

**Contributions to the Knowledge of the Alpheid
Shrimp of the Pacific Ocean**
**Part XIX. On *Alpheus randalli*, a New Species of the Edwardsii
Group Found Living in Association with a Gobiid Fish¹**

ALBERT H. BANNER and DORA M. BANNER²

ABSTRACT: A new species of snapping shrimp, *Alpheus randalli*, which was collected in association with a goby, *Amblyeleotris* sp., in the Marquesas is described. A shrimp of similar coloration and association was observed in the Indian Ocean. This species is the second of the Edwardsii group reported to live in association with gobies.

Alpheus randalli sp. nov.

Figures 1-3

HOLOTYPE: BPBM S8572; 28-mm male from Nuka Hiva, Marquesas Islands, northwest side Sentinelle de l'est, in sand and fine coral rubble at 18 m (60 ft). Collected by J. E. Randall, 7 May 1971. Commensal with orange-barred goby *Amblyeleotris* sp. (Specimen collected with a small multiprong Hawaiian spear; its impalement distorted the anterior body region.)

PARATYPE: 25-mm male at the same time and location as holotype. (Specimen lacking small chela.)

DESCRIPTION: In paratype, rostrum acute, 1.5 times as long as broad at base, orbitorostral margin rather abrupt, not broadly rounded nor indented; tip reaching almost to end of first antennular article. Rostral carina strong and reaching to posterior margin of orbital hoods. Second antennular article 1.8 times the visible portion of first, 1.9 times as long as broad and more than twice length of third. Stylocerite with

acute tip reaching to end of first article. Scaphocerite with squamous portion narrow and reaching to middle of third antennular article; lateral tooth strong, curved and markedly longer than squame. Carapocerite 4.6 times as long as broad when viewed inferiorly and as long as lateral tooth of scaphocerite. Basicerite with acute lateral tooth. (Note: The general proportions are similar to those found in the holotype, but in the holotype the cephalic appendages are displaced forward in relation to carapace. Contrast Figures 3a and m.)

Ratio of articles of third maxilliped: 10:4:8. Inferior margins of all articles carrying many long hairs; tip of third article bearing a brush of long fine hairs.

Large chela 2.4 times as long as broad with fingers occupying the distal 0.3. Plunger of dactylus of only slight development and fitting into shallow socket on pollex. Superior saddle shallow, proximal shoulder markedly overhanging floor of groove, distal shoulder gradually rounded. Lateral palmar depression well defined, triangular, reaching proximally to linea impressa. Medial palmar depression slightly quadrangular, well defined, reaching to linea impressa near middle of palm. Inferior shoulder heavy but rounded, superior portion at right angle to axis of chela. Medial face of merus 1.3 times as long as broad distally, bearing five small spines on its inferior margin and a strong tooth

¹Hawaii Institute of Marine Biology contribution number 599. This work was supported in part by National Science Foundation grants GB-42498 and BMS-74-1184. Manuscript accepted 12 July 1980.

²University of Hawaii, Hawaii Institute of Marine Biology, Post Office Box 1346, Kaneohe, Hawaii, 96744.

distally. Superodistal margin bearing several long hairs. Small chela of male (small chela of female unknown) subbalaeniceps, 3.5 times as long as broad with fingers equal in length to palm. Oppositional surface of dactylus bearing a rounded ridge that fits into excavate oppositional surface on pollex. Medial side of excavation forms a strong ridge, inner side of ridge bearing several short stiff hairs. Superior surface of palm with broad shallow longitudinal groove extending proximally to linea impressa. Carpus cup-shaped, bearing on its medial face a slight distal notch; both the inferolateral and inferomedial surfaces bearing slight incision-like depressions that continue proximally to the articulation. Merus similar to that of large chela, 1.8 times as long as broad distally and bearing distally on its inferointernal margin five short heavy spines and an acute tooth.

Ratio of carpal articles of second leg: 10:7:4:4:5.

Ischium of third leg bearing heavy spine. Merus inermous, 4.8 times as long as broad; carpus 0.5 as long as merus, inferior and superior margins terminating in small rounded projections; propodus 0.6 as long as merus, bearing on its inferior margin 13 spines placed in irregular pairs and a pair distally, superior and inferior margin both bearing long setae. Dactylus simple, 0.35 as long as propodus.

Telson 2.2 times as long as posterior margin is wide, maximum width 1.35 times width of tip. Posterolateral spines small, with inner pair slightly longer. Anterior pair of dorsal spines placed anterior to middle.

DIAGNOSIS: The form of the large chela places this species firmly within the *Edwardsii* group of the genus *Alpheus*. Of the large number of species placed within the group, only six species and subspecies have the following combination of characteristics in common with this species [see key, dichotomies from 52 to 84, Banner and Banner (1981a)]: (a) males (and/or females) with a balaeniceps or subbalaeniceps dactylus on the small chela; (b) with the proximal shoulder of the superior saddle of the large chela

overhanging the floor of the groove; (c) with the merus of the third leg unarmed and with a simple dactylus. In this group, *A.* [species novum] Banner and Banner (1981a) can be separated from *A. randalli* by the papillae carried on the inferior lobe of the large chela and the inner face of the small chela of the male; by the fingers of the small chela, which run about 1.5 times the length of the palm; and by the second carpal article of the second leg, which is only 0.5 instead of 0.7 the length of the first. *Alpheus bisincisus* De Haan (1850) can best be separated from this species by the rostrum, which is flat and overhanging deep orbitorostral grooves. *Alpheus chiragricus* Milne-Edwards (1837) is characterized by the acute spiniform tips of the proximal shoulder both on the superior saddle and on the lower shoulder on the large chela. In *A. edwardsii* (Audouin, 1827) the inferior shoulder of the large chela extends forward of the associated groove on the outer face, and the meri of both chelipeds lack movable spines. *Alpheus pareuchirus* Coutière (1905) and *A. p. imitatrix* De Man (1909) again do not bear movable spines on the meri of both chelipeds, and the small chela of the male of the first subspecies and of both sexes of the second subspecies bears a definite superior saddle with associated depressions of the medial and lateral faces instead of the ill-defined superior longitudinal depression.

The holotype is placed in the Bernice P. Bishop Museum, Honolulu, Hawaii (BPBM S8572). The paratype is placed in the Smithsonian Institution, Washington, D.C.

DISCUSSION: The color of *Alpheus randalli* is as follows (based upon several 55 × 55-mm transparencies by J. E. Randall of the holotype, one of which is reproduced in Figure 1): Base color of shrimp transparent to white with broad red bands and spots. Large cheliped with band at articulation of fingers, a second band proximal to middle of palm, both bands strong on medial surface, disappearing on lateral surface; with red patch at carpal articulation and red patch on superior portion of merus. Small chela with red band running from articulation of fin-

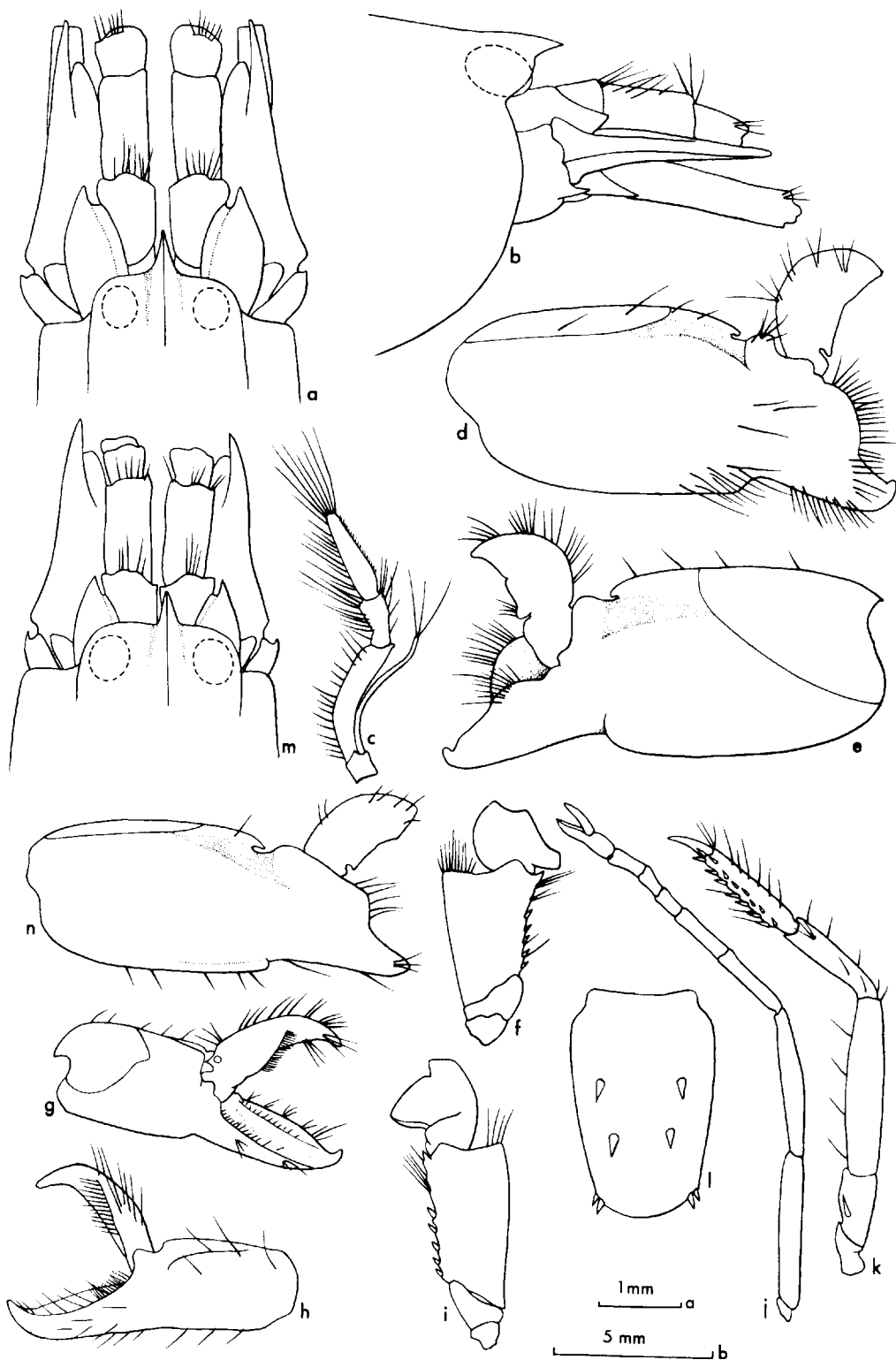


FIGURE 3. *Alpheus randalli* sp. nov. Holotype, 28-mm male; *a, b*, anterior region, dorsal and lateral views; *c*, third maxilliped, lateral face; *d, e*, large chela, medial and lateral faces; *f*, merus, large cheliped, medial face; *g, h*, small chela, lateral and medial faces; *i*, merus, small cheliped, medial face; *j*, second leg; *k*, third leg; *l*, telson. 25-mm paratype: *m*, anterior region, dorsal view; *n*, large chela, medial face. Parts *a, b, k*, scale a; parts *c-j, l-n*, scale b.

gers almost to carpal articulation; carpus white, merus bearing broad red band distally. Antennular and antennal bases and third maxillipeds white. Bar of red color anterior to cardiac groove. Distal portions of thoracic appendages yellow to yellow-green. Posterior end of carapace and tergum of first and second abdominal segment with small red patches. Two white patches on first and second pleura, with small red patches posterior to white patches. Tergum and pleura of third thoracic somite almost solid red. Tergum and pleura of fourth abdominal segment with more narrow red bar. Red saddle on posterior portion of sixth tergum. Distal three-quarters of uropods and half of telson with final red bar. We know of no other species of the *Edwardsii* group, or in the group of species associated with gobies, that have this color pattern (Banner and Banner 1981a, 1981b, passim).

As indicated above, this species was collected by John E. Randall of the Bernice P. Bishop Museum, Honolulu, in the Marquesas Islands at 18 m, where both specimens were found living in association with a new species of goby of the genus *Amblyeleotris* (to be described in a future paper by D. F. Hoese and J. E. Randall). The only other species of the *Edwardsii* group reported to be living in association with gobies is *Alpheus lobidens* De Haan by Macnae (1957:361) from South Africa, Thomassin (1971:381) from Madagascar, and Farrow (1971:487) from Aldabra Atoll (all as *A. crassimanus* Heller). However, *A. lobidens* is largely confined to rather silty intertidal zones [as reported in the papers cited and in Banner and Banner (1975:435)], while this specimen of *A. randalli* was collected at 18 m in sand and rubble [one exception to this distribution is our record from 26 m in the Gulf of Carpenteria, Australia (1981a)]. Moreover, *A. lobidens* is characterized by dark-olive to brown transverse bands on an olive-green ground color, rather than brilliant red bands on a white ground color.

Randall has reported to us that he has found similarly banded shrimp in associ-

ation with *Amblyeleotris aurora* (Polunin and Lubbock 1977:84) at North Male Atoll, Maldives Islands (Figure 2), at 36 m, and with *Stonogobiops dracula* Polunin and Lubbock (1977:74) at Mahé, Seychelles, at 20 m. He reports that *A. aurora* carries strong transverse bars of salmon pink; that *Amblyeleotris* sp. from the Marquesas have similar bands, but their color is more muted; and that *S. dracula* has a white ground color with near-vertical chocolate-brown bars, each white interspace bisected by a narrow red vertical line; all three gobies live from about 10 to at least 35 m in depth. The two named species of gobies have been reported only from the central Indian Ocean (Maldives, Seychelles, Aldabra, etc.), while the unnamed species is known only from its type locality. On the basis of gobiid-shrimp relationship and of color, we are presuming that the specimens observed but not collected from the Indian Ocean are the same species as those that in the Marquesas.

As spearing is not a usual method for the collection of alpheid shrimp, it might be of interest to report on Randall's technique (Randall 1963:6). The spear is of spring steel, 1/8 inch (3.2 mm) diameter and 18 inches (45.7 cm) long; at its tip are about eight divergent steel barbless prongs, each about 6 inches (15.2 cm) long and of 1/16 inch (1.59 mm) diameter; the whole is electroplated with zinc to retard corrosion. In use, the spear is placed through a spool-like piece of wood 6 inches (15.2 cm) long and 1 inch (2.5 cm) in diameter that is fitted at its end with a sling made of rubber and cord; the device has no cocking mechanism, but instead is hand-held until release by gripping on the sling side of the collar or spool. Randall waits motionless in the water near the mouth of the burrow until both the goby and shrimp appear; he then releases his grip, and the stretched rubber propels the spear. (The senior author can attest to the efficacy of the spear, not only against small fishes and shrimp, but also against the feet of other biologists, the latter when the spear is left unattended in a small wave-tossed boat that may be used in collecting.)

LITERATURE CITED

- BANNER, A. H., and D. M. BANNER. 1975. Contributions to the knowledge of the alpheid shrimp of the Pacific Ocean. Part XVII. Additional notes on the Hawaiian alpheids: new species, subspecies, and some nomenclatorial changes. *Pac. Sci.* 28(4):423-437.
- . 1981a. The alpheid shrimp of Australia. Part III. The remaining alpheids, principally the genus *Alpheus*, and the family Ogyrididae. *Rec. Austral. Mus.* [In press, publication scheduled for June 1981.]
- . 1981b. Annotated checklist of the alpheid shrimp of the Red Sea and Gulf of Aden. *Zool. Verh., Leiden.* [In press, publication expected in 1981.]
- FARROW, G. E. 1971. Back reef and lagoonal environments of the Aldabra Atoll distinguished by their crustacean burrows. Pages 455-500 in D. R. Stoddard and M. Yonge, eds. Regional variation in the Indian Ocean coral reefs. *Symp. Zool. Soc., Lond.* 28.
- MACNAE, W. 1957. The ecology of the plants and animals in the intertidal regions of Zwartkops estuary near Port Elizabeth, S. Africa. Part II. *J. Ecol.* 45(2):361-387.
- POLUNIN, N. V. C., and R. LUBBOCK. 1977. Prawn-associated gobies (Teleostei: Gobiidae) from the Seychelles, Western Indian Ocean: Systematics and ecology. *J. Zool., Lond.* 183:63-101.
- RANDALL, J. E. 1963. Methods of collecting small fishes. *Underw. Nat.* 1(2):6-11, 32-56.
- THOMASSIN, B. A. 1971. Les facies d'epifaune et d'epiflore des biotopes sedimentaires des formations coralliennes dans la region de Tulear (sud-ouest de Madagascar). Pages 371-386 in D. R. Stoddard and M. Yonge, eds. Regional variation in the Indian Ocean coral reefs. *Symp. Zool. Soc., London* 28.



Figure 1. Holotype of *Alpheus randalli*, BPBM S8572, Nuku Hiva, Marquesas Islands. (Photograph by J. Randall.)



Figure 2. *Alpheus randalli* with host goby *Amblyeleotris aurora*, Male Atoll, Maldives Islands, 36 m. (Underwater photograph by J. Randall.)

