

Old and Unreported Collections of Alpheid Shrimp from the Zoologisches Museum, Berlin, Principally from Melanesia¹ALBERT H. BANNER² AND DORA M. BANNER²

ABSTRACT: Previously unstudied collections of 70 species of alpheid shrimp held by the Zoologisches Museum (East Berlin) are reported upon. Except for four species from the west coast of the Americas, all specimens were from the Indo-Pacific faunal realm, and principally came from the area of the Pacific south of the equator and west of the International Date Line known as Melanesia (exclusive of the Fiji Archipelago), with 46 species from this area. Of these 46, only 11 species had been previously reported in this region. All of the German specimens were collected before 1914, but we have supplemented the records with six additional collections from Melanesia made in the last two decades. No new species or subspecies are described; one species, *Alpheus japonicus* Miers, 1879, heretofore unfigured, is shown in drawings from the type specimens in the British Museum (Natural History), and one species, *Synalpheus tridens* (Borradaile, as *Alpheinus tridens*) 1899, is placed in synonymy to *Synalpheus stimpsonii* (De Man) 1888.

THIS PAPER IS BASED PRIMARILY upon some old collections of alpheid shrimp which are stored at the Zoologisches Museum, Museum für Naturkunde der Humboldt-Universität zu Berlin, D.D.R. (East Germany). The specimens have never been identified nor reported on. Most of the specimens were from what were the German colonies in the Pacific from 1884 to 1914, from the area anthropologists call "Melanesia," distinct from Polynesia, Micronesia, and Indonesia. Its principal archipelagoes and islands are the Solomons, Vanuata, New Caledonia, the Bismarcks, and New Guinea. Although the people of the Fiji Archipelago are of a Melanesian/Polynesian mixture, that archipelago is not included in this study as its alpheids were previously reported upon (Banner and Banner 1966), and this collection had no specimens from Fiji. These earlier collections of the Zoologisches Museum have been supplemented by a few

minor collections made in more recent times. In addition, the Zoologisches Museum had some collections from other parts of the Indo-Pacific (and even from the Americas) which were also unidentified and unreported; these, too, we report upon. (The collections from the Zoologisches Museum, Universität Hamburg, which may also represent the German colonies in the Pacific, were not available to us as they had been loaned for study to Yasuhiko Miya of Nagasaki University, Japan.)

In total we report on 70 species in 5 genera, of which 46 species are from Melanesia (as defined above). Of these, only 11 have been previously reported by the three authors touching upon collections from Melanesia, Borradaile (1899), De Man (1926), and Monod (1976). We ignore the sweeping general distribution lists of Balss in his various publications, for example, 1914, 1915, for he gives no specific records or specific references to other publications. We are disappointed in the number of species for this rather vast area, especially considering that De Man (1911) reported 113 species from Indonesia and our work (1973, 1975, and 1982) reported 131 species and subspecies from Australia. We do not believe that the small number of species

¹Contribution No. 684, Hawaii Institute of Marine Biology. This study was supported in part by National Science Foundation grants DEB 77-23378 and DEB 81-17603. Manuscript accepted 1 August 1983.

²Hawaii Institute of Marine Biology, P.O. Box 1346, Kaneohe, Hawaii 96744.

TABLE I
GERMAN COLONIES IN THE PACIFIC

COLONY	DATE ACQUIRED	METHOD OF ACQUISITION
German New Guinea	1884	Annexation
Bismarck Archipelago	1884	Annexation
Marshall Islands	1885	Annexation (claim acknowledged in treaty with Great Britain, 1887)
Solomon Islands	1886	Annexation (released to Great Britain, 1899, except for Bougainville and Buka)
Western Samoa Islands	1879, 1899	Trading rights established; colony established in 1899 in treaty with United States and Great Britain
Caroline, Palau, and Northern Marianas Archipelagoes	1899	Purchase from Spain

reflects a paucity of the fauna but rather insufficient collecting.

A brief historical review of the German colonies in the Pacific is in order. The historical data are derived from Townsend (1966) and from the historical sections of the 14th edition of the *Pacific Islands Handbook* (see Carter 1981).

The independent principalities that now make up modern Germany (both East and West) did not participate in the exploration of the Pacific as did the Spanish, English, and French in the 16th to 18th centuries (and the United States in the early and middle 19th century). Nor did Germany officially establish zones of influence, protectorates, or colonies in the 19th century until after 1884. However, German commercial firms did establish economic ties in the Pacific, such as the House of Godeffroy in Samoa as early as 1857, and the firm of Robertson and Hensheim in New Britain in 1875, expanding subsequently to the Marshall, Caroline, and other islands. These firms were followed by other trading and agricultural companies, some in the pattern of the English chartered companies (such as the East India Company). These included the Deutsche-See-Handelsgesellschaft which in turn was followed by the New Guinea Company and the Jaluit Company.

The extent of the German colonies with their dates and methods of acquisition are given in Table 1. Germany, at this time of colonial expansion and *Weltpolitik*, cast co-

vetous eyes on other Pacific Islands; for example, observing the unrest of the population of the Philippines in the last part of the 1890s, the government considered the establishment of a protectorate there, but deferred to the stronger American interests. It finally compromised upon obtaining by purchase from Spain the Marianas (except for Guam), the Carolines, and the Palaus. An interesting side note was the confrontation among the Germans, Americans, and British over the control of the Samoas in the 1890s. In 1889 each of the disputing countries had warships anchored in the broad harbor of Apia. Upolu. Whether the possible conflict between these ships could have led to a colonial war is moot, for a hurricane on 16 March wrecked the three German and the three American ships, with only the English warship making it safely out of the harbor. In the final compromise on Samoa the United States was awarded what is now American Samoa, Germany received Western Samoa, and Great Britain received undisputed claim to the eastern Solomons while Germany retained Bougainville and Buka.

The end of the German Pacific empire was swift. Following the expansion of the small Balkan confrontation into a world war in the last days of July and in early August 1914, New Zealand attacked and captured the German administration in Western Samoa by 1 September, Australia the Kaiser Wilhelmsland (Northeastern New Guinea)

and the associated Melanesian islands in mid-September, and Japan the German islands north of the equator in October.

METHODS

In the text we follow our previous style in checklists, arranging the genera and species alphabetically. The locality records are divided into two categories, from Melanesia and from other areas, and within these two categories they are arranged numerically by the museum numbers of the Zoologisches Museum (ZMB). Some of the collections we were able to examine during our short visit to the museum in East Berlin in 1981; on these our notes list only the identification, the locality, and number, not the number of specimens or other data that might have been on the label. These records are marked by an asterisk (*). The bulk of the specimens, however, were sent by H.-E. Gruner to our institute for more extended study, and on these we have reproduced all information on the museum label (with the exception of some place names; see paragraph below). In most cases the information was meager. The collections of C. Semper, made in the Philippines, do not bear the ZMB number but are evidently numbered in his own series. One set of five specimens from Papua New Guinea was made under the auspices of the University of Papua-New Guinea and was sent to us by the Smithsonian Oceanographic Sorting Center, Washington, D.C.; the center's number is prefaced by *sosc*.

The place names we have attempted to render into the currently officially accepted names. The Germans, like all other colonial peoples, gave their own names to parts of their colonies. When the Germans lost control, other names were substituted, and subsequently with the loss of colonial status, still other names were instituted: thus Kaiser-Wilhelmsland became British New Guinea and finally Papua New Guinea. The changed place names we have used are as follows (a few place names on the labels we have been unable to locate):

NAME USED	PREVIOUS NAME
Ambon	Amboina
Kaohsiung, Taiwan	Takao, Formosa
Madang	Friedrich-Wilhelmshafen
New Britain	Neu-Pommern
New Guinea	Kaiser-Wilhelmsland
Rabaul	Ralum ³
Sri Lanka	Ceylon
Talasea	Talassia (also Kikiwiei)
Tanzania	Tanganyika
Teop	Tiop
Udjung Padang, Sulawesi	Makassar, Celebes
Vanuatu	New Hebrides

ACKNOWLEDGMENTS

We wish to acknowledge the gracious help given us by H.-E. Gruner of the Zoologisches Museum when we visited his institution and to thank him for sending us the rest of the study collections. Mary K. Wicksten, now of Texas A & M University, College Station, Texas, kindly identified for us the specimens from the west coast of the Americas and loaned us a specimen of *Nemalpheus sibogae* from the collections of the Allan Hancock Foundation, University of Southern California, Los Angeles. John E. Randall, Jr., of the Bernice P. Bishop Museum, Honolulu, gave us his field notes and two specimens of alpheid shrimp collected by diving in the Solomons and New Guinea. G. R. Pettit of the Cancer Research Institute, Arizona State University, Tempe, Arizona, collected five specimens in the vicinity of Port Moresby, Papua New Guinea. These were loaned to us by Gordon Hendler of the Smithsonian Oceanographic Sorting Center, Washington, D.C. We also wish to thank the Hawaii Institute of Marine Biology, University of Hawaii at Manoa, for support and allocation of space, even after the official retirement of one of us (AHB) from the University of Hawaii.

³ There may be another old name for Rabaul, for in the rather extensive collection under ZMB 18703, some carried "Ralum, Neu-Pommern" and others "Ulavalo, Neu-Pommern," but we could find no listing for the latter name.

SPECIMENS EXAMINED

Alpheus alcyone de Man, 1902:870, pl. 27, fig. 61

COLLECTIONS FROM MELANESIA: Buka Is., Solomons, 23 October 1910 (ZMB 14443), one specimen; Teop, Bougainville Is., Solomons, coll. H. Schuele, 4 September 1903 (ZMB 14446), five specimens.

COLLECTIONS FROM OTHER AREAS: Camiguin Is. (off Mindanao), Philippines, coll. C. Semper (no. 226), one specimen.

Alpheus astrinx Banner and Banner, 1982:35, fig. 5

COLLECTION FROM MELANESIA: Buka Is., Solomons, 23 October 1910 (ZMB 14443), one specimen.

Alpheus bicostatus de Man, 1908:102

COLLECTIONS FROM MELANESIA: Rabaul, New Britain, coll. Dahl, 10 November 1896 (ZMB 18703), one specimen.

Alpheus bisincisus de Haan, 1850:170, pl. 45, fig. 3

COLLECTIONS FROM MELANESIA: Madang, New Guinea (ZMB 14445), one specimen.

COLLECTIONS FROM OTHER AREAS: Banda, Indonesia (ZMB 2769), one specimen.

Alpheus brevicristatus de Haan, 1850:177, pl. 45, fig. 1

COLLECTIONS FROM OTHER AREAS: Japan, coll. Hilgendorf (ZMB 6018), seven specimens; Kaohsiung, Taiwan, coll. H. Sauter, 5 June 1907 (ZMB 12344), two specimens.

Alpheus brevipes Stimpson, 1861:30

COLLECTIONS FROM MELANESIA: Teop, Bougainville Is., Solomons, coll. H. Schuele, 4 September 1903 (ZMB 14446), three specimens.

Alpheus bucephalus Coutière, 1905:890, pl. 78, fig. 29

COLLECTIONS FROM MELANESIA: Teop, Bougainville Is., Solomons, coll. H. Schuele, 4 September 1903 (ZMB 14446), three specimens; New Britain (ZMB 14450), one specimen; Rabaul, New Britain, in coral, 13 April 1896 (ZMB 18703), one specimen.

COLLECTIONS FROM OTHER AREAS: Camiguin Is. (off Mindanao), Philippines, coll. Semper (no. 226), two specimens.

Alpheus chiragricus H. Milne Edwards, 1837:354

COLLECTIONS FROM OTHER AREAS: East Asia, perhaps Singapore. Ostasiatische Exped., coll. Stephani (ZMB 12899), one specimen.

Alpheus clamator Lockington, 1877:43

COLLECTIONS FROM OTHER AREAS: San Pedro, California, coll. R. Paessler (ZMB 16505), one specimen (id. M. Wicksten).

Alpheus coctivensis Coutière, 1908:210

COLLECTIONS FROM MELANESIA: Teop, Bougainville Is., Solomons, coll. H. Schuele, 4 September 1903 (ZMB 14446), one specimen.

Alpheus collumianus Stimpson, 1861:30

COLLECTION FROM MELANESIA: New Britain (ZMB 14450), one specimen.

Alpheus crockeri (Armstrong), 1941:8, figs. 2, 3

COLLECTIONS FROM MELANESIA: Buka Is., Solomons, 23 October 1910, (ZMB 14443), one specimen; Teop, Bougainville Is., Solomons, coll. H. Schuele, 4 September 1903 (ZMB 14446), three specimens.

Alpheus deuteropus Hilgendorf, 1879:834, pl. 4, figs. 8–10

COLLECTIONS FROM MELANESIA: Hermit Islands, Bismarck Archipelago, coll. Dr.

Gareef, 30 September 1906 (ZMB 13446), one specimen.

COLLECTIONS FROM OTHER AREAS: Zanzibar (Hilgendorf's type), (ZMB 5966), one specimen; Djibouti (ZMB 15551).*

Alpheus diadema Dana, 1852a:23

COLLECTIONS FROM MELANESIA: Rabaul, New Britain, coll. Dahl, 13 April 1896 (ZMB 18703), one specimen; Talasea, New Britain (ZMB 18073).*

REMARKS: Borradaile (1899:417, fig. 17, pl. 39) records this species under this name from Lifu, Loyalty Is. It is notable that this was the only time Dana's name was used for actual specimens between 1852, when the species was described, and 1953, when *A. insignis* Heller, 1861, was placed in synonymy (Banner 1953:118).

Alpheus distinguendus de Man, 1909:155, pl. 7, figs. 9-14

COLLECTIONS FROM OTHER AREAS: Singapore, coll. Stephani (ZMB 8482), two specimens; Kaohsiung, Taiwan, coll. H. Sauter, October 1907 (ZMB 12668), one specimen; Kobe, Japan (ZMB 15976), one specimen.

REMARKS: The identity of the 47 mm female specimen from Kaohsiung, Taiwan, is somewhat questionable as the pollex of the small chela is missing and the large chela is in the process of regeneration.

Alpheus djeddensis Coutière, 1897b:202.

COLLECTIONS FROM MELANESIA: Yacht Harbor, Honiara, Guadalcanal, Solomons, 16 m, 3 August 1973, one specimen; Madang, New Guinea, outside of reef, 45 m, 17 August 1973, one specimen; both coll. by J. Randall.

REMARKS: The specimen from Honiara was collected on a mud bottom and was living in a burrow with a large goby of the genus *Cryptocentrus*. Randall's field notes on the specimen from Madang, a 39 mm male, stated: "Lives with yellow-barred goby in sand in cave. Shrimp was pinkish, the chelae

palms salmon, with a few white spots (transversely oriented) dorsally on back of abdomen."

Alpheus edamensis de Man, 1888:518

COLLECTION FROM MELANESIA: Teop, Bougainville Is., Solomons, coll. H. Schuele, 4 September 1903 (ZMB 14446), one specimen.

Alpheus edwardsii (Audouin), 1827:274

COLLECTIONS FROM OTHER AREAS: Red Sea (ZMB 12910), five specimens; Tanzania [Tanganyika], coll. Reimer, 1897, (ZMB 15438), one specimen; Djibouti, Gulf of Aden (ZMB 15549), five specimens; Madagascar (ZMB 17195), two specimens.

REMARKS: The identity of the specimen referred to by Miers (1884:285) as *A. edwardsii* from the New Hebrides is questionable considering the number of species that he listed as synonyms.

Alpheus frontalis H. Milne Edwards, 1837:87

COLLECTIONS FROM MELANESIA: Madang, New Guinea (ZMB 13821), one specimen; Lubliche Is., New Guinea (ZMB 14444), one specimen; Madang, New Guinea (ZMB 14445), three specimens; Rabaul, New Britain, coll. Dahl, 10 November 1896 (ZMB 18703), one specimen.

COLLECTIONS FROM OTHER AREAS: Chagos, coll. Deutschen Tiefsee Expedition (Valdivia Exped.), 1898-1899 (ZMB 19206)*; Mauritius, coll. Möbius (ZMB 8052), one specimen (type for *Betaeus utricola* Richters; see Miya, 1981:66, 70).

REMARKS: Borradaile (1899:417) reported this species from Lifu, Loyalty Islands.

Alpheus gracilipes Stimpson, 1861:31

COLLECTIONS FROM MELANESIA: New Guinea, (ZMB 1382)*; Teop, Bougainville Is., Solomons, coll. H. Scheule, 4 September 1903 (ZMB 14446), three specimens; Talasea, New Britain, coll. H. Schroede, 10 May 1910 (ZMB

14450), one specimen; Rabaul, New Britain, coll. Dahl, 10 November 1896 (ZMB 18370), three specimens.

COLLECTIONS FROM OTHER AREAS: N. W. Australia (ZMB 5392)*; Zamboanga, Philippines, coll. C. Semper (327), seven specimens.

REMARKS: Monod (1976:141) reports two specimens of this species from Noumea, New Caledonia. The specimen that Thallwitz (1892:21) reported under this name from New Caledonia apparently does not belong to this species—see Ortmann, 1894:15—but, to our knowledge, the Thallwitz specimen has never been reidentified.

Alpheus gracilis Heller, 1861:27

COLLECTIONS FROM MELANESIA: Rabaul, New Britain, coll. Dahl, 26 December 1896 (ZMB 18703), four specimens.

Alpheus hippothoe de Man, 1888:268, pl. 17, figs. 1–5

COLLECTIONS FROM MELANESIA: Ulavalo, New Britain (ZMB 18073).*

COLLECTIONS FROM OTHER AREAS: Ambon (ZMB 5984).*

Alpheus hululensis Coutière, 1905:908, pl. 85, fig. 46

COLLECTION FROM MELANESIA: Teop, Bougainville Is., Solomons, coll. H. Schuele, 4 September 1903 (ZMB 14446), one specimen.

REMARKS: This specimen agrees well with the figures of the holotype and those supplied later by Crosnier and Forest (1966:284, figs. 26a, b). There are only two characters in which it differs. First, the inferodistal margin of the merus of the large cheliped bears two sharp teeth directed distally instead of the usual one. We feel this is probably a growth anomaly. Second, the fingers of the small cheliped are not nearly as hirsute as those figured by Coutière (fig. 46b) (compare Banner and Banner, 1982:246 et seq.).

Alpheus japonicus Miers, 1879:53

Figure 1

COLLECTIONS FROM OTHER AREAS: Yokohama, Japan, coll. Von Martens (ZMB 3391), two specimens; Nagasaki, Japan, coll. Sander, 10 June 1884 (ZMB 12940), one specimen.

REMARKS: While *A. japonicus* never has been recorded from the tropical portions of the Indo-Pacific, we are using these three specimens from Japan from the Zoologisches Museum to review the species. Miers described the species on the basis of two specimens, a male and a female, collected near Nagoya, Japan. In the British Museum (Natural History) these were labelled as "syntypes"; at the suggestion of A. J. Rice of that museum we have designated one as the holotype and the other as the allotype.

HOLOTYPE: BM(NH) (new registration) 1983.81, the 30 mm male from 34°6' N, 136°15' E, 11 fms (= 20 m).

ALLOTYPE: BM(NH) (new registration) 1983.82, the 41 mm female from 35°7' N, 136°55' E, 3 fms (= 4 m).

Miers, in spite of his complaint that the characteristics in the genus *Alpheus* are "hardly to be defined and accurately appreciated without the aid of well-executed figures" (1879:52), failed to supply any figures for his description. Therefore, during our visit to the museum in London in 1967 we made camera-lucida sketches of the now-designated holotype and allotype and of a specimen from the Inland Sea of Japan, as well as detailed notes on their outstanding characteristics. We are supplying the drawings and now append a short diagnosis, but with the latter we recommend perusal of Miers' rather good description and subsequent descriptions by Ortmann (1890:476) and de Man (1907:430).

The development of the small chela of the male may be variable in this species. In the holotype the dactylus is like that of the female although the superior notch on the palm is more prominent. The von Martens' Yokohama male is similar (the Sander's male from Nagasaki has a regenerating large chela

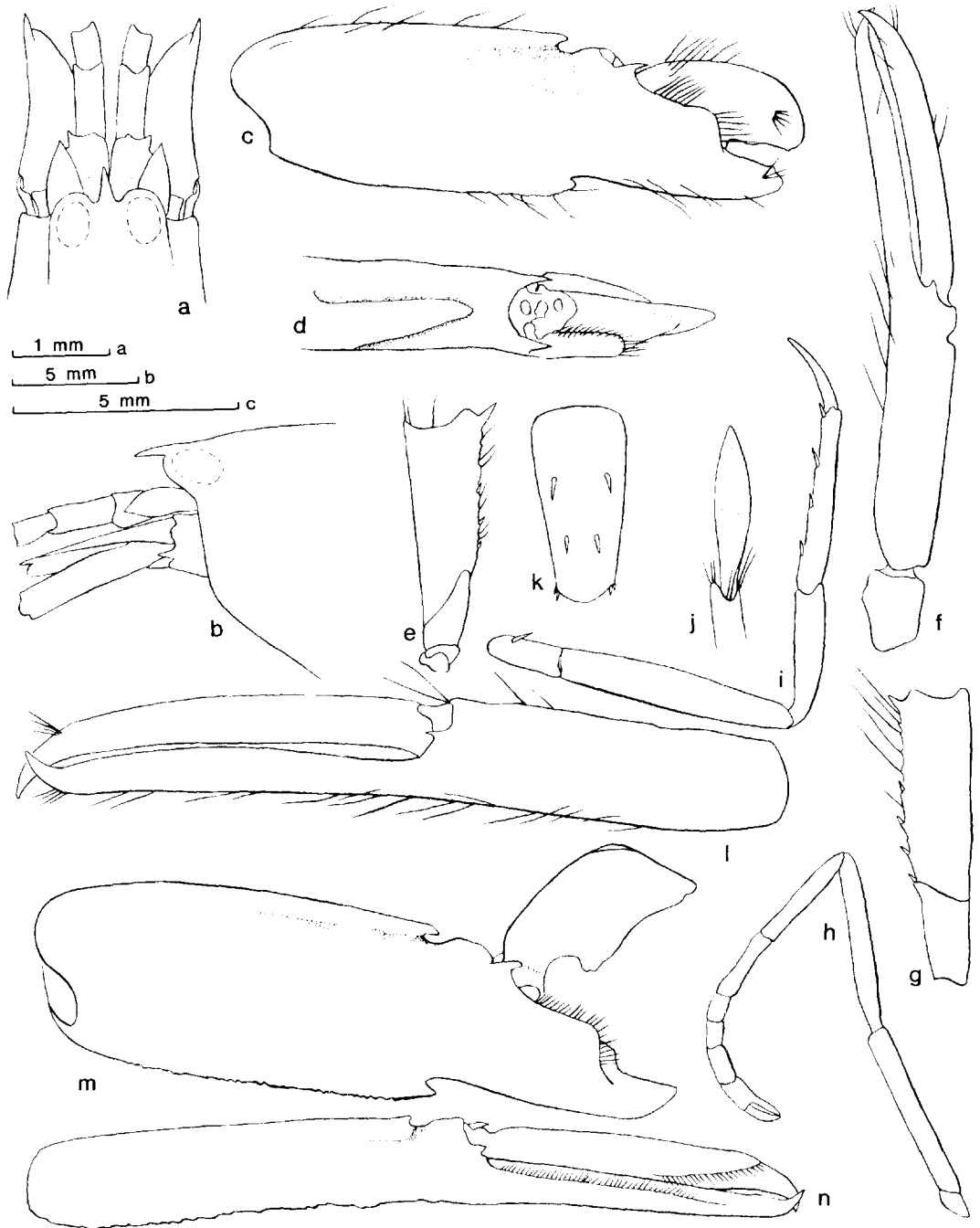


FIGURE 1. *Alpheus japonicus* Miers. Holotype, 30 mm male. *a, b*, anterior region, dorsal and lateral view; *c, d*, large chela, medial and superior face; *e*, merus, larger chela, medial face; *f, g*, small chela and merus, medial face; *h*, second leg; *i, j*, third leg and enlarged dactylus; *k*, telson. Allotype, 41 mm female. *l*, small chela, lateral face. Specimen from Inland Sea of Japan, 50 mm male. *m*, large chela, medial face; *n*, small chela, lateral face. Parts *a, b, j, k*, scale a; parts *m, n*, scale b; parts *c, i, l*, scale c.

and the small chela may also be regenerating and not of final form); Bate's specimen (1888:551, pl. 98, fig. 4, described under the name of *A. longimanus*) also was shown with a female-type chela. However, both Ortmann's males from Tokyo Bay and de Man's male specimens from the Inland Sea had slender balaenicepstype dactyli. This same condition is shown in our figure drawn from a 50 mm male from the Inland Sea (BM [NH] 4-27-47-49). This appears to be a mark of maturity, as it seems to be in *A. lobidens* de Haan (see Banner and Banner 1981:29).

A little confusion has arisen in the nomenclature. Bate's *A. longimanus* was put into synonymy by Ortmann and accepted by de Man; we also see no valid separation between Bate's species and *A. japonicus*, which Bate did not even mention in his discussion. Bate also mentioned another specimen taken off the coast of Madras, India, "which resembles this [species] in all respects, except the presence of the deep notch on the upper and lower margins [of the large chela]." Inasmuch as the presence and character of these notches is very important in species separation in the Edwardsii Group, we suggest that that specimen was not *A. longimanus* (= *A. japonicus*). Finally, Yokoya, who listed *A. japonicus* as present in his area of Japan, supplied figures of three chelae for *A. haanii* Ortmann (1939:255, 256); we believe that his figures 3A and 3C probably are *A. japonicus*, while his figure 3B may be *A. haanii* (which may be, as we have pointed out, a synonym for *A. edwardsii* (Audouin); see Banner and Banner 1982:273).

In addition to records from Japan, the species has also been reported from the coasts of China (Yu 1935:59 and Liu 1959:36), by Balss from Vladivostok (1914:40), and by Holthuis from "S. E. Siberia" (1980:121).

DIAGNOSIS: Rostrum slender, acute; orbito-rostral margin rather deeply incised; orbito-rostral grooves shallow. Second antennular article equal in length to visible portion of first, slightly more than twice as long as broad; stylocerite shorter than first antennular article. Merus of large cheliped 2.4 times as long as broad, bearing on inferointernal margin

three small spines and an acute distal tooth; chela compressed, 3.5 times as long as broad, with tooth overhanging transverse superior notch and somewhat blunt to acute; tooth on inferior shoulder also overhanging, blunt to acute; depressed areas on either side of palm as found in other members of the Edwardsii Group; teeth flanking dactylar articulation acute; plunger on opposite face of dactylus low. Merus of small cheliped similar to that of large; chelae similar in holotype and allotype, equal in length to large chela, almost 8 times as long as broad, palm almost cylindrical, with transverse groove proximal to dactylar articulation deeper in male than female; teeth flanking dactylar articulation acute; dactylus in holotype and allotype similar with only scattered setae, tapering, with tips crossing. (Small chelae in other males balaeniceps, with slight sculpturing on palm; see Figure 1 n). First two articles of carpus of second legs subequal. Merus of third legs 6 times as long as broad, unarmed; propodus bearing four spines; dactylus almost half as long as propodus, spatulate. Telson as normal for Edwardsii Group.

Alpheus leviusculus leviusculus Dana, 1852b: 541

COLLECTIONS FROM OTHER AREAS: Camiguin Is. (off Mindanao), Philippines, coll. C. Semper (226), one specimen.

Alpheus lobidens de Haan, 1850:179

COLLECTIONS FROM OTHER AREAS: Camiguin Is. (off Mindanao), Philippines, coll. C. Semper, three specimens; Manila, Philippines, coll. C. Semper (196), seven specimens; Kaohsiung, Taiwan, coll. H. Sauter, 31 May 1907 (ZMB 12533), seven specimens.

Alpheus longecarinatus Hilgendorf, 1879:833, pl. 4, fig. 3-7

COLLECTIONS FROM OTHER AREAS: Zanzibar (Hilgendorf's type) (ZMB 5956); Bagamoyo, Tanzania, coll. Dr. Sander, 3 August 1885 (ZMB 12946), two specimens.

Alpheus lottini Guérin, 1829, pl. 3, fig. 3

COLLECTIONS FROM MELANESIA: Talasea, New Britain, coll. H. Schroede, 10 March 1910 (ZMB 14450), one specimen; Rabaul, New Britain, coll. Dahl, 30 October 1896 (ZMB 18703); two specimens; Ulavalo, New Britain (ZMB 18703).*

COLLECTIONS FROM OTHER AREAS: Gulf of Suez (ZMB 11301)*; Red Sea (ZMB 11713, 12910)*; Djibouti, Gulf of Aden (ZMB 15549), one specimen; same (ZMB 15550)*; Zamboanga, Philippines, coll. C. Semper, (227), six specimens.

REMARKS: Borradaile (1899:417) reported this species under the name of *A. laevis* Randall from Blanche Bay, New Britain, and Lifu, Loyalty Is.

Alpheus malabaricus malabaricus (Fabricius), 1775:415

COLLECTION FROM OTHER AREAS: Philippines (ZMB 6396).*

Alpheus malleator Dana, 1852a:23

COLLECTIONS FROM OTHER AREAS: Acajutla, San Salvador, coll. R. Paessler, 23 April 1912 (ZMB 16503), four specimens.

Alpheus malleodigitus (Bate), 1888:565, pl. 101, fig. 5

COLLECTIONS FROM MELANESIA: Talasea, New Britain (ZMB 14448), four specimens.

COLLECTION FROM OTHER AREAS: Madagascar (ZMB 17195), one specimen.

Alpheus microstylus (Bate), 1888:566, pl. 101, fig. 6

COLLECTIONS FROM MELANESIA: Talasea, New Britain (ZMB 14448), four specimens.

COLLECTIONS FROM OTHER AREAS: Djibouti, Gulf of Aden, coll. Wache, 2 March 1909 (ZMB 15548), five specimens.

Alpheus novaezealandiae Miers, 1876:224

COLLECTIONS FROM OTHER AREAS: Port Phillip Bay, Victoria, Australia, 8 fms (ZMB 13488).*

Alpheus obesomanus Dana, 1852a:21

COLLECTIONS FROM MELANESIA: Talasea, New Britain, coll. H. Schroede, 10 May 1910 (ZMB 14450), two specimens.

COLLECTIONS FROM OTHER AREAS: Jaluit Lagoon, Marshall Is., coll. Steinbach, 5 April 1894 (ZMB 17184), two specimens.

REMARKS: Borradaile (1899:417) reported specimens of this species from Lifu, Loyalty Islands and from Blanche Bay, New Britain.

Alpheus pachychirus Stimpson, 1861:30

COLLECTIONS FROM MELANESIA: Madang, New Guinea (ZMB 14445), eight specimens; Teop, Bougainville Is., Solomons, coll. H. Schuele, 4 October 1903 (ZMB 14446), two specimens; W. side Loloata Is., Bootless Inlet, Papua New Guinea, mid-tide, from brown algae (SOSC Stn. P14-958), one specimen.

Alpheus pacificus Dana, 1852a:21

COLLECTIONS FROM OTHER AREAS: Camiguin Is. (off Mindanao), Philippines, coll. C. Semper, two specimens; Ujung Pandang, Sulawesi, Indonesia (ZMB 5981)*; Zanzibar (ZMB 12190)*.

REMARKS: Borradaile (1899:417) reported this species under the name of *A. gracilidigitus* Miers from Île des Pins, New Caledonia.

Alpheus paracrinitus Miers, 1881:365, pl. 16, fig. 6

COLLECTION FROM MELANESIA: Talasea, New Britain, coll. H. Schroede, 10 May 1910 (ZMB 14450), one specimen.

Alpheus paralcycone Coutière, 1905:895, pl. 80, fig. 34

COLLECTION FROM MELANESIA: Buka Is.,

Solomons, 23 October 1910 (ZMB 14443), one specimen.

COLLECTION FROM OTHER AREAS: Camiguin Is. (off Mindanao), Philippines, coll. C. Semper (226), one specimen.

Alpheus parvirostris Dana, 1852a: 22

COLLECTIONS FROM MELANESIA: Lubliche Is., New Guinea, (ZMB 14444)*; Teop, Bougainville, Solomon Is., coll. H. Schuele, 4 September 1903 (ZMB 14446), one specimen; Rabaul, New Britain, coll. Dahl, 1896 (ZMB 18703), one specimen.

COLLECTIONS FROM OTHER AREAS: Enoshima, Japan, coll. H. Schroede, from stomach content of whale (ZMB 12421), one specimen; Trincomalee, Sri Lanka (ZMB 12566)*; Bagamoyo, Tanzania (ZMB 12946), two specimens; Upolu, Samoa, coll. B. Griedlander (ZMB 15690), six specimens.

Alpheus rapax Fabricius, 1798: 405

COLLECTIONS FROM OTHER AREAS: Philippines (ZMB 6395)*; Singapore, coll. Stephani (ZMB 8492), six specimens.

Alpheus serenei Tiwari, 1963: 310, figs. 27, 28

COLLECTIONS FROM MELANESIA: Teop, Bougainville, Solomons, coll. H. Schuele, 4 September 1903 (ZMB 14446), four specimens; Rabaul, New Britain, coll. Dahl, 30 October 1896 (ZMB 18703), two specimens.

COLLECTIONS FROM OTHER AREAS: Djibouti, Gulf of Aden, coll. Wasch, Feb. 1901 (ZMB 15549), three specimens.

Alpheus spongiarum Coutière, 1897b: 236

COLLECTION FROM MELANESIA: Talasea, New Britain, coll. H. Schroede, 10 May 1910 (ZMB 14450), one specimen.

Alpheus staphylinus Coutière, 1908: 204

COLLECTIONS FROM MELANESIA: Rabaul, New Britain, coll. Dahl, 30 October 1896 (ZMB 18703), three specimens.

Alpheus strenuus strenuus Dana, 1852a: 21

COLLECTIONS FROM OTHER AREAS: Mozambique, coll. O. Peters (ZMB 5958), two specimens; Fouquets, Mauritius, coll. Möbius, 1874–1875 (ZMB 8051), four specimens. (id. Miya, 1981: 66); Île Europa, coll. Voeltzkow, 4 June 1904 (ZMB 13890)*; Jaluit Is., Marshalls (ZMB 17187)*.

Alpheus styliceps Coutière, 1905: 889, pl. 78, fig. 28

COLLECTIONS FROM MELANESIA: Teop, Bougainville Is., Solomons, coll. H. Schuele, 4 September 1903 (ZMB 14446), four specimens.

Alpheus sulcatus Kingsley, 1878: 193

COLLECTIONS FROM OTHER AREAS: Camiguin Is. (off Mindanao), Philippines, coll. C. Semper (196), two specimens.

Alpheus tungii Banner and Banner, 1966: 160

COLLECTION FROM OTHER AREAS: Fouquets, Mauritius, coll. Möbius, 1874–1875 (ZMB 8050), one specimen (id. Y. Miya, 1981: 66).

REMARKS: This specimen is one of a group of four that were originally identified by Richters (1880:163) as *Alpheus villosus* (Olivier). Miya (1981: 66, fig. 1) upon reexamination of three of the four specimens found them to be *A. tungii*. Only one of the specimens is in the Zoologisches Museum, Berlin, and two are at the Zoologisches Museum, Universität Kiel; where Richters' fourth specimen may be was not reported.

Alpheopsis equalis Coutière, 1896: 382

COLLECTIONS FROM MELANESIA: Buka Is., Solomons, 23 October 1910 (ZMB 14443), six specimens; Teop, Bougainville Is., Solomons, coll. H. Schuele, 4 September 1903 (ZMB 14446), three specimens.

Athanas indicus (Coutière), 1903: 84, fig. 25–30

COLLECTIONS FROM MELANESIA: Rabaul,

New Britain, coll. Dahl, 26 December 1896 (ZMB 18703), three specimens.

REMARKS: Field notes indicate the specimen was violet-black, with whitish mid-dorsal and lateral lines, and was on a sea urchin colored in the same way.

Metalpheus aglaopheniae (Borradaile), 1899: 417

REMARKS: Borradaile reported the specimen under this name from a hydroid of the genus *Aglaophenia* from Engineers Bay, British New Guinea (Papua). This may be a synonym of *M. paragracilis* (Coutière); see Banner and Banner, 1982: 281.

Nemalpheus sibogae (de Man), 1910: 307

COLLECTIONS FROM MELANESIA: Efate Is., New Hebrides, coll. Kerstitch, 12-18 July 1982 in 10 m from coral and rubble, Allan Hancock Foundation, Los Angeles, California.

REMARKS: This is a 19.5 mm male and, like the holotype, it has articulated pleura on the sixth abdominal somite.

Synalpheus bituberculatus de Man, 1910: 294

COLLECTIONS FROM MELANESIA: New Guinea, coll. H. Schroede, 10 May 1910 (ZMB 14450), one specimen; Rabaul, New Britain, coll. Dahl, 10 November 1896 (ZMB 18703), three specimens.

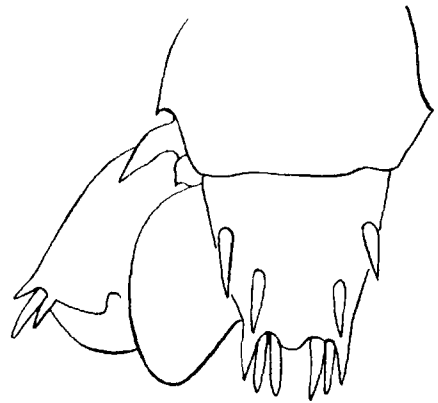
Synalpheus charon (Heller), 1861: 27

COLLECTIONS FROM OTHER AREAS: Kenya (ZMB 17190).*

Synalpheus coutierei Banner, 1953: 36

COLLECTION FROM OTHER AREAS: Suez, 1914 (ZMB, without number), one specimen.

REMARKS: Borradaile (1899: 416) reported this species under the name *Synalpheus biunguiculatus* (Stimpson) from Rabaul, New Britain.



1 mm

FIGURE 2. *Synalpheus hastilicrassus* Coutière. 13 mm male from Talasea, New Britain (ZMB 14447), showing extraordinary development of telson armature.

Synalpheus demani Borradaile, 1899: 416

COLLECTION FROM MELANESIA: Madang, New Guinea (ZMB 13821), one specimen.

COLLECTIONS FROM OTHER AREAS: Philippines, coll. C. Semper (193).

REMARKS: Borradaile (1899: 416) reported this species from Lifu, Loyalty Islands. Monod (1976: 139) reported it from Noumea, New Caledonia.

Synalpheus digueti Coutière, 1909: 48, fig. 28

COLLECTION FROM OTHER AREAS: Acajutla, San Salvador, coll. R. Paessler, 2 April 1912 (ZMB 16504), one specimen (id. M. Wicksten).

Synalpheus fossor (Paulson), 1875: 103, pl. 13, fig. 5

COLLECTION FROM MELANESIA: off Osborne Point, Bootless Inlet, Papua New Guinea, 8.9-15.2 m, 29 May 1981, from black cylindrical sponge, (SOSC Sta. M112-344), one specimen.

COLLECTIONS FROM OTHER AREAS: Philippines, coll. Semper (222), 12 specimens.

Synalpheus hastilicrassus Coutière, 1905: 857, pl. 72, fig. 12

Figure 2

COLLECTIONS FROM MELANESIA: Teop, Bougainville Is., Solomons, coll. Scheule, 4 September 1903 (ZMB 14446), three specimens; Talasea, New Britain, coll. Schroede (ZMB 14447), one specimen; Rabaul, New Britain, coll. Dahl, 30 October 1896 (ZMB 18703), three specimens.

COLLECTIONS FROM OTHER AREAS: Red Sea (ZMB 12910), two specimens.

REMARKS: The 13 mm specimen from Talasea (ZMB 14447) has an unusual telson (Figure 2), with the posterolateral teeth and the dorsal and terminal spines even larger in proportion to the telson than the most extreme development we found in this species in Australia (Banner and Banner 1975: 353, fig. 21). Because in its other characteristics the specimen cannot be separated from *S. hastilicrassus*, we are interpreting this as a further extension of the range of the variation found in the armature of the telson in this species.

Synalpheus laticeps Coutière, 1905:847, pl. 72, fig. 11

COLLECTION FROM MELANESIA: Rabaul, New Britain, coll. Dahl, 13 April 1896, in coral (ZMB 18703), one specimen.

Synalpheus lockingtoni Coutière, 1909: 29, fig. 1

COLLECTION FROM OTHER AREAS: Acajutla, El Salvador, coll. R. Paessler, 28 April 1912 (ZMB 16504), one specimen (id. M. Wicksten).

Synalpheus neomeris (de Man), 1897: 734, fig. 61 a,d,e

COLLECTIONS FROM MELANESIA: Rabaul, New Britain 10 November 1896, 53–73 m in sand (ZMB 18703), one specimen; S. Point, Manudaba Is., Bootless Inlet, Papua New Guinea, 12 m, 5 June 1981, from dark blue finger-shaped sponge (SOSC Sta. M171-3515), one specimen; Borea Pt., SE Caution Bay, Papua New Guinea (35 mi. W of Univ. Papua New Guinea Marine Lab), 9.1–11.2 m, 5 June 1981, from a possible alcyonarian (SOSC Sta. M258-3598), one specimen.

COLLECTION FROM OTHER AREAS: Kao-hsiung, Taiwan (ZMB 17182), one specimen.

REMARKS: Borradaile (1899:416) reported this species from Lifu, Loyalty Islands.

Synalpheus nilandensis Coutière, 1905:871, fig. 4

COLLECTIONS FROM MELANESIA: Madang, New Guinea (ZMB 14445).*

Synalpheus nobili Coutière, 1909: 40, fig. 22

COLLECTION FROM OTHER AREAS: Acajutla, San Salvador, coll. R. Paessler, 28 April 1912 (ZMB 16504), one specimen (id. M. Wicksten).

Synalpheus pachymeris Coutière, 1905:873, pl. 71, fig. 9

COLLECTION FROM MELANESIA: Madang, New Guinea (ZMB 14445).*

Synalpheus pescadorensis Coutière, 1905:877, pl. 73, fig. 15

COLLECTION FROM MELANESIA: New Guinea, coll. H. Schroede, (ZMB 20872).*

REMARKS: De Man (1926: 341) reported an 8 mm specimen of this species from Buka, Solomon Is.

Synalpheus quinquedens Tattersall, 1921: 376, pl. 28, fig. 1–5

COLLECTIONS FROM OTHER AREAS: Madagascar (ZMB 17195), one specimen.

Synalpheus stimpsonii (de Man), 1888:513, pl. 22, fig. 1

Alpheimus tridens Borradaile 1899:415

COLLECTIONS FROM MELANESIA: Astrolabe Bay, New Guinea, coll. H. Schroede (ZMB 15019), two specimens.

COLLECTION FROM OTHER AREAS: Philippines, coll. C. Semper (193), one specimen.

DISCUSSION: Borradaile (loc. cit.) described two specimens of alpheid shrimp from Lifu,

Loyalty Islands, as belonging to his new genus and species cited above. Since his paper we can find his genus mentioned only twice in the literature: de Man (1911:133, 134) lists the genus as an Indo-Pacific form that was not collected by the Siboga Expedition and Holthuis (1955:93) lists *Alpheinus* as a synonym for *Synalpheus*. We could find no mention of his species.

Through the courtesy of C. B. Goodhart of the University Museum of Zoology, Cambridge (England), we were able to examine Borradaile's specimens at the museum and later to have them sent to our institute for further study. Neither specimen is intact: one, evidently dissected by Borradaile, is represented by a fairly intact abdomen, a loose carapace, some detached appendages, and a vial containing mouthparts; the other is reasonably intact except that it lacks all pereopods on one side, some of which are free in the jar; the other side has a few attached legs.

As Holthuis pointed out (without discussion), the genus *Alpheinus* is plainly a synonym of *Synalpheus* Bate (1888). In neither Borradaile's short definition of his genus nor in his description and figures of species are there any characteristics that could be used for its separation from *Synalpheus*. One should make allowance, however, for Borradaile undoubtedly did not have available a copy of Coutière's thesis (1899) where he described the genus, and it was Coutière's work that "definitely established the characters by which the genus *Synalpheus* is differentiated from other genera of the family Alpheidae" (de Man 1911:186).

Inspection of the specimens leaves no doubt that they belong to the species *S. stimpsonii*, especially in view of the variation we have found within that species (see Banner and Banner 1968:274, 1975:292). Two characteristics should be remarked upon: On one of the large chelae loose in the vial, the dactylus bears a definite conical tooth on the opposite edge proximal to the tip (at about three quarters of the dactylar length); the second one has more of a rounded projection at that point. De Man had used a tooth like this as one of the characteristics to separate his *S. consobrinus* (1911:204, pl. 6, fig. 21; note espe-

cially fig. 21c) from *S. stimpsonii*; *S. consobrinus* is now a synonym of *S. stimpsonii* (Banner and Banner 1968:274). In the collections from Indonesia that we are currently studying we have reexamined the chelae on a number of specimens and found this characteristic to be variable, ranging from a low, ill-defined ridge to a rounded projection; none had a tooth as well defined as it was in Borradaile's one specimen. A second characteristic we observed was a tuft of several rows of tightly packed setae on the propodal finger of the second leg, starting slightly proximal to the dactylar articulation and continuing to near the tip. This has not been remarked upon in the previous literature, but these chelae are largely ignored (except for those in *Batella* [= *Cheirothrix*]); similar tufts were found on some of the Indonesian specimens of this species.

Synalpheus streptodactylus Coutière, 1905: 870, fig. 1

COLLECTIONS FROM MELANESIA: Madang, New Guinea, (ZMB 13821)*; Buka Is., Solomons, 23 October 1910 (ZMB 14443), one specimen; Teop, Bougainville Is., Solomons, coll. H. Schuele, 4 September 1903 (ZMB 14446), two specimens.

COLLECTIONS FROM OTHER AREAS: Red Sea, coll. Siemens, 5 September 1869 (ZMB 3355), one specimen.

REMARKS: Monod (1976:141) reported two specimens that were of "rouge brique" color from Noumea, New Caledonia.

Synalpheus trianguiculatus (Paulson), 1875: 109, pl. 14, fig. 1

COLLECTIONS FROM OTHER AREAS: Gulf of Suez (ZMB 11307)*; Red Sea (ZMB 11714).*

Synalpheus tumidomanus (Paulson), 1875: 101, pl. 13, fig. 2

COLLECTIONS FROM OTHER AREAS: Ras el Millan, coast of Sinai, coll. Hartmeyer, 21 August 1901 (ZMB 23360).*

LITERATURE CITED

- ARMSTRONG, J. C. 1941. The Caridea and Stomatopoda of the second Templeton Crocker-American Museum expedition to the Pacific Ocean. *Am. Mus. Novit.* (1137): 1-14, 4 figs.
- AUDOUIN, V. 1827. Description de l'Égypte ou recueil des observations et des recherches qui ont été faites en Égypte pendant l'expédition de l'armée française. Éd. 2, 22: 249-290. *Atlas Hist. Nat.*, Vol. 2, Crust., pl. 1-13.
- BALSS, H. 1914. Ostasiatische Decapoden II. Die Natantia und Reptantia. In F. Dolflein. Beiträge zur Naturgeschichte Ostasiens. *Abh. bayer. Akad. Wiss.* 2(10): 1-101, text figs. 1-50, pl. 1.
- . 1915. Die Decapoden des Roten Meeres. I. Die Macruren. Expeditionen S. M. Schiff "Pola" in das Rote Meer. Nördliche und südliche Hälfte 1895-96—1897-98. *Zoologische Ergebnisse* 30. Berichte der Kommission für ozeanographische Forschungen. *Denkschr. Akad. Wiss. Wien* 91: 1-38, text figs. 1-30.
- . 1921. Stomatopoda, Macrura, Paguridea and Galatheidea. In Results of Dr. E. Mjöberg's Swedish scientific expeditions to Australia 1910-1913. XXIX. *K. Svenska Vetensk. Akad. Handl.* 61(10): 1-24, 12 figs.
- BANNER, A. H. 1953. The Crangonidae or snapping shrimp of Hawaii. *Pac. Sci.* 7(1): 1-147, 50 figs.
- BANNER, A. H., and D. M. BANNER. 1966. Contributions to the knowledge of the alpheid shrimp of the Pacific Ocean. Part X. Collections from Fiji, Tonga and Samoa. *Pac. Sci.* 20(2): 145-188, 20 figs.
- . 1968. Contributions to the knowledge of the alpheid shrimp of the Pacific Ocean. Part XII. Collections from the Marshall and Caroline Islands. *Micronesica* 4(2): 261-294, 1 fig.
- BANNER, D. M., and A. H. BANNER. 1973. The alpheid shrimp of Australia. Part I. The lower genera. *Rec. Aust. Mus.* 28(15): 291-382, 19 figs.
- . 1975. The alpheid shrimp of Australia. Part II. The genus *Synalpheus*. *Rec. Aust. Mus.* 29(12): 267-389, 29 figs.
- . 1981. Annotated checklist of the alpheid shrimp of the Red Sea and Gulf of Aden. *Zool. verh.*, Leiden No. 190: 1-99, 11 figs.
- . 1982. The alpheid shrimp of Australia, Part III. The remaining alpheids principally the genus *Alpheus*, and the family Ogyrididae. *Rec. Aust. Mus.* 34(1): 1-357, 95 figs.
- BATE, C. SPENCE, 1888. Report on the Crustacea Macrura dredged by H.M.S. *Challenger* during the years 1873-76. In The voyage of H.M.S. *Challenger*. *Zoology* 24: xc + 942 (157 pls. in separate vol.). Eyre and Spottiswoode, London.
- BORRADAILE, L. A. 1899. On the Stomatopoda and Macrura brought by Dr. Willey from the South Seas. In A. Willey, ed. *Zoological results based on material from New Britain, New Guinea, Loyalty Islands and elsewhere collected during the years 1895, 1896, 1897*. Part IV., No. 20. University Press, Cambridge, England, Pp. 395-428, pls. 36-39.
- CARTER, JOHN, ed. 1981. Pacific islands year book, 14th edition. Pacific Publications, Sydney and New York. Pp. 1-559, with numerous maps.
- COUTIÈRE, H. 1896. Note sur quelques genres nouveaux ou peu connus d'Alphéidés formant la sous-famille des Alphéopsides. *Bull. Mus. Hist. Nat.*, Paris, 2(8): 380-386.
- . 1897a. Note sur quelques Alphéidés nouveau ou peu connus rapportés de Djibouti (Afrique Orientale). *Bull. Mus. Hist. Nat.*, Paris 3(6): 233-236.
- . 1897b. Note sur quelques espèces du genre *Alpheus* du Musée de Leyde. *Notes Leyden Mus.* 19(23): 195-207.
- . 1899. Les "Alpheidae" morphologie externe et interne, formes larvaires, biologie. Thèses présentées à la Faculté des Sciences de Paris ... Sér. A, No. 321 No. d'ordre 980. 559 pp., 409 text figs., 6 pls. Masson et Cie, Paris. (Also in *Ann. Sci. Nat.*, VIII, *Zool.* 9: 1-560.)
- . 1903. Note sur quelques Alpheidae des Maldives et Laquedives. *Bull. Soc. philomath.* Paris IX, 5(2): 72-90, 38 figs.
- . 1905. Les Alpheidae. In J. S.

- Gardiner, ed. The fauna and geography of the Maldive and Laccadive Archipelagoes. University Press, Cambridge, England (Vol. dated 1906). 2(4): 852-921, pl. 70-87, text figs. 127-139.
- . 1908. Sur quelques nouvelles espèces d'Alpheidae. Bull. Soc. philomath. Paris IX, 11(5): 191-216.
- . 1909. The American species of the snapping shrimp of the genus *Synalpheus*. Proc. U. S. Natl. Mus. 36(1659): 1-93, 54 figs.
- CROSNIER, A., and J. FOREST. 1966. Crustacés décapodes: Alpheidae. In Campagne de la Calypso dans le Golfe de Guinée et aux îles principe, São Tomé et Annobon (1956), et campagne aux îles du Cap Vert (1959). XXVII (Fasc. 7). Ann. Inst. Océan. 44: 199-314 (Masson et Cie, Paris).
- DANA, J. D. 1852a. Conspectus Crustaceorum quae in Orbis Terrarum circumnavigatione, Carolo Wilkes e Classe Republicae Foederatae Duce, lexit et descripsit. Proc. Acad. Nat. Sci. Philadelphia 1852: 6-28.
- . 1852b. Crustacea. United States Exploring Expedition, during the years 1838, 1839, 1840, 1841, 1842 under the command of Charles Wilkes, U.S.N. C. Sherman, Philadelphia. 13: viii + 685.
- FABRICIUS, J. C. 1775. Systema entomologiae sistens insectorum classes ordines, genera, species adiectis synonymis, locis, descriptionibus, observationibus. Flensburgi et Lipsiae [Flensburg and Leipzig]. Pp. 1-832.
- . 1798. Supplementum entomologiae systematicae, Hafniae [Copenhagen]. Pp. 1-572.
- GUÉRIN-MÉNEVILLE, F. E. 1829-44. Iconographie du règne animal de G. Cuvier, ou représentation d'après nature de l'une des espèces les plus remarquables et souvent non encore figurées, de chaque genre d'animaux. Avec une texte descriptif mis au courant de la science. Ouvrage pour servir d'atlas a tous les traités de zoologie. Vol. 2, Planches des animaux invertébrés, pls. 1-104; Vol 3 (?), Crustacés. J. B. Bailliére, Paris, London.
- HAAN, W. de. 1850. Crustacea. In P. F. de Siebold. Fauna Japonica sive descriptio animalium, quae in itinere per Japoniam, jussu et auspiciis superiorum, qui summum in India Batava Imperium tenent, suscepto, annis 1823-1830 collegit, notis observationibus et adumbrationibus illustravit, pp. i-xvii, i-xxxii, 1-244, pls. 1-55, A-Q, 1, 2. Lugduni: Batavorum.
- HELLER, C. 1861. Synopsis der im rothen Meere vorkommenden Crustaceen. Verh. zool. bot. Ges. Wien 11: 3-32.
- HILGENDORF, F. 1879. Die von Hrn. W. Peters in Mocambique gessammelten Crustaceen (bearbeitet von Hrn. Dr. F. Hilgendorf). K. Akad. Wiss. Berlin Mbr. 25: 782-851, 4 pls.
- HOLTHUIS, L. B. 1955. The recent genera of the caridean and stenopodidean shrimps (class Crustacea, order Decapoda, supersection Natantia) with keys for their determination. Zool. verh. Leiden (26): 1-157, figs. A, B + 105.
- . 1980. FAO species catalogue. Vol. 1 Shrimps and prawns of the world. An annotated catalogue of species of interest to fisheries. FAO Fisheries synopsis No. 125, v. 1, pp. i-xvii, 1-271.
- KINGSLEY, J. S. 1878. (Art. VII). A synopsis of the North American species of the genus *Alpheus*. Bull. U. S. Geol. and Geogr. Surv. Territories 4(1): 189-199.
- LIU, J. Y. 1959. Notes on the economic macrurous crustacean fauna of the Yellow Sea and East China Sea (In Chinese except for abstract). Oceanol. Limnol. Sin. 2(1): 35-42.
- LOCKINGTON, W. N. 1877. Description of seven new species of Crustacea. Proc. Calif. Acad. Sci. 7: 41-49.
- MAN, J. G. de. 1888. Bericht über die im indischen Archipel von Dr. J. Brock gesammelten Decapoden und Stomatopoden. Arch. Naturgesch. 53(1): 215-600, pls. 7-22a.
- . 1897. Bericht über die von Herrn Schiffscapitän Storm zu Atjeh, an den westlichen Küsten von Malakka, Borneo und Celebes sowie in der Java-See gesammelten Decapoden und Stomatopoden. Fünfter theil. Zool. Jb. Syst. 9: 725-790, pl. 12-14 (in vol. 10).
- . 1902. Die Von Herrn Professor

- Kükenthal im Indischen Archipel gesammelten Dekapoden und Stomatopoden. In W. Kükenthal ed. Ergebnisse einer zoologischen Forschungreise in den Molukken und Borneo. Abh. Senckenb. naturforsch. Ges. 25(3):467-929, pls. 19-27.
- . 1907. On a collection of Crustacea, Decapoda and Stomatopoda, chiefly from the Inland Sea of Japan; with descriptions of new species. Trans. Linn. Soc. Lond. II, 9:387-454, pls. 31-33.
- . 1908. Diagnosis of new species of macrurous decapod Crustacea from the "Siboga-Expedition." III. Notes Leyden Mus. 30(14):98-112.
- . 1909. Note sur quelques espèces du genre *Alpheus* Fabr. appartenant au Groupe Brevirostris de M. Mém. Soc. Zool. Fr. 22:146-164, pls. 7, 8.
- . 1910. Diagnoses of new species of macrurous decapod Crustacea from the "Siboga Expedition." V. Tijdschr. ned. dierk. Vereen. II, 11(4):287-319.
- . 1911. The Decapoda of the Siboga Expedition, Part II. Family Alpheidae. Siboga-Expeditie 39a¹(2):133-465. (Livre 60). 1915. Op. cit. Supplement ... Explanation of plates of Alpheidae. Siboga-Expeditie 39a¹(2):23 pls. (Livre 74). E. J. Brill, Leiden.
- . 1926. Beschreibung zweier Arten von Decapoda Macrura von der Insel Buka (Salomoninseln). Mitt. zool. Mus. Berl. 12(2):339-345.
- MIERS, E. J. 1876. Descriptions of some new species of Crustacea chiefly from New Zealand. Ann. Mag. Nat. Hist. IV, 17(99):218-229.
- . 1879. On a collection of crustacea made by Capt. H. C. St. John R. N. in the Corean and Japanese Seas. Part I. Podophthalmia. Proc. Zool. Soc. Lond. 1879:18-61, pls. 1-3.
- . 1881. On a collection of Crustacea made by Baron Hermann-Maltzan at Goree Island, Senegambia. (Macrura). Ann. Mag. Nat. Hist. V, 8(47):364-377, pls. 13-16.
- . 1884. Crustacea. In Report of the zoological collections made in the Indo-Pacific Ocean during the voyage of H. M. S. "Alert," 1881-2, pp. 178-322, 513-575, pls. 18-35, 46-52. Trustees of the British Museum (Natural History). London.
- MILNE EDWARDS, H. 1837. Histoire naturelle des crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux. Atlas pt. 2. Roret, Paris. 2:1-532.
- MIYA, Y. 1981. Re-examination of some alpheid shrimps (Crustacea, Decapoda) of Richters (1880) collected from Mauritius and the Seychelles by Prof. Karl Möbius in 1874-75. Mitt. Zool. Mus. Univ. Kiel 1(7):65-73, 3 figs.
- MONOD, Th. 1976. Sur une nouvelle collection de crustacés décapodes de Nouméa (Nouvelle Calédonie). Cah. Pacif. no. 19:133-152, 71 figs.
- ORTMANN, A. E. 1890. Die Unterordnung Natantia Boas. Theil I. Die Decapoden-Krebse des Strassburger Museums, mit besonderer Berücksichtigung der von Herrn Dr. Döderlein bei Japan und bei den Liu-Kiu-Inseln gesammelten und z. Z. im Strassburger Museum aufbewahrten Formen. Zool. Jb. Syst. 5(1):437-542, pls. 36, 37.
- . 1894. Crustaceen. In R. Semon, ed. Zoologische Forschungsreisen in Australien und dem Malayischen Archipel mit Unterstützung des Herrn Dr. Paul von Ritter ausgeführt in den Jahren 1891-93. Denkschr. med. naturw. Ges. Jena 8:3-80, pls. 1-3.
- PAULSON, O. 1875. Studies of the Crustacea of the Red Sea with notes regarding other seas. Part I. Podophthalmata and Edriophthalmata (Cumacea). Pp. xiv + 144, pls. 1-21. S. V. Kul'zhenko, Kiev (In Russian). (English translation by Francis D. Por with above title, 1961, issued by Israel Program for Scientific Translations and available from Office of Technical Services, U. S. Department of Commerce, Washington, D. C. 164 pp. Note: pagination of translation does not correspond to original.)
- RICHTERS, F. 1880. Decapoda. In K. Möbius, ed. Beiträge zur Meeresfauna der Insel Mauritius und der Seychellen bearbeitet von K. Möbius, F. Richters and E. von

- Martens nach Sammlungen angelegt auf einer Reise nach Mauritius. Gutmann, Berlin. Pp. vi + 352, 25 pls.
- STIMPSON, W. 1861. *Prodomus descriptionis animalium evertibratorum, quae in expeditione ad Oceanum Pacificum Septentrionalum. Pars VIII. Crustacea Macrura.* Proc. Acad. Nat. Sci. Philadelphia 12:22-47.
- TATTERSALL, W. 1921. Report on the Stomatopoda and macrurous Decapoda collected by Mr. Cyril Crossland in the Sudanese Red Sea. J. Linn. Soc. 34(229): 345-398, pl. 27, 28.
- THALLWITZ, J. 1892. Decapoden-Studien, insbesondere basirt auf A. B. Meyer's Sammlungen in Ostindischen Archipel, nebst einer Aufzählung der Decapoden und Stomatopoden des Dresdener Museums. Abh. zool.-anthrop. Mus. Dresden 1890-1891 (3):1-53, pl. 1.
- TIWARI, K. 1963. Alpheid shrimps (Crustacea: Decapoda: Alpheidae) of Vietnam. Ann. Fac. Sci. Saigon 1963:269-362, 1 table, 32 figs.
- TOWNSEND, M. E. 1966. The rise and fall of Germany's colonial empire, 1884-1918. Howard Fertig, New York. Pp. xxix + 424, 6 maps, 7 tables, 8 graphs.
- YOKOYA, Y. 1939. Macrura and Anomura of decapod Crustacea found in the neighborhood of Onogawa, Miyagi-ken. Sci. Rep. Tohoku Imp. Univ. IV, 4:261-289, 13 figs.
- YU, S. C., 1935. Sur les crevettes chinoises appartenant au genre Crangon (*Alpheus*) avec descriptions de nouvelle espèces. Chinese Journ. Zool. 1:55-67, 4 figs.

