line of such chromatophores extends over the full length of the rostrum, a few of them are placed near the posterior margin of the abdominal segments and on the tail fan, while they form a transverse band

over the base of the telson and the uropods. The eyes have the cornea dark brown to black. The peduncle bears white and reddish chromatophores on the upper side and a broad dark blackish line below. Scattered chromatophores are visible on the antennular peduncle and the scaphocerite, they are most numerous near the outer and inner margins. A broad dark red line is visible at the base of the antennulae, behind the statocysts. The flagella are pale yellowish brown. The legs generally are not coloured, though sometimes chromatophores are present near the articulations. In one of my specimens the fingers of the second chelipeds are pinkish, while the articulation between the dactylus and the palm is of a pale greyish blue colour. The pleopods have some scattered red chromatophores. On the ventral surface of the body some very conspicuous dark red streaks are visible. One of these streaks is placed in the basal part of the third maxilliped, another in the basal part of the third pereiopod, two more on the last two pairs of pleurobranchs, and finally there is a streak along the abdominal part of the intestine.

*Material examined:* In the collection of the U. S. National Museum 2 small specimens of this species from Rio Amava, 2 km south of Maturin, E. Venezuela are preserved. The Rijksmuseum van Natuurlijke Historie at Leiden, Holland, possesses some thousands of individuals of this species from various localities in Surinam (Dutch Guiana); between Coronie and Paramaribo, Paramaribo, Zanderij I. and Republiek both at about 40 km S. of Paramaribo, Sectie Q and Guyana Goud Placer both at about 70 km S. of Paramaribo, Kabelstation at about 130 km S. of Paramaribo, Saramacca River basin, and N. of Moengotapoe in N. E. Surinam.

*Distribution:* The species is known at present from fresh-water in Venezuela, British, Dutch and French Guiana. The records in literature are: Upper Cuyuni River, British Guiana (Gordon, 1935a), Mazaruni River near Penal Settlement, British Guiana (Gordon, 1935a), between Coronie and Paramaribo, Surinam! (Holthuis, 1950b), Paramaribo, Republiek at about 40 km S. of Paramaribo, Guyana Goud Placer at about 70 km S. of Paramaribo, and Saramacca River basin! (Holthuis, 1950b), Zanderij I. at about 40 km S. of Paramaribo, and Sectie Q at about 70 km S. of Paramaribo! (Holthuis, 1948), Kabelstation at about 75 km S. of Paramaribo! (Holthuis, 1948, 1950b), N. of Moengotapoe, N. E. Surinam! (Holthuis, 1950b), Cayenne, French Guiana (Sollaud, 1923).

*Type:* The type locality is Upper Cuyuni River, British Guiana. The holotype (Reg. No. 5.20.19) and the paratypes (Reg. No. 5.20.20-29) are preserved in the collection of the British Museum, London.

*Remarks:* The species shows a strong resemblance to *Palaemon pandaliformis* Stimpson. The differences, however, are:

1. The branchiostegal spine in *Palaemonetes carteri* lies behind the anterior margin of the carapace, in *Palaemon pandaliformis* it lies on that margin.

2. The mandible in *Palaemonętes carteri* lacks a palp, while it is present in *Palaemon pandaliformis.*

3. The eggs of *Palaemonetes carteri* are much larger than those of *Palaemon pandaliformis.*

## Palaemonetes (Palaemonetes) ivonicus Holthuis

Pl. 53, figs. d-h

*Palaemonetes ivonicus* Holthuis, 1950, Proc. Kon. Nederl. Akad. Wetensch., vol. 53, p. 98.

*Palaemonetes (Palaemonetes) ivonicus* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 10.

*Description:* The rostrum is straight and extends beyond the antennular peduncle, it fails, however, to reach as far as the end of the scaphocerite. The upper margin is arched in the larger proximal part, and bears 6 to 10 teeth, the first of which is placed behind the orbit. The distal teeth are placed wider apart than the proximals; a small subapical tooth is situated just before the apex. The lower margin bears 3 teeth. The carapace is smooth, the branchiostegal groove is very distinct. The branchiostegal spine is placed much below the groove and is so far removed from the anterior margin of the carapace that even its tip falls short of that margin.

The abdomen is smooth. The pleura of the 5th segment ends in a rounded tip, the posterior margin of the pleura is, however, concave. The sixth segment is almost twice as long as the fifth and is slightly shorter than the telson. The anterior of the 2 dorsal pairs of spines of the telson is placed about in the middle of the length of the telson, the posterior pair lies somewhat closer to the anterior pair than to the posterior margin of the telson. This posterior margin is truncate and ends in an acute median point, it bears the usual 2 pairs of spinules and 2 feathered setae. The inner spines overreach the tip of the telson.

The eyes are well developed, have the cornea globular and provided with pigment.

The antennules have the basal segment very broad, becoming broader anteriorly. The stylocerite is small and just fails to reach the middle of the basal segment. The anterolateral angle bears a distinct tooth.

The anterior margin of the basal segment is produced extremely far forward and reaches to the end of the second segment of the peduncle. The third segment of the peduncle is as broad as but distinctly longer than the second. The upper antennular flagellum has the two rami fused for about 3 joints, the free part of the shorter ramus consists of about 8 joints and is twice as long as the fused part.

The scaphocerite is about thrice as long as broad. The outer margin is straight or slightly convex. The final tooth is far overreached by the lamella.

The oral parts are normal in shape. The epipod of the first maxilliped is not bilobed.

The first pereiopod reaches with the fingers beyond the scaphocerite. The fingers are about as long as the palm. The carpus is fully twice as long as the chela and 1.2 times as long as the merus. The second legs are distinctly longer and stronger than the first, they reach with the chela and part of the carpus beyond the scaphocerite. The fingers are only slightly shorter than the palm. The dactylus has the cutting edge provided with 2 teeth, the distal of which is placed somewhat before the middle of the edge. The fixed finger bears one tooth which is placed just between the teeth of the dactylus. The carpus is 1.6 times as long as the chela and about 1.8 times as long as the merus. In my specimens, both of which are ovigerous females, the ischium is distinctly longer than the merus. The third leg reaches about to the end of the scaphocerite. The propodus is slightly more than 2.5 times as long as the dactylus and twice as long as the carpus, but is somewhat shorter than the merus. The fifth leg reaches slightly beyond the scaphocerite. The propodus is more than thrice as long as the dactylus, twice as long as the carpus, and slightly longer than the merus.

The pleopods and uropods are normal in shape. The final tooth at the outer margin of the exopod is provided at its inner side with a small, but distinct movable spine.

*Size:* Both specimens at my disposal are ovigerous females. They are 26 and 29 mm long. The eggs are few and large, being 1.0 to 1.5 mm in diameter.

*Material examined:* The U. S. National Museum possesses two specimens of this species from Ivon at the Beni River, N. Bolivia (February, 1922, W. M. Mann coll., The Mulford Biological Exploration of the Amazon Basin). The locality lies in the Amazon Basin.

*Type:* The larger of the females is the holo-, the other the paratype (U.S.N.M. Cat. No. 85234).

*Remarks:* The species seems to be closest related to *Palaemonetes argentinus,* but may immediately be distinguished from that species by the situation of the branchiostegal spine, and by the strongly forwardly produced anterior margin of the basal segment of the antennular peduncle.

### Palaemonetes (Palaemonetes) argentinus Nobili

Pl. 53, figs. i-m

*Leander brasiliensis* Ortmann, 1890, Zool. Jb. Syst., vol. 5, p. 524, pl. 37, fig. 16.

*Palaemon (Leander) brasiliensis* Thallwitz, 1892, Abh. Ber. Zool. Anthrop. Mus. Dresden, 1890-91, pt. 3, p. 7 (non Heller, 1862).

*Palaemon Borellii* p.p. Nobili, 1896, Boll. Mus. Zool. Anat. Comp. Torino, vol. 11, n. 265, p. 2.

*Leander brasiliensis* Ortmann, 1897, Rev. Mus. Paulista, vol. 2, p. 191, pl. 1, fig. 12; Von Ihering, 1897, Rev. Mus. Paulista, vol. 2, p. 422.

*Palaemonetes argentinus* Nobili, 1901b, Boll. Mus. Zool. Anat. Comp. Torino, vol. 16, n. 402, p. 3.

*Palaemon Borellii* p.p. Nobili, 1901b, Boll. Mus. Zool. Anat. Comp. Torino, vol. 16, n. 402, p. 5.

*Leander brasiliensis* Kemp, 1925, Rec. Indian Mus., vol. 27, p. 291.

*Palaemonetes argentinus* Kemp, 1925, Rec. Indian Mus., vol. 27, p. 316.

*Palaemon brasiliensis* Sawaya, 1946, Zoologia, São Paulo, vol. 11, p. 397.

*Palaemonetes argentinus* Ringuelet, 1949, Notas Mus. La Plata, vol. 14, Zool., n. 119, p. 84, text fig. 1, pls. 2, 3, 6.

*Palaemonetes (Palaemonetes) argentinus* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 10.

*Description:* The rostrum is straight and high, its upper margin is slightly arched over the eyes. It reaches to or a little beyond the end of the scaphocerite. The upper margin bears 6 to 10 teeth, generally 8, the first of which is placed behind the orbit on the carapace. The teeth are regularly divided over the upper margin. The lower margin is provided with 2 or 3 teeth. The branchiostegal spine is placed on the anterior margin of the carapace, just below the place where the branchiostegal groove reaches the anterior margin.

The pleura of the fifth abdominal segment ends in a more or less distinct angle. The sixth segment is 1.5 times longer than the fifth. The telson is about as long as the sixth abdominal segment. The anterior pair of dorsal spinules lies about in the middle of the telson, the posterior pair lies midway between the anterior pair and the posterior margin

or somewhat closer to the posterior margin. The posterior margin has the usual shape and armature; it ends in a sharp median point, which is flanked by two pairs of spinules, the inner of which overreach the median point. Between the inner (longer) spinules two feathered setae are present.

The eyes are well developed. The cornea is globular and pigmented.

The antennular peduncle has the stylocerite slender, reaching about to the middle of the basal segment. The anterolateral spine is rather strong and reaches to the end of the forwards produced anterior margin of the segment, sometimes, however, the margin reaches somewhat beyond the spine. The second segment of the peduncle is about as long as, but broader than the third segment. The upper antennular flagellum has the two rami fused for 8 to 12 joints. The free part of the shorter ramus consists of 13 to 17 joints and is about 1½ times to almost twice as long as the fused part.

The scaphocerite is thrice as long as broad and of nearly equal breadth throughout the largest part of its length. The lamella distinctly overreaches the final tooth.

The oral parts are typical. The epipod of the first maxilliped is distinctly bilobed.

The first pereiopod reaches to or almost to the end of the scaphocerite. The fingers are as long as the palm. The carpus is somewhat less than twice as long as the chela, and slightly longer than the merus. The second pereiopod is distinctly stronger than the first, it reaches with the fingers, sometimes even with part of the palm, beyond the scaphocerite. The fingers are ⅔-¾ of the length of the palm. The fingers have the cutting edge unarmed, the edges are gaping in their proximal part. The carpus is 1.15 to 1.20 times as long as the chela, and somewhat longer than the merus. The ischium is almost as long the merus. The third pereiopod fails to reach the end of the scaphocerite. The propodus is slightly less than twice as long as the dactylus, also less than twice as long as the carpus, and somewhat shorter than the merus. The fifth leg reaches to or just beyond the scaphocerite. The propodus is less than three times as long as the dactylus, twice or slightly more than twice as long as the carpus, and distinctly longer than the merus. In small specimens the legs reach less far forwards.

Pleopods and uropods are normal in shape. The exopod of the uropod possesses a movable spinule at the inner side of the immovable tooth at the end of the outer margin.

*Size:* The largest male specimen seen by me measured 25 mm. The ovigerous females are 28 to 40 mm long. The eggs are rather numerous and small, measuring 0.6 to 1.0 mm in diameter.

*Colour:* Ringuelet (1949) states that the colour of living specimens is absolutely white.

*Material examined:* In the collection of the United States National Museum this species is represented from the following localities: Rio Grande do Sul State, S. Brazil (Lagoa dos Quadros, and river between Lagoa dos Quadros and Lagoa Itapeva), S. Uruguay (Arroyo Canelon Grande near Canelones, Canelones Department; Rio Santa Lucia; Punta Yeguas, Arroyo Miguelete and Paso Molino all three localities near Montevideo, Montevideo, Montevideo Department), Argentina (Concordia and Gualeguaychu, Entre Rios Province; Rio Lujan, Rio de las Conchas, San Isidro, Tigre near Buenos Aires, Buenos Aires, Punta de Lara, and Rio Santiago, Buenos Aires Province).

In the Turin Museum I was able to examine the type specimens of the present species: five specimens from Buenos Aires (1900, coll. C. Berg), four specimens from Buenos Aires (1901, coll. Silvestri), ten specimens and some larvae from Tigre, Rio de la Plata (1901, coll. F. Silvestri). Furthermore a specimen of this species was found among the type material of *Palaemon Borellii* Nobili from San Luis Province, Argentina. In the Natural History Museum in Genoa, Italy, I examined part of the material from La Plata, which Nobili (1901b) identified as *Palaemon Borellii.* The lot contained 30 specimens, of which only 9 actually belong to *Macrobrachium borellii,* the other specimens all are *Palaemonetes argentinus.*

*Distribution: Palaemonetes argentinus* lives in fresh water in E. South America from S. Brazil to Argentina. The records in literature are: Rio Grande do Sul, S.E. Brazil (Ortmann, 1890), Rio Camaquam, Rio Grande do Sul State, S.E. Brazil (Von Ihering, 1897), Rio Parana Mini, Goya, near La Invernada Island, Reconquista Department, Santa Fé Province, Argentina (Ringuelet, 1949), Buenos Aires!, Tigre near Buenos Aires!, and La Plata!, Argentina (Nobili, 1901b), San Luis Province, Argentina! (Nobili, 1896).

*Type:* The type localities are Buenos Aires and Tigre, Rio de la Plata, near Buenos Aires. The type specimens are preserved in the Museo di Zoologia ed Anatomia comparata at Turin, Italy.

*Remarks:* Ortmann (1890) was the first to describe the present species. He named it *Leander brasiliensis,* overlooking the fact that the mandible bears no palp. Probably he did not examine the mandible,

as he does not say anything about it in his description. Nobili (1901b), not realizing Ortmann's mistake correctly referred the species to *Palaemonetes* and described it as new under the name *Palaemonetes argentinus.* Though Ortmann's name *brasiliensis* is older than *argentinus,* it may not be used, as Thallwitz (1892) brought both *Palaemon brasiliensis* Heller (1862) and *Leander brasiliensis* Ortmann (1890) to the genus *Palaemon.* Heller's name thus preoccupies that of Ortmann, the latter thereby becoming invalid. The name *Palaemon brasiliensis* (Ortmann) also has been used by Sawaya (1946).

### Palaemonetes (Palaemonetes) hiltoni Schmitt

Pl. 53, figs. n-s

*Palaemonetes hiltoni* Hilton, 1916, Journ. Ent. Zool. Pomona Coll., vol. 8, p. 69 (nom. nud.); Schmitt, 1921, Univ. Calif. Publ. Zool., vol. 23, p. 36, pl. 12, fig 5; Kemp, 1925, Rec. Indian Mus., vol. 27, p. 317.

*Palaemonetes (Palaemonetes) hiltoni* Holthuis, 1949, Proc. Kon. Nederl. Akad. Wetensch., vol. 52, p. 92, fig. 2 a-d; 1950a, Siboga Exped., mon. 39a9, p. 10.

*Description:* The rostrum is straight, it reaches about to the end of the scaphocerite. The upper margin bears 8 to 11 teeth, which are regularly divided over that margin though the proximal teeth are placed closer together than the distals, sometimes there is a naked space before the tip. The first of these teeth is placed behind the orbit. The lower margin bears 2, or 3 teeth. The branchiostegal spine stands on the anterior margin of the carapace just below the branchiostegal groove.

The fifth abdominal segment has the tip of the pleura rounded. The sixth segment is 1.5 times to about twice as long as the fifth and is shorter than the telson. The anterior dorsal spines lie about in the middle of the telson, the posterior pair is situated about midway between the anterior pair and the posterior margin. The posterior margin of the telson is typical, it ends in a median point, with at each side a short and a long spine and a feathered seta. The longer spines overreach the median point.

The eyes are well developed. The cornea is globular and provided with pigment.

The stylocerite is rather strong and pointed, it reaches about to the middle of the basal segment of the antennular peduncle. The anterior margin of the segment is strongly forward produced and distinctly overreaches the strong anterolateral spine. The third segment of the anten-

nular peduncle is more slender and slightly longer than the 2nd segment. The upper antennular flagellum has the two rami fused for 6 to 8 joints. The free part of the shorter ramus is 1.3 to 1.5 times as long as the fused part, and consists of 9 to 11 joints.

The scaphocerite is three times as long as broad. The final tooth is strong but fails to overreach the apex of the lamella.

The oral parts are typical in shape, the epipod of the first maxilliped is deeply bilobed.

The first pereiopod reaches about to the end of the scaphocerite. The fingers are about as long as the palm and the carpus is 1.5 to 1.75 times as long as the chela, and a little longer than the merus. The 2nd leg reaches with the fingers, and often with part of the palm, beyond the scaphocerite. The palm is 1.3 to 1.4 times as long as the fingers. In ovigerous females the dactylus possesses 2 teeth in the proximal part of the cutting edge, the fixed finger has 1 tooth there. The carpus is as long as the palm and half the length of the fingers and is only slightly shorter than the merus. The ischium is ⅔ to ¾ of the length of the merus. The third pereiopod reaches to, or with part of the dactylus beyond, the scaphocerite. The propodus is 2.0 to 2.3 times as long as the dactylus, less than twice as long as the carpus, and shorter than the merus. The fifth leg reaches about as far as the third, the propodus is 2.5 to 3 times as long as the dactylus, slightly more than twice as long as the carpus and distinctly longer than the merus.

The pleopods and uropods are normal in shape. The exopod of the latter has a movable spine at the inner side of the final tooth of the outer margin.

*Size:* Ovigerous females are 19 to 24 mm long. The largest male seen by me measures 19 mm. The eggs are numerous and small being 0.6 to 0.9 mm in diameter.

*Material examined:* In the U. S. National Museum material of this species is present from the following localities: S. California (San Pedro, Los Angeles Co.; Del Mar, San Diego Co.), Mexico (Guaymas, Sonora State; estuary in Sinaloa State).

*Distribution:* The species is known so far only from the localities above. The records in literature are: San Pedro, S. California! (Hilton, 1916; Schmitt, 1921), Sonora and Sinaloa States, Mexico! (Holthuis, 1949). Very little is known about the habitat of the species. The specimens from Del Mar are provided with the indication that they are collected in a slough, those from Sinaloa are collected in an estuary.

*Type:* The type locality is San Pedro, Los Angeles Co., S. California. The type specimens (1 holo- and 3 paratypes) are preserved in the United States National Museum (holotype, Cat. No. 48990).

*Remarks:* The species shows most resemblance to *Palaemonetes pugio,* but may be separated by having the teeth of the rostrum placed generally up to the tip, by having the anterior margin of the basal segment of the antennular peduncle produced strongly forwards, by having the fingers of the second chela provided with distinct teeth in the adult female and by having the tip of the pleura of the fifth abdominal segment rounded.

### Palaemonetes (Palaemonetes) schmitti Holthuis

Pl. 54, figs. a-e

*Palaemonetes* spec. Hildebrand, 1939, Zoologica, New York, vol. 24, pp. 23, 24.

*Palaemonetes schmitti* Holthuis, 1950, Proc. Kon. Nederl. Akad. Wetensch., vol. 53, p. 99; 1950a, Siboga Exped., mon. 39a9, p. 10.

*Description:* The upper margin of the rostrum is straight, the midrib, however, is curved upwards. It reaches slightly beyond the scaphocerite. Compared with those of other *Palaemonetes* species the rostrum is very deep. The upper margin bears 11 to 13 teeth, the first two of which are placed behind the posterior limit of the orbit. The distance between the first and the second dorsal tooth is larger than that between the other teeth. The other teeth are divided regularly over the upper margin of the rostrum, though the proximals are placed slightly closer together than the distals. The ventral margin bears 3 or 4, seldom 2, large and broad teeth. The branchiostegal spine is placed on the anterior margin of the carapace just below the branchiostegal groove. The fifth abdominal segment has the apex rounded. The sixth segment is about 1.7 times as long as the fifth and shorter than the telson. The telson has the 2 pairs of dorsal spinules placed in the middle and at three quarters of its length. The posterior margin of the telson ends in a point and is provided with the usual 2 pairs of spines and two feathered setae; the inner spines overreach the posterior point.

The eyes are well developed, the cornea is globular and provided with pigment.

The antennular peduncle has the stylocerite slender and reaching about to the middle of the basal segment. The anterolateral spine is very strong and reaches as far as the forward produced anterior margin

of the basal segment. The third segment of the antennular peduncle is somewhat slenderer than the second. The upper antennular flagellum has the fused portion of the two rami consisting of 6 to 8 joints, the free part of the shorter ramus is formed by 11 to 14 joints and is about twice as long as the fused portion.

The scaphocerite is about thrice as long as broad. The outer margin is straight or somewhat concave. The final tooth is strong and reaches almost to the end of the lamella. The oral parts are typical for the genus. The first maxilliped has the epipod deeply bilobed.

The first pereiopod reaches about to the end of the scaphocerite. The fingers are somewhat shorter than the palm. The carpus is somewhat more than 1.5 times as long as the chela. The merus is slightly shorter than the carpus. The second legs are much stronger than the first, in adult specimens they reach with the entire chela beyond the scaphocerite. The fingers are about 0.6 to 0.9 of the length of the palm. The cutting edge of the dactylus bears 2 distinct teeth in the proximal part, while 1 similar tooth is present on the edge of the fixed finger, placed between the 2 teeth of the dactylus. The rest of the edges is entire. The carpus is of about the same length as the palm, and about ¾ of the length of the merus. The ischium is about 0.6 times as long as the merus. The third pereiopod reaches with a distinct part of the propodus beyond the scaphocerite. The propodus is thrice as long as the dactylus, less than twice as long as the carpus and a little shorter than the merus. The fifth leg reaches slightly beyond the third. The propodus is about 3.5 times as long as the dactylus, 1.7 times as long as the carpus and somewhat longer than the merus.

The pleopods and uropods are normal in shape. The uropods reach far beyond the telson. The outer margin of the uropodal exopod has the final tooth provided with a movable spine at the inner side.

In juveniles the legs reach less far than in the adult specimens described above. The second leg has the teeth on the cutting edges less distinct than in the adult specimens. The carpus in a specimen of 15 mm is as long as the palm and half the length of the fingers combined, and slightly shorter than the merus. In still younger specimens the carpus may become even longer in relation to the chela. No difference could be found in the shape of the 2nd legs of adult males and females.

*Size:* The largest male seen by me measures 28 mm. Ovigerous females are 20 to 33 mm long. The eggs are numerous and small, measuring 0.5 to 0.7 mm in diameter.

*Material examined:* In the U. S. National Museum material is present from: Venado Beach, Canal Zone, east of the Panama Canal (Jan. 29, 1937; G. S. Miller, Jr., coll.), Farfan Beach, Canal Zone, east of the Panama Canal (Feb. 24, 1937; S. F. Hildebrand coll.), Miraflores Locks, Upper Chamber, East side, Panama Canal (April 28, 1937, S. F. Hildebrand coll.), Miraflores Locks, Upper Chamber, West side, Panama Canal (March 24, 1937, S. F. Hildebrand coll.), Miraflores Locks, Lower Chamber, Panama Canal (Mar. 26 and 29, 1937, S. F. Hildebrand coll.), San Francisco Beach near Panama City, Republic of Panama (Feb. 10 and 17, 1937, S. F. Hildebrand coll.), in tide pool, San Francisco Reef near Panama City, Republic of Panama (Feb. 13, 1937, S. F. Hildebrand coll.). The species obviously is marine, but it also is collected in the Upper Miraflores Locks, where the salinity, according to Hildebrand (1939, p. 18) sometimes is considerably lowered by the fresh-water which gets in from Miraflores Lake during the passage of southbound traffic through the canal.

*Type:* Holotype (U.S.N.M. Cat. No. 85233) is an ovigerous female of 30 mm from the Upper Chamber, East side, Miraflores Locks. The other specimens (about 100 in number) mentioned above may be considered paratypes.

*Remarks:* The species seems to be most closely related to *P. vulgaris*. It differs from that species by having the rostrum very deep, with the upper margin straight and provided with more teeth (11 to 13 instead of 8 to 11), by having the telson shorter, and the legs distinctly longer.

I deem it a great pleasure to name this species in honour of Dr. Waldo L. Schmitt, who discovered it to be new, but who from lack of time was not able to describe it, and kindly gave me the opportunity to make and publish the description.

### Palaemonetes (Palaemonetes) vulgaris (Say)

Pl. 54, figs. f-l

!*Palaemon vulgaris* Say, 1818, Journ. Acad. Nat. Sci. Phila., vol. 2, p. 248.

*Palaemon vulgaris* Hitchcock, 1835, Catal. Anim. Plants Massach., p. 29.

!*Palemon vulgaris* H. Milne Edwards, 1837, Hist. Nat. Crust., vol. 2, p. 394.

*Palaemon vulgaris* Gould, 1841, Rep. Invert. Massach., p. 332.

!*Palemon vulgaris* DeKay, 1844, Zool. New York, vol. 6, p. 29, pl. 9, fig. 30.

*Palaemon vulgaris* White, 1847, List Crust. Brit. Mus., p. 77; Gibbes, 1848, Tuomey's, Rep. Geol. S. Carolina, App., p. xvi; Gibbes, 1850, p. 29.

*Palemon vulgaris* Gibbes, 1850a, Proc. Amer. Ass. Adv. Sci., vol. 3, p. 198. non *Palaemon vulgaris* Jones, 1859, The Naturalist in Bermuda, p. 129.

!*Palaemonopsis carolinus* Stimpson, 1860a, Amer. Journ. Sci., ser. 2, vol. 29, p. 444 (nom. nud.).

*Palaemon vulgaris* Coues, 1871, Proc. Acad. Nat. Sci. Phila., 1871, p. 124.

?*Palaemonetes vulgaris* Stimpson, 1871, Ann. Lyc. Nat. Hist., New York, vol. 10, p. 129.

?*Palaemonopsis vulgaris* Stimpson, 1871, Ann. Lyc. Nat. Hist. New York, vol. 10, p. 129.

!*Palaemonetes carolinus* Stimpson, 1871, Ann. Lyc. Nat. Hist. New York, vol. 10, p. 129.

!*Palaemonopsis carolinus* Stimpson, 1871, Ann. Lyc. Nat. Hist. New York, vol. 10, p. 129.

?*Palaemon (Leander) vulgaris* Von Martens, 1872, Arch. Naturgesch, vol. 38, pt. 1, p. 136.

non *Palaemonetes vulgaris* Smith, 1873, Rep. U. S. Fish Comm., vol. 1, pp. 339, 369, 516, 520, 528, 550, pl. 2, fig. 9.

*Palaemonetes vulgaris* Coues & Yarrow, 1878, Proc. Acad. Nat. Sci. Phila., 1878, p. 298.

non *Palaemonetes vulgaris* Kingsley, 1878, Proc. Acad. Nat. Sci. Phila., 1878, p. 330.

!*Palaemonetes carolinus* Kingsley, 1878, Proc. Acad. Nat. Sci. Phila., 1878, p. 330.

*Palaemonetes vulgaris* Kingsley, 1878a, Bull. Essex Inst., vol. 10, p. 65.

*Palaemonetes carolinus* Kingsley, 1878a, Bull. Essex Inst., vol. 10, p. 65.

*Palaemonetes vulgaris* Uhler, 1878, Sci. Res. Chesapeake Zoöl. Lab., 1878, p. 26; Faxon, 1879, Bull. Mus. Comp. Zoöl. Harv., vol. 5, p. 304, pls. 1-4; Leidy, 1879, Proc. Acad. Nat. Sci. Phila., 1879, p. 198; Smith, 1879, Trans. Conn. Acad. Arts Sci., vol. 5, p. 88; Verrill, 1879, Check-List Invert. Atlant. Coast, p. 2.

*Palaemonetes carolinus* Kingsley, 1880, Proc. Acad. Nat. Sci. Phila., 1879, p. 424.

*Palaemonetes vulgaris* Kingsley, 1880, Proc. Acad. Nat. Sci. Phila., 1879, p. 424; R. Rathbun, 1880, Proc. U. S. Nat. Mus., vol. 9, p. 120.

non *Palaemonetes vulgaris* Gissler, 1881, Scientific American, vol. 45, p. 151, fig. 1.

*Palaemonetes vulgaris* Faxon, 1882, Mem. Mus. Comp. Zool. Harvard, vol. 9, pt. 1, pl. 11, figs. 10-14.

*Palaemonetes carolinus* Howard, 1883, South Carolina, p. 294.

*Palaemonetes vulgaris* Howard, 1883, South Carolina, p. 294; R. Rathbun, 1883, Bull. U. S. Fish Comm., vol. 2, p. 145.

non *Palaemonetes vulgaris* R. Rathbun, 1884, Fish. Fish Industr. U. S., vol. 1, p. 818, pl. 275, fig. 2.

*Palaemonetes vulgaris* Benedict, 1885, Rep. U. S. Fish Comm., vol. 11, p. 176.

non *Palaemonetes vulgaris* Herrick, 1887, Mem. Denison Sci. Ass., vol. 1, pt. 1, p. 45, pl. 5, fig. 7.

*Palaemonetes vulgaris* Leidy, 1888, Proc. Acad. Nat. Sci. Phila., 1888, p. 330.

non *Palaemonetes vulgaris* Evermann, 1892, Bull. U. S. Fish Comm., vol. 11, p. 90.

*Palaemon (Palaemonetes) carolinus* Thallwitz, 1892, Abh. Ber. Zool. Anthrop. Mus. Dresden, 1890-91, pt. 3, p. 7.

*Palaemon (Palaemonetes) vulgaris* Thallwitz, 1892, Abh. Ber. Zool. Anthrop. Mus. Dresden, 1890-91, pt. 3, p. 14.

*Palaemonetes vulgaris* Sharp, 1893, Proc. Acad. Nat. Sci. Phila., 1893, p. 124; Bumpus, 1898, Science, N. Y., n. ser., vol. 7, p. 485; Bumpus, 1898a, Science, N. Y., n. ser., vol. 8, p. 854.

non ?*Palaemonetes vulgaris* Kingsley, 1899, Amer. Nat., vol. 33, p. 718, fig. 47.

*Palaemonetes carolinus* Kingsley, 1899, Amer. Nat., vol. 33, p. 718.

*Palaemonetes vulgaris* Thompson, 1899, Science, N. Y., n. ser., vol. 9, p. 581.

non *Palaemonetes vulgaris* Duncker, 1900, Amer. Nat., vol. 34, p. 621, pls. 1-3.

*Palaemonetes vulgaris* Wilson, 1900, Amer. Nat., vol. 34, p. 352; Prentiss, 1901, Bull. Mus. Comp. Zoöl. Harv., vol. 36, p. 180, pls. 1-3, pl. 4, figs. 13-18; Thompson, 1901, Catal. Crust. Mus. Dundee, p. 19.

non *Palaemonetes vulgaris* Arnold, 1901, Sea-Beach at Ebb-Tide, p. 260, fig.

non *Palaemonetes vulgaris* Paulmier, 1905, Bull. N. Y. State Mus., vol. 91, p. 132, fig. 4.

*Palaemonetes vulgaris* M. J. Rathbun, 1905, Occ. Pap. Boston Soc. Nat. Hist., vol. 7, p. 25; Coulon, 1907, Bull. Soc. Étud. Sci. Nat. Elbeuf, 1907, p. 191.

non *Palaemonetes vulgaris* Fowler, 1907, Science, N. Y., n. ser., vol. 26, p. 639.

non *Palaemonetes vulgaris* Fowler, 1908, Rep. New Jersey State Mus., 1907, p. 161.

*Palaemonetes carolinus* p.p. Cary & Spaulding, 1909, Contr. Mar. Fauna Louisiana, p. 11.

?*Palaemon vulgaris* Valdés Ragués, 1909, Mis. Trabajos Acad., p. 183.

non *Palaemonetes vulgaris* Fowler, 1912, Ann. Rep. New Jersey State Mus., 1911, p. 324, pl. 94.

!*Palaemonetes carolinus* Fowler, 1912, Ann. Rep. New Jersey State Mus., 1911, p. 328.

*Palaemon vulgaris* Stafford, 1912, Contr. Canad. Biol., 1906-1910, p. 60.

non *Palaemonetes vulgaris* Fowler, 1913, Proc. Acad. Nat. Sci. Phila., 1913, pp. 61, 64.

*Palaemonetes vulgaris* Sumner, Osburn & Cole, 1913, Bull. U. S. Bur. Fish., vol. 31, pp. 139, 663.

*Palaemon vulgaris* Williamson, 1915, Nord. Plankt., vol. 18, p. 407, figs. 140-143.

!*Palaemonetes carolinus* Hay & Shore, 1918, Bull. U. S. Bur. Fish., vol. 35, p. 393, pl. 27, fig. 4.

non *Palaemonetes vulgaris* Hay & Shore, 1918, Bull. U. S. Bur. Fish., vol. 35, p. 393, pl. 27, fig. 5.

*Palaemonetes vulgaris* Ortmann, 1918, in Ward & Whipple's Fresh-water Biol., p. 845; Allee, 1923, Biol. Bull., vol. 44, p. 180; Sollaud, 1923, Bull. Biol. France Belg., vol. 57, p. 527; Fish, 1925, Bull. U. S. Bur. Fish., vol. 41, p. 156, figs. 55, 56.

!*Palaemonetes vulgaris* Kemp, 1925, Rec. Indian Mus., vol. 27, p. 317.

non *Palaemonetes carolinus* Kemp, 1925, Rec. Indian Mus., vol. 27, p. 317.

*Palaemonetes vulgaris* Stiles & Hassall, 1927, Hygienic Lab. Bull., n. 148, p. 216.

!*Palaemonetes vulgaris* M. J. Rathbun, 1929, Canad. Atlant. Fauna, vol. 10m, p. 19, non fig. 23.

*Palaemonetes vulgaris* Cowles, 1930, Bull. U. S. Bur. Fish., vol. 46, pp. 355, 356, 357.

non *Palaemonetes carolinus* Cowles, 1930, Bull. U. S. Bur. Fish., vol. 46, pp. 355, 356.

non *Palaemonetes vulgaris* Richards, 1931, Ecology, vol. 12, p. 444; Crowder, 1931, Between the Tides, p. 316, pl. 27, fig. 5.

*Palaemonetes carolinus* Creaser, 1936, Publ. Carnegie Inst., vol. 457, p. 126.

!*Palaemonetes vulgaris* Pearse, 1936, Journ. Elisha Mitchell Sci. Soc., vol. 52, p. 195.

non *Palaemonetes carolinus* Pearse, 1936, Journ. Elisha Mitchell Sci. Soc., vol. 52, p. 195.

non *Palaemonetes vulgaris* Townes, 1937, Ann. Rep. Biol. Surv. New York, vol. 11, p. 226, fig. 2.

*Palaemonetes vulgaris* Richards, 1938, Animals of the Seashore, p. 220, non fig. 38.

non *Palaemonetes vulgaris* Townes, 1939, Ann. Rep. New York Conserv. Dept., vol. 28 suppl., p. 165, figs. 35, 36B, 37B, 38.

!*Palaemonetes carolinus* Townes, 1939, Ann. Rep. New York Conserv. Dept., vol. 28 suppl., p. 165, fig. 36A.

*Palaemonetes vulgaris* Reed, 1941, Marine Life Texas, p. 46.

*Palaemonetes carolinus* Anonymus, 1942, Ann. List Fauna Grand Isle Reg., p. 6.

*Palaemonetes carolinus* McDougall, 1943, Ecol. Monogr., vol. 13, p. 371.

*Palaemonetes vulgaris* Dexter, 1944, Ecology, vol. 25, p. 356; Gunter, 1945, Publ. Inst. Mar. Sci. Texas, vol. 1, pt. 1, pp. 69, 93, 108; Hedgpeth, 1946, Texas Game and Fish, vol. 4, n. 12, p. 31; Burkenroad, 1947, Amer. Nat., vol. 81, p. 392; Dexter, 1947, Ecol. Monogr., vol. 17, p. 291.

*Palaemonetes carolinus* Pearse, 1947, Journ. Parasitol., vol. 33, p. 454.

*Palaemonetes vulgaris* Ferguson & Jones, 1949, Amer. Midl. Nat., vol. 41, p. 442.

*Palaemonetes carolinus* Ferguson & Jones, 1949, Amer. Midl. Nat., vol. 41, p. 442.

*Palaemonetes (Palaemonetes) vulgaris* Holthuis, 1949, Proc. Kon. Nederl. Akad. Wetensch., vol. 52, p. 94, fig. 2e-i; 1950a, Siboga Exped., mon. 39a9, p. 11.

*Description:* The rostrum reaches to or slightly beyond the end of the scaphocerite. The tip is directed upwards, the upper margin thereby often being more or less concave. There are 8 to 11 upper rostral teeth the first two of which are situated behind the posterior orbital margin

on the carapace. The first tooth generally is separated from the second, by a space, which is larger than that between the other proximal teeth. The teeth are rather regularly divided over the rostrum, though the proximals generally are placed closer together than the distals, there is no unarmed space behind the apex. Often the apex is bifid. The lower margin of the rostrum is provided with 3 to 5, generally 4, teeth. The branchiostegal spine is situated on the anterior margin of the carapace just below the branchiostegal groove.

The fifth abdominal segment has the tip of the pleura rectangular or slightly acute. The sixth segment is 1.5 times as long as the fifth, and somewhat shorter than the telson. The anterior pair of dorsal spines lies somewhat behind the middle of the length of the telson, the 2nd pair lies halfway between the first pair and the posterior margin of the telson. This margin has the usual shape, it ends in a rather long and sharp median point and is provided with 2 pairs of spines, the inner of which are very long. Between these inner spines 2 feathered setae are present.

The eyes are well developed and provided with dark pigment.

The basal segment of the antennular peduncle has the stylocerite slender and reaching slightly beyond the middle of the basal segment. The anterolateral spine of the basal segment is strong and overreaches the rounded anterior margin of the segment. The upper antennular flagellum has the two rami fused for 7 to 9 joints, while the free part of the shorter ramus consists of 10 to 17 joints and is 1.5 times to twice as long as the fused portion.

The scaphocerite is about thrice as long as broad. The final tooth is very strong and almost reaches to the end of the lamella.

The oral parts are normal in shape. The epipod of the first maxilliped is distinctly bilobed.

The first pereiopod generally fails to reach the end of the scaphocerite, sometimes it just reaches the end of that scale. The fingers are about as long as the palm. The carpus is 1.3 to 1.7 times as long as the chela, and is slightly longer than the merus. The second legs are distinctly longer and stronger than the first. In adult females they are much stronger than in the males and reach with the fingers and part of, sometimes with the whole, palm beyond the scaphocerite. The fingers are 0.6 to 0.7 times as long as the palm. The cutting edge of the dactylus bears 2 small teeth in the proximal part, while that of the fixed finger is provided with one similar tooth, which fits between the two teeth of the dactylus. The rest of the cutting edges is straight and entire. The carpus is slightly or distinctly shorter than the palm and about 0.75

times as long as the merus. The ischium is 0.7 times as long as the merus. In the full grown male the second leg is less robust than in the female, it reaches with the fingers beyond the scaphocerite. The fingers are about 0.75 times as long as the palm. The cutting edges bear very faint indications of teeth, which have the same position as in the female. The carpus is 1.1 times as long as the palm and 0.8 times as long as the merus. The ischium is 0.7 times as long as the merus. The third leg (in both sexes) reaches about to the end of the 2nd segment of the antennular peduncle, sometimes, however, it may reach the end of the scaphocerite. The propodus is twice or slightly more than twice as long as the dactylus, somewhat less than twice as long as the carpus and distinctly shorter than the merus. The fifth leg reaches slightly farther than the third. The propodus is about thrice as long as the dactylus, twice as long as the carpus and somewhat longer than the merus.

The pleopods and uropods are normal in shape. The outer margin of the uropodal exopod ends in a strong tooth, which at its inner side is provided with a slender movable spine.

*Size:* Ovigerous females seen by me ranged between 22 and 42 mm in length. The size of the males is about 30 mm. The eggs are numerous and small, being 0.5 to 0.7 mm in diameter.

*Material examined:* In the collection of the United States National Museum a large amount of material of this species is present. It originated from the following localities: Massachusetts (Sandwich, Provincetown, off Falmouth, Quissett Harbor, Nobska Beach and Woods Hole, Barnstable Co.; Hadley Harbor at Naushon Island, Dukes Co.; Vineyard Sound; Wareham River, Plymouth Co.), Rhode Island (off Newport, Newport Co.; Narragansett Bay), New York (Peconic Bay, Patchogue, Scallop Pond and Clam Pond Cove, Long Island), New Jersey (Atlantic City, Atlantic Co.; Sea Isle City, off Cape May and Dennis Creek, Cape May Co.), Delaware (Mispillion River, between Kent and Sussex Co.), Maryland (38° 07′ .2 N 76° 13′ .5 W, Chesapeake Bay; Thomas Point Light, Anne Arundel Co.; Cove Pt. Light, Patuxent River, Calvert Co.; St. George Point, St. Marys Co.; Bloody Point Light, Queen Anne's Co.), Virginia (37° 54′ N 76° 06′ .3 W, Tangier Island, 37° 13′ .2 N 76° 04′ .5 W, and 37° 12′ N 76° 10′ W, Chesapeake Bay; Lewisetta, Northumberland Co.; Weems and Windmill Point Light, Lancaster Co.; between Back River and Thimble Light, Thimble Shoal, Hampton and Phoebus, Elizabeth City Co.; Norfolk, Norfolk Co.; Chincoteague Island, Accomac Co.; Sandy Point Light, Cherrystone Light, Kings Creek, Cape Charles City and Planta-

tion Light, Northampton Co.), North Carolina (Beaufort and Fort Macon, Carteret Co.), South Carolina (Winyah Bay, Georgetown Co.; Bull Bay, Charleston Co.; Jericho Creek), Georgia (Brunswick, Glynn Co.), Florida (Apalachicola, Franklin Co.; St. Joseph's Bay near Port St. Joe, Gulf Co.), Alabama (Mobile Bay), Mississippi (near Biloxi, Harrison Co.), Louisiana (Errol Island and Chandeleur Islands, Bernard Parish; Grand Isle and Fort Livingston, Jefferson Parish). Furthermore I examined some specimens of this species from the collection of the Institute of Marine Science at Port Aransas, Texas. This material originated from: Harbor Island near Port Aransas, Nueces Co., Texas, and from Port Isabel near Rio Grande, Cameron Co., Texas.

*Distribution:* The species occurs along the east and south coast of the U.S.A. in salt or brackish water. It is known with certainty from Massachusetts (Provincetown) to Texas (Port Isabel, Cameron Co.). In literature it is recorded from the following localities: North America (White, 1847), Gaspé, New Brunswick, Canada (Stafford, 1912), Cape Breton Island, Nova Scotia, Canada (M. J. Rathbun, 1929), Hampton, New Hampshire[15] (M. J. Rathbun, 1905), Massachusetts (Hitchcock, 1835; Gould, 1841), Ipswich Bay, Mass. (Dexter, 1944), Cape Ann, Mass. (Dexter, 1947), Salem, Mass. (Kingsley, 1878), Charles River near Cambridge, Mass. (Prentiss, 1901), Provincetown, Mass. (R. Rathbun, 1880), Nantucket, Mass. (Sharp, 1893), Woods Hole, Mass. (Faxon, 1879; Bumpus, 1898, 1898a; Thompson, 1899; Coulon, 1907; Sumner, Osburn & Cole, 1913; Allee, 1923; Fish, 1925), Vineyard Sound, Mass. (Smith, 1879), Buzzards Bay, Mass. (Smith, 1879), Newport, R. I. (Faxon, 1879), Narragansett Bay, R. I. (Thompson, 1901), Connecticut (M. J. Rathbun, 1905), Fisher's Island Sound, N. Y. (Smith, 1879), Long Island Sound, N. Y. (Smith, 1879), Long Island, N. Y. (Smith, 1879; Townes, 1939), Montauk Point, Long Island, N. Y. (Benedict, 1885), Greenport, Long Island, N. Y. (Sharp, 1893), Hudson River, N. Y. (De Kay, 1844), New Jersey (Smith, 1879), Beachhaven, N. J. (Leidy, 1888), Atlantic City, N. J. (Leidy, 1879), Great Egg Harbor, N. J. (Stimpson, 1871), Beesleys Point, N. J. (Sharp, 1893), Chesapeake Bay. (Cowles, 1930), Northampton Co., Va. (Kingsley, 1880), Ocean View, Norfolk Co., and Virginia Beach, Princess Anne Co., Va. (Ferguson & Jones, 1949), Fort Macon, N. C.! (Coues, 1871; Coues & Yarrow, 1878; Kingsley, 1878!; Smith,

[15] In all probability this record was based by Miss Rathbun on a specimen in the U. S. National Museum, which, however, does not originate from Hampton, N. H., but from Hampton, Va.

1879), Beaufort, N. C. (Stimpson, 1860a, 1871; Kingsley, 1880; Wilson, 1900; Hay & Shore, 1918; Pearse, 1936, 1947; McDougall, 1943), South Carolina (Gibbes, 1848; Howard, 1883), Charleston Harbor, S. C. (Gibbes, 1850a; Stimpson, 1871), East Florida (Say, 1818), St. Johns River, Fla. (Smith, 1879), Marco Pass, Fla. (Kingsley, 1880), Charlotte Harbor, Fla. (Kingsley, 1880), Chandeleur Islands, La.! (Cary & Spaulding, 1909), Grand Isle, La. (Anonymous, 1942), Texas (Reed, 1941; Hedgpeth, 1946), Copano and Aransas Bays, Texas (Gunter, 1945), Rio Champoton and near Progreso, Yucatan, Mexico (Creaser, 1936), ?Cuba (Von Martens, 1872; Valdés Ragueés, 1909). As up till now three species have been included in *Palaemonetes vulgaris,* all references in literature must be considered with much reserve, even if a description or a figure is given. The three species namely often occur together, so that it is not always certain that the material of a certain author was homogeneous.

*Type:* The type locality is Atlantic coast of the United States "as far south as East Florida." It is not known if Say's type specimens are extant.

*Remarks:* A considerable confusion existed in regard to the *Palaemonetes* species of the salt and brackish water of the eastern and southern coast of the United States. Usually two species were accepted: *P. vulgaris* and *P. carolinus.* According to Kemp (1925) the two species differ by having the carpus of the second leg differently shaped: in *P. carolinus* the carpus is much more elongate than in *P. vulgaris.* Hay and Shore (1918), however, just like Townes (1939), apply the name *vulgaris* to the form with the elongate, *carolinus* to that with the short carpus. Kingsley's (1878) material from Fort Macon was studied by me; his *P. carolinus* proves to be a *P. vulgaris,* while his *P. vulgaris* is the species named here *P. pugio.* When studying the large quantity of material of this species in the United States National Museum, I came to the conclusion that there are three species involved, one with a short carpus, and two with elongate carpi, the two latter differ in the shape of the rostrum, of the scaphocerite and of the chela.

The original description of Say states: "carpus of the second pair [of pereiopods], nearly equal to the preceding joint, unarmed, shorter than the palm of the hand." This indicates that Say's specimens belong to the first form, in which the carpus of the adult female is shorter than the palm (in both other species the carpus is longer than the palm), which thus has to bear the name *Palaemonetes vulgaris* (Say). Stimpson's description of *Palaemonetes carolinus* (his type specimens, un-

fortunately, are no longer extant in the U. S. National Museum) states the rostrum to be curved upwards, with the teeth regularly divided over the whole length, while the third dorsal rostral teeth is situated "directly above the base of the eye-peduncles," indicating thereby, that the first two teeth are placed behind the orbit. The lower margin of the rostrum of Stimpson's specimens bears four teeth, while the second legs are much stouter than in *"P. vulgaris."* This description only fits for the true *Palaemonetes vulgaris,* as it is the only one of the three species with two dorsal teeth of the rostrum behind the orbit, furthermore its rostrum generally is recurved (though this character is variable). The stout legs also indicate that his specimens must be females of *P. vulgaris,* which have the legs much more robust than any of the other forms. All other characters mentioned by Stimpson are in good accordance with those of *P. vulgaris.* The specimens identified by Stimpson as *Palaemonetes vulgaris* either are the males of that species, or belong to one of the two other Atlantic American *Palaemonetes* species. *Palaemonetes carolinus* Stimpson thus is a synonym of *Palaemonetes vulgaris* (Say). As no other names have ever been given to the other *Palaemonetes* species mentioned above, I have indicated them with the names *Palaemonetes pugio* and *Palaemonetes intermedius.*

The great confusion which exists in the literature regarding these three species, makes it generally impossible to find out which of the three species an author meant if he mentioned *P. vulgaris* or *P. carolinus,* while also the possibility exists that he had a mixture of two or all of the species at his disposal. References to authors giving a good description or figure of their species the identity of (at least part of) their material could be made sure, have been given an exclamation point in the list of references.

Jones's (1859) *Palaemon vulgaris* does not belong in the present species, but in all probability is *Palaemon northropi.*

Von Martens's (1872) record of *Palaemon (Leander) vulgaris* from Cuba needs special confirmation. His specimens may belong to *Palaemon northropi,* but his description is too short to give certainty in this matter. Valdés Ragués's (1909) record probably is based on that of Von Martens.

There is very little to say about the ecology of this species. The information in literature generally is not to be trusted, as it may deal with more than one species. The general impression I got is that *Palaemonetes vulgaris* is much more confined to salt water than *Palaemonetes pugio* is. This is confirmed by the observations made by Mr. Gordon Gunter and Mr. Joel W. Hedgpeth on *Palaemonetes vulgaris* at the

Texas coast near Port Aransas. Mr. Gunter (in litt.) furthermore remarks: "I can say, however, that we have never found any *Palaemonetes* on the outside beaches (the open Gulf), but always in the bays. However, I suspect that absence of these shrimps on the Gulf beach is due not to the higher salinity, but the lack of vegetative cover, etc." *Palaemonetes vulgaris* material in the U. S. National Museum collected by the *Fish Hawk* Expeditions in Chesapeake Bay ranges from depths up to 45.75 m. generally, however, it occurs in less deep water.

### Palaemonetes (Palaemonetes) intermedius Holthuis

Pl. 55, figs. a-f

*Palaemonetes vulgaris* Smith, 1873, Rep. U. S. Fish Comm., vol. 1, pp. 339, 369, 516, 520, 528, 550, pl. 2, fig. 9; Gissler, 1881, Scientific American, vol. 45, p. 151, fig. 1; R. Rathbun, 1884, Fish. Fish Industr. U. S., vol. 1, p. 818, pl. 275, fig. 2; Herrick, 1887, Mem. Denison Sci. Ass., vol. 1, pt. 1, p. 45, pl. 5, fig. 7; Kingsley, 1899, Amer. Nat., vol. 33, p. 718, fig. 47; Arnold, 1901, Sea-Beach at Ebb-Tide, p. 260, fig. ....; Paulmier, 1905, Bull. N. Y. State Mus., vol. 91, p. 132, fig. 4; M. J. Rathbun, 1929, Canad. Atlant. Fauna, vol. 10m, fig. 23. (non *Palaemon vulgaris* Say, 1818.)

?*Palaemonetes vulgaris* Townes, 1937, Ann. Rep. Biol. Surv. New York, vol. 11, p. 226, fig. 2.

*Palaemonetes vulgaris* Richards, 1938, Animals of the Seashore, fig. 38; Townes, 1939, Ann. Rep. New York Conservation Dept., vol. 28 suppl., p. 165, figs. 35, 36B, 37B, 38.

*Palaemonetes (Palaemonetes) intermedius* Holthuis, 1949, Proc. Kon. Nederl. Akad. Wetensch., vol. 52, p. 94, fig. 2j-1.

*Palaemonetes intermedius* Hedgpeth, 1950, Publ. Inst. Mar. Sci. Texas, vol. 1, n. 2, p. 113.

*Palaemonetes (Palaemonetes) intermedius* Holthuis, 1950a, Siboga Exped., mon. 39a9, p. 10.

*Description:* The rostrum reaches to or somewhat beyond the end of the scaphocerite. The tip is directed upwards, the upper margin is generally more or less concave. The number of dorsal teeth varies between 7 and 10, generally being 8 or 9. The first tooth in most cases is separated from the second tooth by a larger distance than the other teeth are separated from each other. The teeth are rather regularly divided over the dorsal margin of the rostrum up to the tip, which often is bifid. The distal teeth are more widely spaced than the proximals. The first

tooth is placed behind the posterior margin of the orbit, the second tooth is placed either before or just over the margin. The lower margin bears 4 or 5 teeth, in few cases 3. The branchiostegal spine is situated on the anterior margin of the carapace, just below the place where the branchiostegal groove hits this margin.

The pleurae of the fifth abdominal segment have the apex rounded. The sixth abdominal segment is 1.5 times as long as the fifth and somewhat shorter than the telson. The telson has the anterior pair of dorsal spinules situated in the middle of its length; the posterior pair lies midway between the posterior margin of the telson and the anterior pair, or somewhat closer to the anterior pair. The posterior margin of the telson is similar to that of *P. vulgaris* and *P. pugio.*

The eyes are well developed, with a globular, pigmented cornea.

The antennular peduncle is of the same shape as in *P. vulgaris.* The upper antennular flagellum has the fused part of the two rami consisting of 7 to 10 joints, the free part of the shorter ramus consists of 7 to 12 joints and is 1.2 to 1.7 times as long as the fused portion.

The scaphocerite is slender, it is 3 to almost 4 times as long as broad in the females, in the males it is even more slender. The outer margin is straight or slightly concave. The final tooth is strong and almost reaches to the end of the lamella.

The oral parts are typical.

The first leg almost reaches the end of the final tooth of the scaphocerite. The fingers are as long as the palm. The carpus is twice as long as the chela and slightly longer than the merus. In the adult female the second legs reach with almost the entire chela beyond the scaphocerite. The fingers are 0.6 to 0.8 times as long as the palm. The dactylus has the cutting edge provided with 1 tooth in the proximal part, the rest of the edge, as well as the entire cutting edge of the fixed finger is entire. The carpus is 1.2 to 1.5 times as long as the palm and is as long as the merus. The male has the second legs somewhat more slender than the female, they reach with the fingers only beyond the scaphocerite. The fingers are about ⅔ to ¾ of the length of the palm. The dentition is like the female. The carpus is 1.4 to 1.5 times as long as the palm, being about 4/5 of the length of the chela and is as long as the merus. The third leg reaches about to the end of the final tooth of the scaphocerite or falls distinctly short of it. The propodus is twice as long as the dactylus, and somewhat less than twice as long as the carpus. The merus is somewhat longer than the propodus. The fifth leg reaches slightly

beyond the third. The propodus is somewhat less than thrice as long as the dactylus, it is twice as long as the carpus and slightly longer than the merus.

The pleopods and the uropods have the usual shape. The exopod of the uropod has the outer margin ending in a strong tooth, which at its inner side bears a movable spine.

In the males and juveniles the legs reach less far forwards than in the female (the above description is made after an ovigerous female).

*Size:* The largest male seen by me is 26 mm long. Ovigerous females of 25 to 37 mm length are present in the collection studied. The eggs are numerous and small, measuring 0.6 to 0.9 mm in diameter.

*Material examined:* In the collection of the U. S. National Museum material of this species is present from the following localities: New York (Long Island: Southampton and Great South Bay near Belfort), Maryland (Island Creek near Oxford, Talbot Co.; Broome's Island, Calvert Co.; Cobb Island, Charles Co.), Virginia (Chincoteague Bay, Accomac Co.; Weems, Lancaster Co.; Parrot Island, Middlesex Co.), Florida (Titusville, Brevard Co.; Pelican Island near Sebastian, Indian River Co.; Indian River Inlet and Fort Pierce, St. Lucie Co.; Jupiter Inlet and Lantana, Palm Beach Co.; New River Inlet, Broward Co.; Card Sound, Dade Co.; Key West, Monroe Co.; Fort Myers, Lee Co.; Gasparilla Pass, Charlotte Co.; Lemon and Sarasota Bays, Sarasota Co.; Cedar Keys, Levy Co.; Apalachicola, Franklin Co.; Pensacola, Escambia Co.), Alabama (Big Lake, Gulf Shores), Mississippi (Cat Island, Harrisson Co.), Louisiana (Cameron, Cameron Parish), Texas (Galveston, Galveston Co.). Through the kindness of Mr. Joel W. Hedgpeth I was able to examine material of this species from Aransas Wildlife Refuge, Aransas Co., Texas, and from Lydia Ann Channel near Port Aransas, Nueces Co., Texas.

*Distribution:* The species is known from the Atlantic coast of the United States from the Vineyard Sound to Texas. According to the material in the U. S. National Museum, it seems to be especially abundant in Florida. The only trustworthy records in literature are: Vineyard Sound (Smith, 1873), Long Island, New York (Townes, 1939), Mississippi Sound, Alabama (Herrick, 1887); Aransas National Wildlife Refuge, Texas (Hedgpeth, 1950). Smith's (1873) figure is reproduced by many authors (Gissler, 1881; R. Rathbun, 1884; Kingsley, 1899; Arnold, 1901; Paulmier, 1905; M. J. Rathbun, 1929; Richards, 1938), this, however, is not proof that their material indeed belongs to the present species. So for instance M. J. Rathbun's (1929) descrip-

tion fits for *P. vulgaris*. The popularity of Smith's figure is shown by the fact that it even is inserted in Webster's Collegiate Dictionary (ed. 5, 1947, p. 779), where, however, it is given as "Prawn *(Peneus sentiferus)*."

*Type:* Holotype (U.S.N.M. Cat. No. 58209) is an ovigerous female of 32 mm from Box Iron Bay, Chincoteague Bay, Virginia (June 1, 1922, R. V. Truitt coll.). The other specimens from the same lot (28 ovigerous females, 5 non-ovigerous females, and 12 males) are the paratypes.

*Remarks:* The present species is more or less intermediate in its characters between *Palaemonetes vulgaris* and *Palaemonetes pugio*. The differences with both species are pointed out under the latter form.

### Palaemonetes (Palaemonetes) pugio Holthuis

Pl. 55, figs. g-l

*Palaemonetes vulgaris* Kingsley, 1878, Proc. Acad. Nat. Sci. Phila., 1878, p. 330; Evermann, 1892, Bull. U. S. Fish Comm., vol. 11, p. 90; Duncker, 1900, Amer. Nat., vol. 34, p. 621, pls. 1-3; Fowler, 1907, Science, N. Y., n. ser., vol. 26, p. 639; Fowler, 1908, Rep. New Jersey State Mus., 1907, p. 161. (non *Palaemon vulgaris* Say, 1818.)

*Palaeomonetes carolinus* p.p. Cary and Spaulding, 1909, Contr. Mar. Fauna Louisiana, p. 11.

*Palaemonetes vulgaris* Fowler, 1912, Rep. New Jersey State Mus., 1911, p. 324, pl. 94; Fowler, 1913, Proc. Acad. Nat. Sci. Phila., 1913, pp. 61, 64; Hay and Shore, 1918, Bull. U. S. Bur. Fish., vol. 35, p. 393, pl. 27, fig. 5.

*Palaemonetes carolinus* Kemp, 1925, Rec. Indian Mus., vol. 27, p. 317; Cowles, 1930, Bull. U. S. Bur. Fish., vol. 46, pp. 355, 356. (non Stimpson, 1871.)

*Palaemonetes vulgaris* Crowder, 1931, Between the Tides, p. 316, pl. 27, fig. 5; Richards, 1931, Ecology, vol. 12, p. 444.

*Palaemonetes carolinus* Pearse, 1936, Journ. Elisha Mitchell Sci. Soc., vol. 52, p. 195.

*Palaemonetes vulgaris* Townes, 1937, Ann. Rep. Biol. Surv. New York, vol. 11, p. 226, fig. 2.

*Palaemonetes carolinus* Richards, 1938, Animals of the Seashore, p. 220.

*Palaemonetes (Palaemonetes) pugio* Holthuis, 1949, Proc. Kon. Nederl. Akad. Wetensch., vol. 52, p. 95, fig. 2 m-o; 1950a, Siboga Exped., mon. 39a9, p. 10.

*Description:* The rostrum reaches to or slightly beyond the end of the scaphocerite, it is straight, sometimes the tip is directed slightly upwards. There are 7 to 10 (almost always 8 or 9) upper rostral teeth, the first of which is placed behind the orbit. The teeth are separated by intervals, which are of about equal size. The ultimate of the teeth is placed a rather large distance from the apex, so that the end of the upper margin is unarmed. The lower margin of the rostrum bears 2 to 4, generally 3 teeth, here too the ultimate tooth is separated by a rather large distance from the apex. The apex thereby is dagger shaped. The branchiostegal spine is situated on the anterior margin of the carapace, just below the branchiostegal groove.

The fifth abdominal segment has the pleura ending in a small acute tooth which, however, sometimes is extremely small. The sixth segment is about 1½ times as long as the fifth and somewhat shorter than the telson. The telson has the same shape and spinulation as that of *P. vulgaris*.

The eyes have the cornea well developed and provided with dark pigment.

The antennular peduncle does not differ essentially from that of *P. vulgaris*. The upper antennular flagellum has the two rami fused for 10 to 14 joints. The free portion of the shorter ramus consists of 12 to 18 joints and is 1.1 times to twice as long as the fused part.

The scaphocerite is rather broad, being about 2.5 to almost 3 times as long as broad (in the males it is thrice as long as broad). The outer margin is convex. The final tooth is strong and almost reaches the end of the lamella.

The oral parts are typical. The epipod of the first maxilliped is deeply bilobed.

The first leg fails to reach the end of the scaphocerite by a short distance. The fingers are as long as the palm. The carpus is almost twice as long as the chela and somewhat longer than the merus. The second legs are stronger than the first. In adult females they reach with the fingers beyond the scaphocerite. The fingers are 0.6 to 0.8 times as long as the palm. The cutting edges of both dactylus and fixed fingers are entire, no teeth are observed here. The fingers often are gaping in the extreme proximal part. The carpus is 1.3 to 1.5 times as long as the palm, but shorter than the entire chela. The merus is as long as the carpus. The ischium is somewhat shorter than the merus. The males have the second legs more slender than the females, they reach only with a part of the fingers beyond the scaphocerite. The fingers are 0.7

to 0.8 times as long as the palm. The carpus is almost as long as the whole chela. The merus is as long as the carpus. The ischium is somewhat shorter than the merus. The third legs reach about to the base of the third segment of the antennular peduncle, sometimes they reach slightly beyond the scaphocerite. The propodus is twice as long as the dactylus and also twice as long as the carpus, it is somewhat shorter than the merus. The fifth leg reaches with its tip beyond the scaphocerite. The propodus is thrice as long as the dactylus, 2.5 times as long as the carpus, and somewhat longer than the merus. The males have the legs reaching less far forwards.

The pleopods and uropods are as in *P. vulgaris.*

The males differ from the females by being smaller, having the rostrum more slender, by having the free part of the shorter ramus of the upper antennular flagellum longer in relation to the fused part, by having the legs reaching less far forwards and having the carpus of the second leg longer in relation to the chela. Similar differences were also observed in *P. vulgaris.* The young specimens resemble more the males than the females.

*Size:* The largest male I measured was 33 mm long. Ovigerous females ranged from 30 to 50 mm in length. The eggs are numerous and small, being 0.6 to 0.9 mm in diameter.

*Material examined:* In the United States National Museum material of this species is present from the following localities: Massachusetts (Woodbridges Island near Newburyport, Essex Co.; Truro, Davis Neck Beach near Falmouth, Woods Hole, and Monument River, Barnstable Co.; Vineyard Sound; Buzzard's Bay; Wareham River near Parker's Mill, Plymouth Co.; Acushnet River, Bristol Co.), Rhode Island (Beach near Newport, Newport Co.; Providence, Providence Co.), Connecticut (Grovebeach, Middlesex Co.), New York (Shinnecock Bay near Southampton and Patchoque, Long Island, Suffolk Co.; Haverstraw Bay in Hudson River, Rockland Co.; Princess Bay, Richmond Co.), New Jersey (Barnegat Bay), Delaware (Bombay Hook and Woodland Beach, Kent Co.; Bethany Beach, Sussex Co.), Maryland (39°01′.2N, 76°22′.5W, Chesapeake Bay; Lake Ovington near Bay Ridge, Thomas Point Light and Herring Creek, Anne Arundel Co.; Parker Creek, Chesapeake Beach, Plum Point, Dare's Wharf, Cove Point, Drum Point, Solomons and Patuxent River, Calvert Co.; Cedar Point, Point Lookout, Ridge, St. George Island, Piney Point and Blakistone Island, St. Mary Co.; Indian Head, Morgantown near Wayside, Nanjemoy, Riverside, Port Tobacco, Neal Sound, Cobb Island, Benedict, Charles Co.; Chester River, Kent Co.; Island Creek and Oxford,

Talbot Co.; Crisfield, Somerset Co.), Virginia (Smith Island, Chesapeake Bay; Lower Machodoc Creek and Colonial Beach, Westmoreland Co.; Smith's Point, Northumberland Co.; off Weems, Lancaster Co.; Parrot Island, Middlesex Co.; Mobjack Bay, Gloucester Co.; Hampton, Elizabeth City Co.; Craney Island near Norfolk, and Grassfield near Dismal Swamp, Norfolk Co.; tidepool near Cape Charles, Northampton Co.), North Carolina (Fort Raleigh on Roanoke Island, and Cape Hatteras, Dare Co.; North River near Beaufort, Carteret Co.; New River, near Camp Lejeune, Onslow Co.), South Carolina (Winyah Bay, Georgetown Co.; Bull's Creek, Morris Island and Seven Reaches, Charleston Co.; Oat Island Creek near Port Royal, Beaufort Co.; Camp Island Pond and Clambank Creek near Town Creek), Georgia (Savannah, Chatham Co.; St. Simon Island, Brunswick and Turtle River, Glynn Co.), Florida (Titusville, Brevard Co.; Lake Butler, Orange Co.[16]; Fort Pierce, St. Lucie Co.; Jupiter Inlet, Palm Beach Co.; Gordon's Pass, Collier Co.; Gasparillo Pass, and Myakka River, Charlotte Co.; Cedar Keys, Levy Co.; St. George Island and Jends Bayou, Franklin Co.; Cape San Blas, Gulf Co.; Pensacola, Escambia Co.), Mississippi (Biloxi and Cat Island, Harrison Co.; Baldwin Lodge, Hancock Co.; Grand Plains Bayou), Louisiana (Pilottown, Plaquemines Parish; Barataria Bay; Fort Livingston and Grand Isle, Jefferson Parish; Calcasieu Pass, Cameron Parish; Indian Isle), Texas (East Bay, Chambers Co.; Galveston, Swan Lake near Galveston and Dickinson's Bayou, Galveston Co.; Copano Bay; Mustang Lake, Aransas Co.; Aransas Pass, San Patricio Co.; Harbor Island near Port Aransas, and Corpus Christi, Nueces Co.). Through the kindness of Mr. Joel W. Hedgpeth of the Marine Institute of Science at Port Aransas, Texas, I was able to examine specimens from Allyns Bight, St. Joseph Island, Aransas Bay, Aransas Co., Texas, and from Lydia Ann Channel near Port Aransas, Nueces Co., Texas.

*Distribution:* The species is known to inhabit brackish to almost fresh-water along the coast of the U.S.A. from N. Massachusetts to Texas. The records in literature are: Cold Spring Harbor, Long Island, New York (Duncker, 1900), Haverstraw Bay, Rockland Co., New York (Townes, 1937), Barnegat Bay and Spray Beach, Ocean Co., New Jersey (Fowler, 1912), New England Creek, Cape May Co., New Jersey (Fowler, 1907, 1908, 1912), Cold Spring Inlet, Grassy Sound, Cedar Swamp Creek, Coxe's Hall Creek, Corson's Inlet, Dennis Creek, and Bidwell's Channel, Cape May Co., New Jersey (Fowler, 1912), Maurice River at Elmer, Cumberland Co., New Jersey (Fowler, 1912),

[16] This record is not very reliable

Chincoteague and Assateague, Accomac Co., Virginia (Fowler, 1913), Cape Charles, Northampton Co., Virginia! (Richards, 1931), Chesapeake Bay (Cowles, 1930), Newport River near Beaufort, N. C. (Hay and Shore, 1918), Harlowe Creek, Morton's Mill Pond, Mullet Pond, Calico Creek, Core Creek Canal and Eastman's Creek, near Beaufort, N. C. (Pearse, 1936), Fort Macon, N. C.! (Kingsley, 1878), Calcasieu Pass, Louisiana! (Cary and Spaulding, 1909), Galveston Bay, Swan Lake near Galveston!, Dickinson Bayou!, Corpus Christi!, Texas (Evermann, 1892). These localities must be taken with some reserve, as the authors may have had specimens of other species mixed up with their material of the present form.

*Type:* The holotype (U.S.N.M. Cat. No. 69599) is an ovigerous female from Lagoon near Cove Point Light, Chesapeake Bay (July 14, 1934; W. L. Schmitt, J. O. Maloney and C. R. Shoemaker coll.). The paratypes are 75 females (74 of which are ovigerous) and 1 male from the same locality. All the types are preserved in the U. S. National Museum at Washington.

*Remarks:* The present species, and the two preceding for a long time have been confused under the names *Palaemonetes vulgaris* and *carolinus*. From a few references in literature only the real identity of the material mentioned (or at least part of it) could be made certain, either by actual examination of the material or by the descriptions and figures given. The differences between the species are:

| | *P. vulgaris* | *P. intermedius* | *P. pugio* |
|---|---|---|---|
| Rostrum dorsal<br>Rostrum ventral | teeth up to tip<br>generally 4 or 5 teeth | teeth up to tip<br>generally 4 or 5 teeth | tip naked<br>generally 2 or 3 teeth |
| Dorsal rostral teeth on carapace | 2 | 1 | 1 |
| Scaphocerite $\frac{\text{length}}{\text{breadth}}$ | about 3 | about 3 | about 2.5 |
| Carpus second legs female | shorter than palm, 0.7 times merus | distinctly longer than palm, as long as merus | distinctly longer than palm, as long as merus |
| Carpus second legs male | 1.1 times as long as palm, 0.8 times merus | almost as long as chela, as long as merus | almost as long as chela, as long as merus |
| Teeth of chela of second legs $\frac{\text{dactylus}}{\text{fixed finger}}$ | $\frac{2}{1}$ | $\frac{1}{0}$ | $\frac{0}{0}$ |
| Pleura of fifth abdominal segment | rounded or rectangular | rounded | generally pointed |

The character of the relation between the length of the fused and free portions of the shorter ramus of the upper antennular peduncle is too variable in the three species to be used as a character for their separation.

Though the three species generally are easily separable, there are instances, especially in juveniles in which it gives some difficulty to make the identity of specimens certain.

The specific name *pugio* (= dagger) is chosen on account of the dagger-like shape of the tip of the rostrum.

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[1] Some parts of this work are issued indicating as authors: Berchon, E., Folin, L. de & Périer, L., while of some others the authors were given as: Fisher, P., Folin, L. de & Périer, L. The dates of publication as far could be found out by me from the copy of the U. S. National Museum are:

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