Contributions to the Knowledge of the Alpheid Shrimp of the Pacific Ocean

Part XII. Collections from the Marshall and Caroline Islands

Albert H. and Dora M. Banner

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This is the last of our projected series of studies on the systematics and distribution of the alpheid shrimp of the Central Pacific. It reports upon collections made by the senior author at Eniwetok in 1957 and upon an extensive series of specimens loaned by the U. S. National Museum and the Alan Hancock Foundation that resulted from studies conducted by a number of investigators under the auspices of the Atomic Energy Commission and the Coral Atoll Studies of the National Academy of Science.

A smaller collection from Arno in the Southern Marshalls was reported on in Part II of this series, and R. W. Hiatt's collection from Yap in the Carolines was reported on in Part IV.

This is also the last of the studies that was completed at the time of the Hawaii Marine Laboratory fire in 1961 (Banner and Banner, 1962). Destroyed in the fire were the specimens, many on loan from the U. S. National Museum and the Hancock Foundation, the figures, and the finished manuscript. As with Parts IX, X, and XI we found the original rough draft sufficiently unburned that it could be reconstructed, although with some ommissions. In some cases the collectors were able to supply full duplicate data; in other the data, like the specimens, were lost.

The senior author's Eniwetok collection was made under the AEC contract AT (29-2)-226; the study was supported in part by NSF grants G-3863, G-9937 and GB-3809 from the division of Systematic Biology, National Science Foundation. We also wish to acknowledge our appreciation of all of the collectors listed in the following pages, especially to Drs. Abbott, Bayer, Garth, Johnson, and Morrison.

LOCALITIES

First presented are the collections of the senior author listed with a BE prefix; following are loaned collections. Here to save space, the name of the collectors are abbreviated to the following code:

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[1] Contribution No. 330, Hawaii Institute of Marine Biology.

Micronesica 4 (2):261-294. 1968 (Dec.).

A	Abbott, D. P.
B	Bates, M.
BA	Bayer, F. M.
BR	Brock, V.
C	Cali
G	Garth, J.
H	Hand, C.
HA	Harry, R. R.
HE	Herald, E.
J	Johnson, M. W.
M	Marr, J.
MO	Morrison, J. P. E.
P	Pakaliop
S	Schultz, L. P.
T	Tawaitiu (native collector)
TA	Taylor, W. R.
W	Wetrilliar
WO	Wolpaitch
Y	Yani (native collector)
YA	Yaniseimen (native collector)
Z	Ziesenhenne, F.
ZI	Zimmerman, E. C.

Following the code is the collector's numerical designation; in the case of the collections of Dr. Martin Johnson where he had assigned no numbers we have arbitrarly assigned numbers from 1-24. Geographical names were taken from the U. S. Board of Geographic Names decision, 1955.

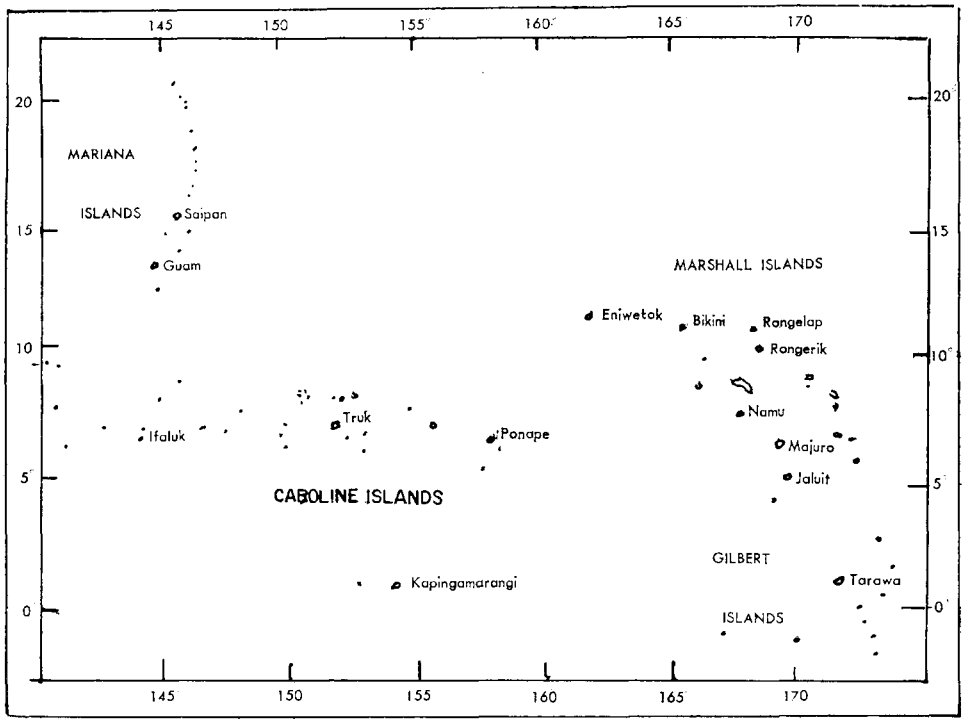

Fig. 1. Marshall and Caroline Islands. Adapted from a figure in Micronesia, August 20 to November 12, 1966.

MARSHALL ISLANDS

Eniwetok

Personal collection made from 23 February to 4 March 1957.

BE 1-3. Japtan Island, lagoon side. From coral patch which was surrounded by sand; 30 meters from shore in 2 meters of water. BE 1 was from a head of dead *Acropora* sp.,

most specimens came from the base; BE 2 was from a head of *Pocillopora meandrina*; BE 3 was from a living head of *Acropora*, most specimens came from the base.

BE 4. Parry Island, windward ocean reef. Collections made about 6-12 meters behind coralline ridge in region of strong surge, slightly below low tide zone. Specimens came from consolidated heads of coral, masses of calcareous alga, and dead, overgrown coral heads. Inner portion of reef was seemingly devoid of alpheids.

BE 5-8. Parry Island, lagoon side. Collection made on patch reef which rises from a sandy bottom located about 200 meters from the south end of the island. Specimens from six dead, overgrown heads of coral, four were of flat *Acropora*, one a massive *Porites* and one a *Pocillopora*; the shrimp come from algae on the top, from spaces between the fronds and from holes in the bases. BE 7 was from dead coral resting on a sandy bottom. BE 8 was from dead and overgrown heads of a ramous *Acropora*.

BE 9. Rigili Island, ocean reef flat. Collection made near the outer edge of the ocean reef flat, about 0.5 meter below low tide zone. Specimens from dead and overgrown head of flat *Acropora*.

BE 10. Rigili Island, edge of inner lagoon of seaward reef. Collection made about 30 meters from shore, about 0.5 meters below low tide zone. Specimens came from two overgrown heads of *Acropora*, and one head of *Pocillopora meandrina*.

BE 11. Parry Island, lagoon side. Collection made about one-third of length from the southern tip; the bottom was sand and about 2 meters deep. Specimens came from the overgrown heads of *Pocillopora meandrina* and bases of branching *Acropora* (BE 11a were specimens from holes occupied by *Echinometra*; BE 11b were specimens from algal tubes.)

BE 12-14. Arambiru-to, from channel between the island and ocean reef flat. At the stage of the tide collections were made, the channel was filled with swiftly flowing water running from the reef flat to the lagoon.

BE 12. Specimens were from various species of coral, mostly dead, lying in 2 meters of water. BE 13 same as above but nearer shore. Water was about 0.6 meter deep (BE 13a, from tube of blue-green algae). BE 14. Located on inner reef flat in water 1 meter deep. This area was subject to strong wave and current action. Specimens were taken from one dead and one partially live head of a massive *Porites*, both coral with *Echinometra* in depressions,

BE 15. Arambiru-to, lagoon side on sand bottom in water 1-2 meters deep. Specimens were taken from a few scattered heads of dead coral.

BE 16, 19, 20. Igurin Island, cove on lagoon side. Evidently the area had some brackish water seepage from the islet; bottom bearing fine powder sand. which continued from near low tide zone to several feet deep; bottom covered with scattered heads of dead coral and boulders; there were some living coral heads at the side of the cove. BE 16 specimens were collected under boulders on sand beach. BE 19 specimens were from overgrown heads of *Heliopora* and *Porites*; many specimens found in superficial tunnels, others in between the fronds and in tunnels in base (BE 19a from a *Porites*, 19b from a *Heliopora*). BE 20 was a revisit of BE 16; this time the beach was surveyed for a quarter of a mile, and specimens (largely *A. strenuus* and two species of *Salmoneus*) were found under almost all boulders larger than 0.3 meters in diameter. The boulders lay on a mixture of fine gravel and sand, or pure sand.

BE 17, 18. Igurin Island, ocean side. BE 17 came from a coralline ridge which had only a slight surf under normal trade winds; ridge, about 0.5 meters above low tide zone, was smooth and consolidated, but with numerous burrows, a little over 1 centimeter in diameter and up to 20 centimeters long, which were twisting and had many branches connected to the sea through numerous regular ports; only one pair of shrimp in each burrow. BE 18, was in a back ridge trough, about 0.3 meters below low tide zone. Specimens found in dead bases of living coral, and in algal tubes between dead coral branches.

BE 21, 22. Muti Island, off north end. Collection extended across broad ocean flat to the

lagoon. BE 21, specimens from consolidated and smooth bottom, composed of dead and overgrown coral from 1 foot below low tide zone. BE 22 was closer to the lagoon, water about 2 meters deep with bottom mostly sandy; specimens from dead heads of *Pocillopora*.

BE 23, 24, 26, 27. Parry Island, ocean reef off the marine laboratory. BE 23, from coralline ridge, and ends of surge channels, exposed about 0.3 meters above 0.0 tides; ridge dense and hard, very irregular and without the usual smooth algal surface; almost all specimens from superficial burrows, roofed over by calcareous algal sheets. BE 24, 27 came from the shallow (0.3 meter deep) back-ridge trough; specimens were from coralline algal masses around the edges of the trough. BE 26 mid-section of reef, 0.3 meter above 0.0 tide level; specimens came from burrows in the bases of dense tufts of worm tubes packed in the sand that rises above the consolidated reef surface.

BE 25. Parry Island, southern tip, lagoon side. Conditions were parallel to BE 5; specimens collected from an overgrown head of massive coral. Almost all specimens came from shallow grooves and burrows in the superficial mat of algae.

Collector and Number	*Locality and Date*	*Notes*
Bikini Atoll		
BA 8	Prayer Is. North end 4/17/47	outer reef
BA 12	Prayer Is. first point from west end 7/10/47	〃
BA 13	Prayer Is. 7/19/57	〃
BA 17	〃 〃	〃
BA 22	〃 〃	〃
BA 33	Enar Is. 6/21/47	〃
BA 51	Bikini Is. 7/24/47	〃
BA 54	〃 〃	outer reef flat, in coral
BA 67	South end Bikini 7/25/47	outer reef flats, under rock near tide line
BA 68	〃 〃	〃 〃
BA 69	〃 〃	〃 〃
BA 119	Enyu Is. 8/1/47	outer reef, tip of Island from coral head
BA 122	〃 〃	〃 〃
BA 126	Extreme south tip Enyu 6/1/47	from head of *Pocillopora verrucosa*
BA 146	Bikini Is. 8/4/47	outer reef
BA 181	Southern part of Bikini Is. 8/16/47	from *Stylophora mordax* from lagoon
BA 186	〃 〃	〃 〃
BA 194	Bikini Is. 8/17/47	outer reef
BA 195	〃 〃	〃
BA 196	Southern part of Bikini Is. 8/17/47	from *Stylophora mordax* from lagoon
BA 197	Bikini Is. 8/17/47	outer reef
BA 200	〃 〃	〃
BA 201	Bikini Atoll 8/17/47	〃
BA 152-2	North Namu 8/6/47	from outer reef
BA 152-7	〃	〃
BA 152-8	〃	〃
J 1	Namu 4/3/46	inside lagoon reef
J 2	Namu 4/4/46	outside reef
J 3	West end Bikini lagoon 4/16/46	inside lagoon reef, intertidal
J 4	Yomyaran, 4/16/46	intertidal, under rocks

(to be continued)

(continued)

Collector and Number	*Locality and Date*	*Notes*
J 5	Enerik, April, 1946	intertidal
J 6	Bokonfuaaku, 5/16/46	intertidal potholes
J 7	South West Enyu	〃 〃
J 8	Enyu Channel	〃 〃
J 9	Bikini Atoll	coral heads
J 10	West end Bikini Lagoon 4/13/46	20 to 25 fathoms
MO 3110	Onimak Is. 6/17/47	under rocks, outer reef
MO 3167	North of Namu, outer reef edge 8/7/47	commensal on slate-pencil sea urchin
MO 3168	〃 〃	under rocks, outer reef
MO 4046	South east corner Bikini 3/7/46	lower intertidal zone, near outer reef, under rocks
MO 4089	North east side Chieerete 3/20/46	under rocks in tide pools in intertidal zone
MO 4148	Yurochi 3/22/46	intertidal zone under rocks
MO 4176	Namu 3/31/46	under rocks north east side island
MO 4261	Bikini	no notes
MO 4317	Bikini 4/18/46	outer reef opposite east central part, from slate pencil urchins
MO 4358	4 miles south of west end of Bikini, 4/25/46	30 fathoms
MO 4378	Bokororyuru-to 4/30/46	under rocks on flats inside outer reef
SMB S-46-8	Enyu 3/16/46	reef at entrance just inside lagoon
S S-46-44	Bikini lagoon, 3/16/46	180-200 ft.
S S-46-50[2]	Namu Is. 4/3/46	
S S-46-95	Bokonfuaaka 4/16/46	ocean reef
S S-46-96	Bikini	
S S-46-98	Chieerete 4/18/46	ocean reef, not in surf
S S-46-114	Bikini lagoon at anchorage	from marine light catch
S S-12-124	Enyu 5/8/46	marine light
TA 4418	Bikini 4/3/46	
Eniwetok Atoll		
BKHE S-46-246	Eniwetok	intertidal
GZ 57-1	Parry Is., Ocean side, south of EMBL laboratory 7/10/57	coral, from reef flat
GZ 57-2	Rigili Is., ocean side 7/11/57	seaward reef flat under rock
GZ 57-3	Arambiru-to, ocean side 7/12/57	seaward reef flat; rock, living coral
GZ 57-4	Engebi, ocean side 7/13/57	seaward reef flat
GZ 57-6	Igurin, ocean side 7/15/57	seaward reef edge, rock with dead coral and sand substrate
GZ 57-7[3]	Japtan, ocean side 7/14/57	〃 〃
GZ 57-8	Eniwetok, ocean side 7/17/57	〃 〃
GZ 57-9	Bogon, South east side 7/18/57	seaward reef flat, from live coral

[2] Part of the records for this series of collections were too badly burned to reconstruct.

[3] The old name Aniyaanii Island 11°24′ N., 162°24′ E has been dropped and is now officially Japtan, while the old island of Japtan 11°26′ N, 162°23′ E has been changed to Muti Island. We are using the new nomenclature.

(to be continued)

(continued)

Collector and Number	*Locality and Date*	*Notes*
GZ 57-14	Parry Is., lagoon side 7/22/57	coral heads, 10-15 feet deep
G 42	Japtan 7/24/56	outer reef flat
G 46	Japtan 7/24/56	outer reef flat
G 50	〃 〃	〃 〃
J 11	Eniwetok 5/20/46	intertidal potholes
J 12	Jeroru 5/21/46	intertidal
J 13	Runit 5/4/46	intertidal potholes
J 14	Bogomboga 5/31/46	intertidal
J 15	Bogon 6/1/46	from intertidal coral
J 16	Rujoru 6/2/46	intertidal
MO 4461	Jeroru 5/21/47	under rocks on flats behind outer reef
MO 4539	Rigili 5/30/46	light at night
MOC S-46-196	Rujoro 5/2/46	ocean reef
S S-46-95	Bokonfuakaa 4/16/46	ocean reef
S S 46-174	Eniwetok Lagoon 5/23/46	light at night
Rongerik Atoll		
BA 208	Latoback Is., Lagoon reef 8/18/47	from *Stylophora mordax* lagoon reef
BAZI 206	Latoback Is. 8/18/47	lagoon reef
BAZI 209	〃 〃	〃 〃
BAZI 210	〃 〃	〃 〃
BAZI 223	Bock Is. 8/19/47	outer reef
BAZI 224	Bock Is. 8/19/47	from *Pocillopora verrucosa* from outer reef edge
BAZI 225	Latoback Is. 8/19/47	outer reef
BAZI 226	〃 〃	〃 〃
BAZI 227	Bock Is. 8/19/47	from *Stylophora mordax* from outer reef edge
BAZI 238	Latoback Is., lagoon reef 8/20/47	from *Stylophora mordax* from lagoon reef
BAZI 242	〃 〃	〃 〃
BAZI 245	〃 〃	〃 〃
BAZI 246	〃 〃	〃 〃
BAZI 249	〃 〃	〃 〃
BAZI 257	〃 〃	from *Pocillopora verrucosa* from lagoon reef
BAZI 262	Latoback Is., lagoon reef 8/27/47	from *Stylophora mordax* from lagoon reef
BAZI 266	Latoback Is., lagoon reef 8/27/47	from *Stylophora mordax* from lagoon reef
BAZI 269	〃 〃	〃 〃
BAZI 272	〃 〃	*Pocillopora*, lagoon reef
BAZI 273	〃 〃	〃 〃
BAZI 274	〃 〃	from lagoon reef
MO 4752	Eniatok Is. 6/29/46	in algae on outer reef flat
TA 4728	Bock Is. 6/29/46	〃 〃
Rongelap Atoll		
J 17	Rongelap Anchorage 6/16/46	from snapper sampler at 23 fathoms
J 18	Eniatok 6/16/46	intertidal potholes

(to be continued)

(continued)

Collector and Number	*Locality and Date*	*Notes*
J 19	Rigonman 7/16/46	intertidal potholes
J 20	Burok Is. 7/18/46	intertidal potholes and coral
J 21	Tufa Is. 7/16/46	〃 〃
J 22	Rongelap 7/19/46	in lagoon 20 fathoms
J 23	Mellu Is. 7/27/46	in coral at low tide
J 24	Kabelle Is. 7/28/46	
BHE 4850	Eniatok	12 feet of water lagoon side
TA 4707	Rongelap lagoon 2 miles West of Busch 6/21/46	rock flats
TA 4780	Busch 6/18/46	
TA 4826	Burok 7/18/46	from algae, outer reef flat

CAROLINE ISLANDS

Collector and Number	*Locality and Date*	*Notes*
Kapingamarangi Atoll		
H 31	Touhou Is. 7/1/54	amphiroa zone
H 75	〃 〃	taken from tubes of blue-green algae
H 77	〃 〃	〃 〃
H 80	〃 7/2/54	〃 〃
H 174	Tiatua Is. 7/13/54	from lagoon side of lagoon reef
H 333	Hare Is. 7/20/54	from lagoon reef
H 465	Taringa Is. 7/29/54	under "micro-atoll" (wheels of *Porites*) on outer reef
H 514	Between Turuaimu and Ribumant 8/2/54	inner reef flat
H 551	Hare Is. 8/4/54	from corals
H 668	Sorkor lagoon reef 8/9/54	coral head 2 ft. below low-low water
H 786	Saratokmalel Is. 8/14/54	in coral
Ifaluk Atoll		
A 12-B-2	Elangalap, NW tip Falarik 8/22/53	washed from alga *Udotea*
A 13-C-4	South end Falarik Is. 8/22/53	washed from corallines and corals
A 14-B-4	Reef south end Falarik Is. 8/25/53	〃 〃
A 18-E-2	〃 〃	〃 〃
A 19-E-5	〃 〃	〃 〃
A 20-D	〃 〃	〃 〃
A 22-D-3	〃 〃	washed from algae and *Tubipora*
A 24-C-3	〃 〃 9/4/53	〃 〃
A 25-E-1	〃 〃	〃 〃
A 27-E-1	〃 〃	〃 〃
A 28-D-2	〃 〃	〃 〃
A 29-B-4	〃 〃	〃 〃
A 30-C-2	〃 〃	washed from corallines and othe algae

(to be continued)

(continued)

Collector and Number	*Locality and Date*	*Notes*
A 31-D-1	〃 〃	〃 〃
A 32-G-1	〃 〃	〃 〃
A 39-E-1	〃 〃 9/17/53	〃 〃
A 40-E-6	〃 〃	〃 〃
A 41-D-1	〃 〃	washed from corallines on outer reef flat
A 42-F-3	South end Falarik Islet, 9/17/53	washed from corallines on outer reef flat
A 43-C-1	〃 〃	〃 〃
A 44-D-1	〃 〃	〃 〃
A 48-E-4	〃 〃	〃 〃
A 50-E-3	〃 〃	〃 〃
A 81-B-4-A	Patch reef, SW end of Falarik Islet 9/21/53	from lagoon shelf, 3 ft. deep washed from algae *Microdictyon*
A 85-F-1	South end Falarik Islet	washed from algae
A91-E-3	〃 〃	〃 〃 , inner reef flat
A 113-H-1	Ifaluk 10/3/53	〃 〃
A 131-G-1	N. end of Falarik Islet 10/8-9/54	from dead coral head lying on shelf adjacent to lagoon slope, sandy bottom, 12 ft. deep
A 141-D-2	NW end Falarik Islet 10/20/53	washed from algae from outer reef margin depth about 1 fathom
A 142-E-1	〃 〃	〃 〃
A 194-E-3	Open lagoon 10/10/53	plankton haul, surface waters
A(146-151)-H-1	Lagoon off Ketalu area SW Falarik Islet 10/2/53	washed from coral fragments covered with algae, 0-4 ft.
A(155-157)-G-7	Lagoon reef between Elangalap and Ella Islets 10/23/53	washed from algae, 1 fathom
AB 707	Southeast of Falarik 8/25/53	from coral heads, outer slope of reef platform
AY 806	Ifaluk Atoll	sand flat, depth 1 fathom from crinoids
AY 808	〃 〃	〃 〃
AYA 66-E-9	South end Falarik Islet 9/21/53	washed from algae from floor of innermost edge of outer reef flat exposed at low tide
AYA 67-D-6	〃 〃	〃 〃
AYA 69-E-3	〃 〃	washed from algae and *Tubipora*
AYA 76-H-6	〃 〃	〃 〃
AYA 100-D-1	Ifaluk 10/3/53	washed from algae
AYA 177-G-2	SW tip of Falarik Islet 10/27/53	from turtle grass and *Halimeda* beds
AYA 178-D-2	In channel separating Falarik and Falalap Islets	washed from rocks bearing algae; from sand delta
AYA 179-184-M-2	West of north end of Falalap Islet	washed from algae 3-6 ft. deep
BA 327	Lagoon reef, Falarik Islet 10/13/53	from head of *Pocillopora*
BA 328	〃 〃	〃 〃
BA 372	〃 〃 9/22/53	dead knobs of coralline algae, seaward reef

(to be continued)

(continued)

BA 376	North end Falarik Islet 10/3/53	from head of *Pocillopora* in breaker zone at outer end of Transect C
BA 380	Inner reef flat, south end Elangalap 10/23/53	from head of *Pocillopora*, 2 1/2 feet water at low tide
BA 382	South of Elangalap 9/23/53	from clump of *Stylophora*
BA 396	Lagoon reef, Falarik Is. 10/24/53	from *Seriatopora*
BA 401	" " 10/26/53	" "
BA 415	Between Elangalap and Ella 9/30/53	from *Stylophora* colony in *Heliopore* zone
BA 416	South of Elangalap 9/30/53	from *Pocillopora* 3 feet water
BA 431	Seaward reef, Falarik Is. 10/1/53	from inner reef flat
BA 454	South end Falarik Is. 10/2/53	from inner edge of reef flat just beyond foot of beach slope
BA 530	Falarik Is., Katelu Benjo 10/7/53	from Thalassia beds, lagoon shore
BA 638	Middle of Falarik Is., 10/7/53	from crevices in *Porolithon* heads just inside *Heterocentrotus* zone
BA 640	Lagoon shelf north of Elangalap 10/19/53	from clump of *Stylophora* coral
BA 690	South end of Falarik Is. 10/22/53	from Elang, seaward reef
BA 703	South of Elangalap	*Stylophora* head, Heliopore zone
BA 768	Katelo Benjo, Rauau, Falarik 9/29/53	from *Pocillopora*, lagoon reef
BA 780	300 yds. north of Elangalap Is. 9/28/53	from *Pocillopora*, 4 ft. water
BA 782	Lagoon reef, Katelu Benjo 9/30/53	from clump of *Pocillopora*
BA 783	" "	" "
BA 784	" "	" "
BA 785	" "	" "
BA 786	" "	" "
BA 787	" "	" "
BA 791	" "	" "
BA 812	" " 10/1/53	" "
HA 484	R.R. Harry Station 45, 10/4/53	from large canals of sponge
HA 741	Ifaluk 10/25/53	from branches of larger *Seriatopora* colony
HAB 417	South of Elangalap 9/30/53	from *Pocillopora*, 3 ft. water
HAYA (158–159)–D–1	Lagoon shelf N. of center of Ella islet, 10/23/53	washed from alga *Udotea*
HAYAA (160–165)–J–2	West of west shore of Elangalap Islet, 10/25/53	washed from algae
HAYAA 166–G–2	" "	from flange on shell of single *Tridachna squamosa*
P 821	Off reef SW of Ella, 11/3/53	from crinoids
T 576	Ifaluk lagoon 10/7/53	from coral in lagoon
W 357	Between Elangalap and NW end Falarik Is., 9/21/53	from *Stylophora* coral, 1 fathom
W 687	Lagoon side of Elang west of Ella, 9/22/53	" "
W 0456	Off Falielang in mouth of pass 10/2/53	commensal on crinoids
YA 718	300 yds. west of Elangalap 2/25/53	outer reef slope; 25–30 ft. water

Automate de Man

Automate gardineri Coutière

For full citation see Banner and Banner, 1966:150

LOCALITY: Marshall Islands, Eniwetok: 1 specimen from BE 20b.

ATHANAS Leach[4]

Athanas areteformis Coutière

LOCALITIES: Marshall Islands: 5 specimens.

Athanas djiboutensis Coutière

LOCALITIES: There were some specimens from both the Marshall and Caroline Islands.

Athanas marshallensis Chace

LOCALITIES: All specimens in the collection were from the Northern Marshall Islands.

Athanas rhothionastes Banner and Banner

LOCALITIES: Marshall Islands. Several specimens, including one specimen from BE 2, came from the base of *Pocillopora meandrina* Verrill in a zone subject to heavy surge.

Athanas esakii Kubo

LOCALITIES: Marshall Islands: The only specimen came from Eniwetok and was found under a boulder in the sand on the lagoon side of the islet.

Athanas verrucosus Banner and Banner

LOCALITIES: Marshall Islands: 1 specimen from BE 23.

Athanas indicus (Coutière)

LOCALITIES: Marshall Islands: Several specimens from the northern Marshall Islands from dead coral associated with the boring sea urchin *Echinometra.*

Athanas dorsalis (Stimpson)

LOCALITIES: Marshall Islands: 61 specimens.

SALMONEUS Holthuis

Salmoneus sibogae (de Man)

For full citation see Banner and Banner, 1964:86.

LOCALITIES: Eniwetok Atoll: 2 specimens from BE 16; 3, BE 20 b.

DISCUSSION: The ecology of this species is discussed with *S. tricristatus* below. In life these specimens were usually bright yellow to muddy white in color, while the eggs were red.

Salmoneus tricristatus Banner

Salmoneus tricristata Banner, 1959. Pac. Sci. 13(2):131 fig. 1a-e.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 2 specimens from BE 16; 2, BE 20 b.

DISCUSSION: The large chela, lost on the type specimen, is intact on all of these specimens. [Four figures were prepared but lost, together with the specimens; only the following notes remain.] The palm of the large chela is roughly square in section, with a shallow depression on the lateral face and another shallow depression on the superior face, this latter to accomodate the slender and twisted merus when the carpal joints are flexed. The small chela is exceedingly small with the length of the chela and carpus combined about equal to the maximum width of the palm of the large chela; it is actually smaller than the

[4] The collection data for this group was lost in the Hawaii Marine Laboratory fire. The information listed below is from Banner and Banner, Pacific Science 14(2):129-155, 1960; this paper also contains the bibliographic citations for these species.

second leg. It should also be noted that while the dorsal carina on the carapace is interrupted in the region where the cephalic groove would be found, it continues posterior to the interruption.

This species differs in two ways from the related *S. sibogae* (de Man). The first difference is in the crests of the carapace, which are always pronounced in this species, with none of the specimens showing intermediate development. The second difference is in the proportions of the third legs, with those of *S. tricristatus* being more slender and elongated. Two specimens of each species from BE 20 showed the following differences: the merus in *S. tricristatus* is 5.5 times as long as broad and 3.1 times the length of the dactylus; in *S. sibogae* it is 4.5 times as long as broad and 3.6 times the length of the dectylus. The propodus shows even greater differences, being 9 times as long as broad in *S. tricristatus* and only 6 times in *S. sibogae*. These differences in proportions appears to be consistant, but in view of the variation in other genera, too much reliance should not be placed upon them.

Ecologically, *S. tricristatus* and *S. sibogae* were collected together in the same narrow habitat. Both came from a fine sand substrate under beachrock slabs low in the intertidal zone, on the lagoon side of an islet; here was also found *Athanas marshallensis* Chace, *Alpheus strenuus* Dana, and bristle worms ("fire worms") probably of the genus *Eurythoe*. While shrimp of this genus have been reported to be ecological association with annelids and other forms, there was no evidence during the collecting that either species was in actual symbiotic association.

The fact that two species of this rather rare genus should be found abundantly in a seemingly narrow habitat casts suspicion upon the separation of the two species. Because of these suspicions the specimens of this habitat especially, but also from other collections, were carefull examined for intergradation. No evidence was found, and on the basis of morphology the species appears to be distinct. However, when an opportunity presents itself these two forms should be studied both from the ecological, and from the genetic aspects to see if they are truly distinct.

ALPHEOPSIS Coutière

Alpheopsis equalis Coutière

For full citation see Banner and Banner 1964:86.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 3 specimens from BE 1; 1, BE 25. Bikini Atoll: 2 specimens from BA 181; 1, J 2; 1, J 5. Caroline Islands: Kapingamarangi Atoll: 2 specimens from H 174.

Alpheosis diabolus Banner

For full citation see Banner and Banner, 1966:157

LOCALITIES: Marshall Islands: Eniwetok Atoll: 1 specimen from BE 9; 2, BE 18; 1, BE 25. Bikini Atoll: 1 specimen from J 5.

DISCUSSION: The 5 specimens previously reported and the 4 from Eniwetok have been compared to discover the extent of variation they exhibit. These few specimens are all similar in general configuration and so not display nearly as much variation as does *A. equalis* Coutière. The rostrum, which in the type was shorter than the first antennular article, usually reaches to the end of the first or to the midlle of the second antennular article; the stylocerite and the scaphocerite show only minor differences in length. Only one specimen has both chelae,

another has one chela only but these three chelae are similar to those of the type. In some specimens the lower unguis of the third leg is somewhat heavier. In several of the specimens the dorsal spinules of the telson are heavier and more conspicuous. No sexual dimorphism could be seen.

Aretopsis de Man

Aretopsis amabilis de Man

Aretopsis amabilis de Man, 1910. V. Ned. Dierk. Ver., Tijdschr. 11(2):311: 1911. Siboga Exped. 39a^1(2):171, fig. 14. Miyake and Miya, 1967. Fac. Agric Kyushu Univ., Journ. 14(2):267, fig. 1, 2.

LOCALITIES: 2 specimens from J18.

DISCUSSION: Two species have been assigned to this genus. The genotype, *Aretopsis amabilis* de Man was originally known only from a single defective specimen, and *Aretopsis aegyptica* Ramadan was known from only one intact specimen. These two species were separated from each other principally by the amount the eyes were covered by the carapace, with the corneas entirely exposed in *A. amabilis* and completely in *A. aegyptica*. However, Holthuis (1958) has described 13 new specimens from Eylath, Israel, which he assigned to *A. aegyptica*, and Miya (1967:267, fig. 1, 2) a further specimen from Okinawa as *A. amabilis*. Holthuis expressed doubts as to the separation of the two species.

Our two specimens lie intermediate between the previous species in the position of the eyes relative to the anterior edge of the carapace. Like Holthuis, when we examined these specimens, we were doubtful about the separation of the two nominal species. However, since then we have examined a series of additional specimens from Australia and are now convinced that only a single species exists in spite of its broad geographic range. The placement of *A. aegyptica* in synonymy will be discussed in a later paper, as will the relationship of this genus to *Athanas*.

These specimens were symbiotic in the large clam *Pterocera*, but Mr. Vernon Brock, one of the collectors, does not remember exactly how they were associated.

Synalpheus Bate

Synalpheus carinatus (de Man)

Alpheus carinatus de Man, 1888. Arch. F. Naturgesch. 53(1):508, pl. 22, fig. 2.

Synalpheus carinatus de Man, 1911. Siboga Exped. 39a^1(2):210 pl. 6, fig. 23

Synalpheus carinatus binongcensis de Man, 1909. V. Ned. Dierk. Ver., Tijdschr. II, 11(2):111; 1911, Siboga Exped. 39a^1(2):211

Synalpheus carinatus ubianensis de Man, 1909. V. Ned. Dierk. Ver., Tijdschr. II, 11(2):111: 1911, Siboga Exped. 39a^1(2):212

Confer: Banner, 1958. Pac. Sci. 12(2):159.

LOCALITIES: Caroline Islands: Ifaluk: 4 specimens from WO 456; 2, T 576; 2, AY 808; 4, P 821. Marshall Islands: Eniwetok Atoll: 2 specimens from GZ 57-2; 2, J 11. (All specimens were obtained from crinoids).

DISCUSSION: These 12 specimens from Ifaluk were all taken from crinoids, one pair from each crinoid. The specimens agree for the most part with de Man's original description (1888:508) and also his later redescription (1911:210). In this later paper he described two subspecies, based on the size of the ova, the absence

of a notch in the dorsal carina between the gastric and cardiac regions, and the proportion of the telson in which the anterior margin was slightly more than twice as broad as the posterior margin in the parent species, and 2.6 times as

Table 1. *Synalpheus carinatus* (de Man).
Characteristics of Cohabiting Pairs

Locality	Sex	Notch of dorsal carina	Telson breadth anterior/breadth posterior
Ifaluk			
WO 456	male	slight	2.3
	male	slight	2.3
	female	present	2.5
	female	present	2.1
T 576	male	very slight	2.3
	female	slight	2.4
AY 808	male	none	2.1
	female	none	2.7
P 821	female	very slight	2.2
	female	none	2.3
	male	none	2.3
	female	slight bump	2.2

Table 2. *Synalpheus carinatus* (de Man).
Proportions of Cohabiting Pairs

Locality	Length as compared to Antennular Articles: of rostrum	of orbital spines	of lower spine of basicerite	of stylocerite	Ratio of length/ breadth of third leg
Eniwetok GZ 57-3					
6.7 mm. male	end 2nd	3/4 1st	3/4 1st	end 1st	5.0
12.3 mm. female	1/2 2nd	1/2 1st	1/4 2nd	1/4 2nd	5.5
Ifaluk P 821					
4.6 mm. male	end 2nd	3/4 1st	end 1st	1/4 2nd	4.6
13.0 mm. female	1/2 2nd	3/4 1st	end 1st	1/4 2nd	4.4
Ifaluk AY 808					
7.1 mm. male	end 2nd	1/2 1st	end 1st	1/4 2nd	4.3
10.3 mm. female	1/2 2nd	1/2 1st	end 1st	1/2 2nd	lacking

broad in the varieties. In 1958 doubts were cast upon the validity of the subspecies (Banner 1958:158) because the chief difference, the size of the ova, was found to vary with the maturity of the ova. This series of specimens removed the validity of the two other differences.

Our findings are presented in Table 1: it will be noted that the two specimens from station AY 808 bridge the differences in the telson between the parent species and the two subspecies.

Three cohabiting pairs were also examined on other characteristics to see if there might be specimens intermediate between this and other species in the Comatularum group. None were found, but in the course of the examination

strong sexual dimorphism was noted. The males were invariably smaller than the females, and rostrums and orbital spines noticeably longer and more slender. These differences are given in Table 2.

Synalpheus demani Borradaile

Synalpheus demani Borradaile, 1900. Willey's Zool. Res. (4):416. De Man, 1911. Siboga Exped. 39a^1(2):257, fig. 52.

Alpheus triunguiculatus de Man, 1888. Archiv. f. Naturgesch. 53:504, pl. 22, fig. 1. (*nec.* Paulson).

Synalpheus brockii Nobili, 1901. Ann. del Mus. Zool. Napoli 1(3):2.

LOCALITY: Marshall Islands: Eniwetok Atoll: 2 specimens, lagoon 1 mile west of Rex. Coll. J. W. Knudsen, 8/17/68.

DISCUSSION: These specimens were collected from a crinoid *Comanthus bennetti* in about 30 ft. of water. They were black in life with red and blue chromatophores on the black. Each abdominal segment bore three large white chromatophores, one on each side, and one medially. Carapace with several white chromatophores. Telson with two white chromatophores symmetrically placed, uropods with one white chromatophore each. (Color notes from collector).

Synalpheus stimpsonii (de Man)

Alpheus stimpsonii de Man, 1888. Arch. F. Naturgesch. 53(1):513, pl. 22, fig. 3.

Synalpheus consobrinus de Man, 1911. Siboga Exped. 39a^{1}1(2):204 pl. 6, fig. 21.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 2 specimens from GZ 57-3; 2 Parry Is..

DISCUSSION: When de Man described *S. consobrinus,* based on seven variable specimens, he was uncertain that it was specifically distinct from *S. stimpsonii,* a species described from a single specimen. The four specimens from Eniwetok lie intermediate between the two nominal species as the following contrast to de Man's specific criteria indicates.

Rostrum: According to de Man (1888:514) in *S. stimpsonii* the rostrum reached to the middle of the second antennular article and in *S. consobrinus* (1911:204) to the distal third of the first antennular article. The rostrum in one specimen in each collection reaches to the first third of the second antennular article while the remaining two are similar to that of *S. consobrinus.*

Length of the first antennular article: De Man's figure of *S. stimpsonii* (1888, pl. 22, fig. 3) showed the visible part of the first article of the antennular peduncle to be only slightly longer than the second article, but the text (p. 514) stated that it was twice as long as the second; the text description agreed with the form of this article in *S. consobrinus.* The visible part of the first antennular article in these specimens ranges from 1.3 to 1.8 times as long as the second antennular article.

Relation of the lower spine of the basicerite to orbital spines: De Man stated that in *S. stimpsonii* the lower spine of the basicerite was much shorter than the orbital spines, while in *S. consobrinus* the tip reached silghtly beyond the orbital spines. In two of the Eniwetok specimens this spine is the same length as the orbital spines but in the other two it is of asymmetrical development with the spine on one side equal in length to the orbital spine and on the other side much shorter.

Length of the terminal spine of the scaphocerite in relation to the squame: In both *S. stimpsonii* and *S. consobrinus* the scaphocerites were reported to reach to the

apices of the antennular peduncles, but in *S. consobrinus* the terminal spine extended for one-third of its length beyond the squamous portion whereas in *S. stimpsonii* the spine was but little longer than the squame. These specimens resemble *S. stimpsonii* in this respect.

Dactylus of large chela: De Man stated that in *S. consobrinus* the cutting edge of the dactylus carried a tooth not far from the tip while in *S. stimpsonii* the edge appeared to be entire. These specimens resemble *S. stimpsonii* in this respect.

Dactylus of the third leg: De Man stated that the superior unguis in *S. stimpsonii* was about twice as thick as the inferior, while in *S. consobrinus* they were approximately equal. The Eniwetok specimens agree with *S. consobrinus* in this character, but to judge from other species of *Synalpheus* this characteristic is variable and unreliable.

Thus, these specimens which are plainly of a single species are similar to *S. stimpsonii* in two of the criteria established by de Man, in one criterion they resemble *S. consobrinus*, and in the other three criteria they lie in an intermediate position. It would appear, therefore that de Man was correct in his suspicions that *S. consobrinus* is a synonym of *S. stimpsonii*.

Synalpheus paraneomeris Coutière

For full citation see Banner and Banner, 1964:86.

LOCALITIES: Marshall Islands: Bikini Atoll: 3 specimens from J 1; 1, J 5. Rongelap Atoll: 1 specimen from J 18. Eniwetok Atoll: 1 specimen from BE 5; 2, BE 9; 1, BE 9a; 1, BE 14; 4, BE 17; 3, BE 18; 1, BE 19; 2, BE 22; 1, BE 27; 3, BZ 57-9; 1, BZ 57-14. Caroline Islands: Ifaluk, 2 specimens from BA 357; 1, BA 372; 1, BA 638; 2, BA 690; 1, A 13-C-4; 1, A 14-B-4; 1, 18-E-2; 1, A 20-D; 4, A 27-E-1; 2, A 29-B-4; 2, A 32-G-1; 2, A 41-D-1; 1, A 43-C-1; 1, A 44-D-1; AYA 66-E-9; 1, AYA 69-E-3. Kapingamarangi Atoll: 2 specimens from H 174; 3, H 551.

Synalpheus charon (Heller)

For full citation see Banner and Banner, 1964:87.

LOCALITIES: Marshall Islands: Bikini Atoll: 1 specimen from station BA 54; 2, BA 68; 2, BA 196; 1, J 9; 2, J 2. Rongerik Atoll: 1 specimen from BA 208; 1, BAZI 224; 1, BAZI 238; 2, BAZI 256; 2 BAZI 248; 1, BAZI 266. Eniwetok Atoll: 1 specimen from BKHE 2-46-96; 3, J 16; 1, BE 10; 1, BE 17; 1, BE 18; 2, BE 22; 2, GAZI 59-9.

Caroline Islands: Ifaluk; 1 specimen from station BA 396; 1, BA 415; 1, BA 416; 1, A 25-E-1. Kapingamarangi Atoll: 1 specimen from H 174; 1, H 551.

DISCUSSION: The living specimens from BE 10 were observed to be orange-red in color while those from BE 22 were bright pink.

Synalpheus tumidomanus (Paulson)

Alpheus tumidomanus Paulson, 1875. Invest. Crust. Red Sea (1):101, pl. 13, fig. 2.

Synalpheus tumidomanus: Coutière, 1909. U. S. Nat. Mus., Proc. 36:24, fig. 5. de Man, 1911. Siboga Exped. 39a^1(2):258, pl. 9, fig. 43.

Alpheus tumidomanus gracilimanus Paulson, 1875. Invest. Crust. Red Sea (1):101, fig. 3.

Synalpheus tumidomanus exilimanus Coutière, 1909. U. S. Nat. Mus. Proc. 36:10. (Evidently a mistake).

Synalpheus hululensis Coutière, 1909. U. S. Nat. Mus., Proc. 36:24, fig. 4.

Synalpheus theophane de Man, 1911. Siboga Exped. 39a^1(2):261, pl. 10, fig. 44.

Nec Synalpheus tumidomanus Kubo, 1940. Imp. Fish. Inst. Tokyo, Journ. 34 (1):90, fig. 11.

Nec Synalpheus tumidomanus Coutière, 1905. Fauna and Geog. Mald. and Laccad. 2(4):876, fig. 14. (This specimen was regarded by Coutière in 1909: 24 as *S. hululensis*; Holthuis 1952:36 regards it to be *S. spinifrons*)

LOCALITIES: Marshall Islands: Eniwetok Atoll: 3 specimens from BE 3; 2, BE 5; 1, BE 6; 3, BE 11; 1, BE 21; 2, BE 22; 6, BE 25; 5 GZ 57-14. Caroline Islands: Ifaluk: 1 specimen from BA 415.

DISCUSSION: In 1875 (p. 101) Paulson described completely, with plates, *Synalpheus tumidomanus*. Coutière in 1905 applied the name to specimens from the Maldive and Laccadive Archipelagoes; again in 1909 he applied the name to a group of specimens from Djibouti, but in the same paper he described a species related to *S. tumidomanus* which he called *S. hululensis*. His separation of these two species was based on only two characteristics; a lesser development of the posterolateral angles of the telson and a larger ovum. In 1911, de Man extended the description for *S. tumidomanus* and described another species *S. theophane* as being closely related; this was also separated by the length of the postero-lateral angles of the telson as well as the ratio of the fingers to the total length in the small chela.

To determine if there were any other unmentioned diagnostic characteristics among these three nominal species, we have compared the written description and the plates of twenty-six different characteristics; only five of these characteristics were found to differ. These characteristics we have contrasted and compared to the variation in our specimens:

Superior tooth of the basicerite: *S. theophane* and *S. tumidomamus* are figured and described as bearing a strong tooth on the superior external angle of the basicerites, but *S. hululensis* is described by Coutière (1905:876) as "dépourvu d'épine à son angle supérieur". However, in his 1909 figure, and even more so in his 1905 figure, this angle is shown acute and projecting. In our specimens the tooth is variable, with some approaching the condition depicted, but not described, for *S. hululensis*.

Large chela: The ratio of the total length to the finger length was 4.7 in de Man (1911:259), 3.8 in Paulson (taken from the plate 1875: fig. 2b) and 3.8 in Coutière (1905:876) for *S. hululensis*. The large chela for *S. theophane* was missing. In the specimens at hand the ratio has been found to vary from 3.8 to 4.8, a range encompassing the supposedly specific differences.

One specimen from a collection from British Samoa (BBS 5) had a much inflated chela with a ratio of total length to fingers 5.8:1; Paulson also pictures a similarly inflated chela. As other specimens of the same locality are normal, this can best be interpreted as a growth anomaly similar to the condition found in *S. charon* (Heller) from Arno (Banner, 1957:194.)

Small chela: The ratio of the total length to the finger length in *S. hululensis* (Coutière, 1905:877) is 1:2.4, in *S. theophane* de Man states it is 1:3.2 (1911:264), however in his figure 44b the ratio is 1:2.7. Paulson did not state the ratio in the original description and de Man apparently did not have a small chela for *S. tumidomanus*. Our specimens range from 1:2.4 to 1:2.8 which encompasses that of *S. hululensis* and *S. theophane*.

Dactyl of the third leg: While the relative lengths of hooks of the third legs

and the relative widths at their bases have been suggested as a differentiating character between the species, the authors discussing the characteristics have agreed that they are variable, and thus the written descriptions of the proportions do not agree with the plates. However, the dorsal hook in the three species under discussion varies from 1.5 to 2.5 times the length of the ventral hook (determined from the plates) and our specimens fall within that range. In *S. hululensis* and *S. tumidomanus* the ventral hook is wider at its base than the dorsal and in *S. thephane* they are very nearly equal. De Man's figure 43a for *S. tumidomanus* appears to have both hooks equal at the base. In Paulson's figure of two thoracic legs (2e and 2f), 2e depicts the base of the dorsal hook as narrower than the ventral while in 2f the dorsal hook appears wider than the ventral. Thus the development of the dactyls do not appear to provide valid characteristics for separation of the species.

Telson: Here Coutière emphasizes that the size of the posterolateral projections on the telson as compared to the adjacent movable spine is a decisive characteristic. *S. tumidomanus* in Paulson's figure 2h showed the projection to be about 0.5 the length of the spine, and the projection was of similar proportion in de Man, (1911: fig. 43); but it is 0.7 its length in Coutière's 1909 work (24: fig. 5). (Coutière's plate shows a much shorter projection in the 1905 figure than in the 1909 figure). Our specimens bridge the gap between the three species with the projection from 0.3 to 0.5 the length of the spine.

These criteria to separate the species therefore, cannot be relied upon. The only other distinguishing characteristic is the fact that *S. tumidomanus*, according to Coutière (1909) has large eggs that hatch directly into a mysis stage while the others, presumably, do not. This characteristic, too, evidently cannot be relied upon, for Coutière (1899) reports many cases of poecilogony for the synalpheids.

Therefore *S. hululensis* Coutière and *S. theophane* de Man have been placed in synonymy.

Also placed in synonymy is the subspecies *gracilimanus*, described from a single female by Paulson. He stated that this specimen showed the following characteristics: 1) the rostrum was only equal in length to the orbital teeth instead of exceeding them; 2) the large chela was more slender and did not show a "pattern of scales"; 3) the second legs were only slightly longer than the third. As in many other species of *Synalpheus*, the relative length of the rostrum to the orbital teeth is variable and the relative length of the second to third legs in this species is also variable, therefore those characteristics cannot be relied upon. The variation in the proportions of the chela has been discussed above; the "pattern of scales" is merely the appearance of the bases of the palmar muscles through the thin chitin.

The subspecies name *exilimanus* of Coutière is either a mistake in transcription of a *nomen nudum*.

The specimen which Kubo called *S. tumidomanus* seems to better fit the description for *S. hastilicrassus* Coutière and will be discussed below.

It should also be noted that the specimens referred to by Coutière in 1905 as *S. tumidomanus* as coming from the coasts of America were separated from the Indopacific species by him in 1909; in 1952 Holthuis assigned them to *S. spinifrons* (1952:36).

Synalpheus hastilicrassus Coutière

Synalpheus hastilicrassus Coutière, 1905. Fauna and Geog. Mald. and Laccad. 2(4):875, pl. 72, fig. 12.

Synalpheus tumidomanus Kubo, 1940. Imp. Fish. Inst. Tokyo, Journ. 34(1):90, fig. 11. [*Nec S. tumidomanus* Paulson]

LOCALITIES: Marshall Islands: Rongelap Atoll: 2 specimens from J 22. Eniwetok Atoll: 1 specimen from BE 22.

DISCUSSION: This species is closely related to *S. tumidomanus* Paulson which has been discussed above. It may be distinguished by the following differences. 1) The superior margin of the basicerite is truncate while in *S. tumidomanus* it carries a definite tooth. 2) There is no tooth above the dactylar articulation of the large chela while in *S. tumidomanus* there is at least a blunt tooth and often a sharp spine. 3) The acute and projecting outer angles of the telson are heavier and almost attain the length of the adjacent spinule while in *S. tumidomanus* they are never more than 0.7 the length of the spinule, usually much shorter.

The specimen well described from Palau by Kubo as *S. tumidomanus* is apparently this species. It agrees with *S. hastilicrassus* in the three criteria above, and therefore has been put in synonymy.

The specimen from BE 22, a single female without its small chela, has been assigned to this species with doubts, for while the basicerite and the dactylar articulation of the chela are both unarmed like *S. hastilicrassus*, the postero-lateral angles of the telson are poorly developed, comparable to the minimal development found in *S. tumidomanus* (as shown by Coutière for *S. hululensis*); the dactyls of the third legs are not similar to either *S. hastilicrassus* or *S. tumidomanus*, but are actually quite similar to those of *S. paraneomeris* Coutière.

Synalpheus laticeps Coutière

Synalpheus laticeps Coutière, 1905. Fauna and Geog. Mald. & Laccad. 2(4): 874, pl. 72, fig. 11.

LOCALITIES: Marshall Islands: Rongelap Atoll: 1 specimen from J 20. Caroline Islands: Ifaluk: 1 specimen from A (146-151)-H-1.

DISCUSSION: Reexamination of the specimens listed as *S. paraneomeris* Coutière from Saipan (Banner, 1956:331) showed that one specimen listed as this species is actually *S. laticeps*. It was one of the specimens collected by Banner for which the locality data was lost.

The two specimens listed above, together with the one from Saipan and the four from Samoa (1966:158) have been compared and they agree well with Coutière's original description, although they show the variations usual for the genus.

In Coutière's original specimen the large cheliped is lacking. It is intact on several of these specimens, and in general resembles that of *S. paraneomeris*. The palm is 2.7 to 3.0 times as long as the fingers, and about 1.8 times as long as high. There may be a slight rounded protuberance on the margin of the palm above the dactylar articulation, but in some this is lacking. The merus is 1.8 times as long as broad and the inferior internal margin is armed with an obtuse tooth; the upper margin in one specimen carries a broad tooth-like subacute projection, but in the others it is scarcely projecting. (A drawing of the cheliped was made but was lost in the fire).

ALPHUS Fabricius

MEGACHELES GROUP

Alpheus crockeri Armstrong

For full citation see Banner & Banner, 1966:159.

LOCALITIES: Marshall Islands: Bikini Atoll: 2 specimens from SBM S-46-8. Caroline Islands: Kapingamarangi Atoll: 7 specimens from H 174.

DISCUSSION: The two specimens from SMB S-46-8 are so fragmentary that their specific identification is uncertain.

In the large group of specimens from Kapingamarangi slight variations were noted in the form of the large chela. In the largest specimen the palm of the large chela was more slender and more elongate than that of the other six, and the merus of the chela was 1.8 times as long as broad instead of 2.2 times as found in the usual specimens.

Alpheus collumianus medius Banner

For full citation see Banner and Banner, 1964:88.

LOCALITIES: Eniwetok Atoll: 2 specimens from BE 9; 1, BE 10. 1, BE 12; 4, BE 21; 1, BE 22; 2, BE 25; 1, BE 27. Bikini Atoll: 1, S S-46-98; 1, J 5. Rongelap Atoll: 1 specimen from J 20. Caroline Islands: Kapingamarangi Atoll: 1 specimen from H 174.

DISCUSSION: A review of all the specimens of this and the other subspecies of *A. collumianus* in the collection have shown no greater variation than that reported in the original descriptions (Banner 1956:338), and no marked integration between the subspecies. Moreover, the suggestion that these subspecies may be ecologically separated seems to be born out by the collection records, for in 93 separate collections of the three forms that have been made, only 11 collections had two subspecies represented, and none had all three.

MACROCHIRUS GROUP

Alpheus paragracilis Coutière

For full citation see Banner, 1956:96.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 4 specimens from BE 1; 2, BE 2; 1, BE 3b; 3, BE 4; 8, BE 5; 7, BE 6; 7, BE 9; 2, BE 10; 15, BE 11; 1, BE 13; 2, BE 14; 1, BE 15; 11, BE 18; 6, BE 19; 2, BE 21; 4, BE 22; 4, BE 25; 1, BE 27. Rongerik Atoll: 4 specimens from TA 4728; 1, BAZI 225; 2, BAZI 262. Rongelap Atoll: 2 specimens from J 20. Bikini Atoll: 4 specimens from J 2; 6, J 5.

Alpheus acutofemoratus Dana

For full citation see Banner and Banner, 1966:160

Locality: Marshall Islands: Eniwetok Atoll: 1 specimen from BE 6.

Alpheus amirantei sizou Banner and Banner

Alpheus amirantei sizou Banner & Banner, 1967. Bishop Mus. Occ. Pap. 23(12):265.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 4 specimens from BE 11; 1, BE 14; 4, BE 15; 2, BE 18; 2, BE 21; 1, BE 22; 7, BE 25. Rongelap Atoll: 1 specimens from J 18; 3, J 20. Rongerik Atoll: 1 specimen from BAZI 272.

DISCUSSION: These few specimens, all small, show less variation than did those from Tahiti, and they also show slight differences from the specimens from

other parts of the Pacific. In the anterior carapace the small promontories between the fronts of the orbital hoods and the rostrum are less pronounced and more confluent with the orbital hoods; also in several the rounded carina of the rostrum continues posterior to the gastric region of the carapace. On the large chela the transverse groove is very slight, the longitudinal groove on the outer face reaches almost to the proximal margin of the palm, on the small chela there is a faint trace of a similar groove; on both chelipeds the meral spines are well developed on all specimens. Otherwise the specimens are similar to those from Tahiti.

When specimens of the type described by de Man as *A. parvus* (1909:102) are again collected they should be compared carefully to this species. Unfortunately his sole specimen lacked a large chela and the species was assigned to the Crinitus group on the basis of other similarities. However, a point-for-point comparison of these specimens of *A. amirantei sizou* with de Man's description and figures show only slight differences in the proportions of the third leg and telson, and in *A. parvus*, a longer dorsal carina. These differences are enough to prevent placing *A. parvus* in synonymy at the present time, but the species is questionable.

Alpheus gracilis gracilis Heller

Alpheus gracilis Heller, 1861. K. Akad. Wiss., Wien, Sitzungber. 44:271, pl. 3, figs. 19-20.

Alpheus gracilis luciparensis de Man, 1911. Siboga Exped. $39a^1(2)$:337, pl. 14, fig. 66.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 2 specimens from MC S-46-196; 2, BE 19; 2, BE 27; 3, BE 30. Bikini Atoll: 1 specimen from J 5; 3, J 13. Rongelap Atoll: 1 specimen from J 23; 3, J 24.

DISCUSSION: This is the first use of the trinomial for the form described by Heller. For the separation between this and the subspecies *simplex*, and the placement of *luciparensis* into synonymy, see the discussion below.

Alpheus gracilis Heller *simplex* (Banner)

Alpheus gracilis Heller, 1861. K. Akad. Wiss., Wien, Sitzungber. 44:271, pl. 3, figs. 19-20.

Crangon gracilis simplex Banner, 1953. Pac. Sci. 7(1):75, fig. 25.

LOCALITIES: Caroline Islands: Ifaluk Atoll: 4 specimens from W 357.

DISCUSSION: All of the non-Hawaiian specimens of this species in the collection were reviewed with considerable detail to determine whether the different forms should be considered to be separate species, separate subspecies, separate varieties as listed by earlier authors, or as a single variable species. The variations already reported from specimens from Hawaii, as well as the variations in all of these specimens, soon showed that de Man's variety *luciparensis* was created on the basis of variable characteristics and is within the normal range of the species.

However, the specimens could easily be divided into two groups. In the first group, agreeing with Heller's description, the orbitorostral grooves were deep, there was no tooth above the dactylus on the small chela, and the dactyl of the third leg was biunguiculate. In the second group, described from Hawaii as *A. gracilis simplex*, the orbitorostral grooves were broad and shallow, the small chela carried a tooth above the dactylus, and the dactylus of the third leg was simple.

The presence or absence of a tooth on the merus of the large cheliped was not correlated with the other characteristics, nor were there correlations in the somewhat variable proportions of the other appendages.

In only two specimens, one from Mellu Island, Rongelap and one from Eniwetok, were these characteristics confused: the Eniwetok specimen had shallow orbitorostral grooves, a tooth on the small chela and a strongly biunguiculate dactylus; the Mellu Island specimen was similar, but was lacking the small chela. These two specimens were assigned to *A. gracilis gracilis* on the basis of the biunguiculate dactylus.

With the exception of these two specimens, all of the specimens in the collections were found to be definitely one subspecies or the other, and both subspecies were never collected from the same island or atoll. However, within an archipelago both subspecies were collected; for example, *A. gracilis gracilis* was collected at Bikini at the northwestern end of the Marshall Islands, and *A. gracilis simplex* was collected at Arno Atoll at the southeastern end (the two atolls lie about 500 miles apart).

Because of the small number of specimens available and especially, with the small number that were collected from any one area, the extent of variation could not be determined, but on the basis of the specimens available it appears that there are two morphologically and geographically separated subspecies of this species.

The last question is whether this *A. gracilis simplex* is a synonym of Coutière's *A. gracilis* var. *alluaudi* (1905:882). Coutière gave a brief description "...le dactylopodite des paires 3, 4, 5 est simple, alors que chez l'*A. gracilis*, il porte une griffe surnuméraire ventrale. Par tous les autres points, ces spécimens me paraissent impossibles à distinguer de l'*A. gracilis*." If this is true there are three subspecies in this species, with the two forms which bear simple dactyli on the thoracic legs being separated by the form of the orbito-rostral grooves and the tooth above the dactylus of the small chela. However, final determination will have to await either the reexamination of Coutière's type or the examination of other specimens from the area from which his type was taken.

Alpheus lottini Guérin

For full citation see Banner and Banner, 1964:88.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 2 specimens from BE 2; 2, BE 10; 3, BE 18. Bikini Atoll: 2 specimens from BA 17; 2, BA 22; 3, BA 33; 1, BA 51; 2, BA 67; 2, BA 69; 1, BA 119; 2, BA 122; 2, BA 126; 1, S-46-50; 14, J 2; 6, J 3; 6, J 5; 1, J 8. Rongerik Atoll: 4 specimens from BAZI 223; 2, BAZI 224; 2, BAZI 257; 1, BAZI 272; 2, BAZI 273. Caroline Islands: Ifaluk Atoll: 1, BA 327; 1, BA 328; 1, BA 376; 2, BA 380; 2, BA 396; 1, BA 401; 2, BA 415; 2, BA 416; 2, BA 640; 2, W 687; 4, W 718; 2, BA 768; 2, BA 780; 2, BA 782; 4, BA 783; 2, BA 785; 1, BA 787; 2, BA 791; 1, BA 812. Kapingamarangi Atoll: 7, H 174; 5, H 333.

DISCUSSION: Some specimens from BE 10 were noted to carry black streaks down their backs.

Alpheus rostratipes Pocock

For full citation see Banner and Banner, 1967:268

LOCALITIES: Marshall Islands: Eniwetok Atoll. 1 specimen from BE 4;

2, BE 10; 21, BE 17; 6, BE 18; 23, BE 19; 21, BE 23; 2, BE 27; 24 specimens on which data was lost. Bikini Atoll: 6 specimens from TA 4418; 1, J 5. Rongelap Atoll: 3 specimens from TA 4826; 1, J 18. Caroline Islands: Ifaluk Atoll: 2 specimens from A 28-D-2; 2, A 29-B-4; 2, A 30-C-2; 1, A 31-D-1; 1, AYA 66-E-9; 1, AYA 67-D-6; 1, A 81-B-4-A. Kapingamarangi Atoll: 1 specimen from H 786.

Alpheus macrochirus Richters

For full citation see Banner, 1957:198

LOCALITIES: Marshall Islands: Eniwetok Atoll: 2 specimens from BE 1; 1, BE 18; 2, S S-46-196; 7, J 13. Rongerik: 1 specimen from BAZI 272. Rongelap Atoll: 3 specimens from J 24. Bikini Atoll: 2 specimens from J 2; 1, J 4; 1, J 6. Caroline Islands: Kapingamarangi Atoll: 1 specimen from H 77; 5, H 80.

OBESOMANUS GROUP

Alpheus obesomanus Dana

For full citation see Banner and Banner, 1966:174.

LOCALITIES: Marshall Islands: Bikini Atoll: 17 specimens from J 2; 1, J 8; 1, MO 4378. Eniwetok Atoll: 5 specimens from J 14; 5, BE 10; 1, BE 11; 53, BE 17; 2, BE 19; 2, BE 19b. Caroline Islands: Ifaluk Atoll: 1 specimen each from A 28-D-2, AYA 100-D-1, A 131-G-1, A 141-D-2; A 142-E-1; HAYAA (160-165)-J-2.

DISCUSSION: The specimens from BE 19b were found in algal tubes on heads of *Porites* and *Heliozoa*.

Alpheus samoa Banner and Banner 1966:174.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 2 specimens from BE 12.

DISCUSSION: These two specimens agree well with the original description except for two characteristics. In the male the scaphocerite reaches to one-quarter of the length of the second antennular article and while that in the female reaches just beyound the end of the same article; in the type specimen it reached only to or just beyond the end of the first antennular article. Considering the variation in the scaphocerites in the Obesomanus group, this cannot be considered as significant. Secondly, the merus of the third leg in the male is 5 times as long as broad and in the female approximately 4.7; in the type specimen it was 3.9 times as long as broad, the ratio of the merus to the carpus and the carpus to the propodus remain essentially the same as in the type.

Alpheus malleodigitus (Spence-Bate)

For full citation see Banner and Banner, 1966:174.

LOCALITIES: Marshall Islands: Bikini Atoll: 4 specimens from J 5. Rongelap Atoll: 1 specimen from J 20.

Alpheus idiocheles Coutière

For full citation see Banner and Banner, 1967:271

LOCALITIES: Marshall Islands: 1 specimen from BE 17; 1, BE 19.

CRINITUS GROUP

Alpheus styliceps Coutière

Alpheus styliceps Coutière, 1905. Fauna and Geog. Mald. and Laccad. 2(4):

889, pl. 78, fig. 28.

LOCALITIES: A non-ovigerous female, carapace length 3.2 mm, from Burok Island (J 20), Rongelap Atoll and a male, 3.9 mm carapace length, from Namu Island (J 2), outer reef, Bikini Atoll, both collected by Johnson.

DISCUSSION: The small female is complete, the male is without a large chela and has been dessicated. These small specimens agree in general with the description of Coutière's, but there are several differences. The articles of the antennular peduncle are somewhat broader, with the second article of the female 2.0 and that of the male 1.5 times as long as broad. On the large chela of the female the "très léger sillon" behind the articulation of the dactyus is almost non-existant. The merus of the large cheliped, which in the type has a rounded shoulder, has a definite and acute tooth; however, the rounded shoulder on the small cheliped is like that depicted by Coutière. The fingers of the small chela of the male in our specimen are heavier and more curved than that shown by Coutière.

These differences are slight, and may be due to growth or to the inherent variation so often found in this group (Banner 1953:104).

Alpheus bradypus Coutière

Alpheus bradypus Coutière, 1905. Fauna and Geog. Mald. and Laccad. 2(4): 891, pl. 79, fig. 30.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 2 specimens from J 13. Bikini Atoll: 1 specimen from J 1; 1, J 4; 1, J 5; 2, J 6. Caroline Islands: Ifaluk Atoll: 1 specimen from A 27-E-1; 1, A 85-F-1.

Alpheus superciliaris Coutière

Alpheus superciliaris Coutière, 1905. Fauna and Geog. Mald. and Laccad. 2(4): 896, pl. 81, fig. 35.

LOCALITIES: Marshall Islands: Rongelap Atoll: 2 specimens from J 23. Rongerik Atoll: 1 specimen from BAZI 210; 1, BAZI 245.

DISCUSSION: These four specimens agree very well with Coutière's description. However, there are minor differences: The tooth on the merus of the large chela is acute in all of these specimens instead of projecting but rounded as described by Coutière; the dactyl of the small chela of the male is a little less expanded than the specimen described by Coutière; the tooth on the merus of the fourth legs is usually lacking; the carpal spines are lacking in all specimens, and Coutière found this condition only in the male; and finally, in one specimen, the telson is 2.6 instead of 2.3 times as long as broad. Obviously these are mere variations.

Alpheus pachychirus Stimpson

Alpheus pachychirus Stimpson, 1860. Acad. Nat. Sci. Philadelphia, Proc., 12:30.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 1 specimen from J 13; 2, BE 11; 4, BE 18. Bikini Atoll: 1 specimen from BA 196; 1, J 2. Rongelap Atoll: 2 specimens from J 20. Rongerik Atoll: 1 specimen from BAZI 245; 1, BAZI 246. Caroline Islands: Ifaluk Atoll: 1 specimen from BA 382; 2, BA 396; 2, BA 784; 1, BA 786. Kapingamarangi Atoll: 1 specimen from station H 77; 2, H 514.

Alpheus bucephalus Coutière

For full citation see Banner, 1957:201.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 3 specimens from BE 1; 3, BE 2; 12, BE 5; 8, BE 6; 1, BE 9; 2, BE 10; 25, BE 11; 1, BE 12; 2, BE 19; 1, BE 21; 2, J 14; 2, J 15. Bikini Atoll: 1 specimen from S S-46-44; 3, J 1; 1, J 2. Rongerik Atoll: 1 specimen from BAZI 266. Rongelap Atoll: 1 specimen from J 23. Caroline Islands: Kapingamarangi Atoll: 1 specimen from H 668.

DISCUSSION: In an earlier paper (1957:201) the senior author suggested that this species and *A. clypeatus* Coutière might prove to be a synonym of *A. brevipes* Stimpson. A careful examination of the many specimens in the collection indicates that while the three species approach each other in many characteristics, they appear to be sufficiently distinct to continue to be regarded as separate species. The differences between *A. clypeatus* and *A. brevipes* were discussed for the Hawaiian specimens in 1953:103 *et seq.*

A. bucephalus differs from *A. brevipes* in the form of the rostrum, which is much longer and better formed in *A. bucephalus*; in the tooth on the merus of the large chela, usually present in *A. bucephalus* and always absent in *A. brevipes*; in the longer fingers of the small chela which at times are sexually dimorphic, and in the ratio of the first two articles of the second leg, never more than 1:2.0 or 1:2.1 in *A. brevipes* and usually ranging from 1:2.5 to more than 1:3.0 in *A. bucephalus*. There are other differences, but more subtle and less reliable, as differences in the orbital hoods, dorsal carina and proportions of the merus of the third legs.

In the series of specimens collected on Eniwetok in on group (BE 11) the cohabiting pairs in each fabricated tube were separated for special examination; in these it was found there was almost no variation between the members of the pair except for the sexual dimorphism.

The tubes, unlike those made by *A. frontalis* and others, appear to be of a variety of materials, including several types of algae and sponges. Some are almost nothing but sponge; others almost purely alga. The tubes are found penetrating between the fronds of dead and overgrown *Pocillopora meandrina* Verrill.

Alpheus alcyone de Man

Alpheus alcyone de Man, 1902. Senken. Naturf. Gesell., Abhandl. 25:87, pl. 27, fig. 61. 1911. Siboga Exped. 39a^1(2):351.

Alpheus aculeipes Coutière, 1905. Fauna and Geog. Mald. and Laccad. 2(4): 892, pl. 79, fig. 31.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 3 specimens from J 13. Bikini Atoll: 2 specimens from BA 8; 2, BA 186; 1, BA 197; 2, BA 201; 4, J 2; 3, J 5; 1, J 9. Caroline Islands: Ifalk Atoll: 1 specimen from BA 415.

Alpheus cloudi Banner

Alpheus cloudi Banner, 1956. Pac. Sci. 10(3):352, fig. 16 a-i; Banner and Banner, 1966. Pac. Sci. 20(2):177, fig. 19.

LOCALITIES: Caroline Islands: Ifaluk Atoll: 2 specimens from HA 484.

Alpheus paralcyone Coutière

For full citation see Banner and Banner, 1966:178.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 2 specimens from BE 12. Bikini Atoll: 3 specimens from J 2.

Alpheus brevipes Stimpson

For full citation see Banner, 1956:345.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 2 specimens from BE 11; 3, BE 14; 2, BE 18; 8, BE 22. Bikini Atoll: 1 specimen from AB 152-8; 1, J 2; 4, J 5. Rongelap Atoll: 1 specimen from J 23. Rongerik Atoll: 1 specimen from BAZI 206; 1, BAZI 208; 2, BAZI 242. Caroline Islands: Ifaluk Atoll: 1 specimen from BA 372. Kapingamarangi Atoll: 1 specimen from H 31.

DISCUSSION: The specimens from BE 11 were living in pairs in algal tubes. The tubes seems to be primarily of a red filamentous alga with the possible addition of sponge. The tubes were branching under the mat of algae covering dead heads of *Pocillopora* with passages running deep into the head. When the specimens were observed both the male and female put their abdomens into deep passages with the heads facing outwards. Color in life usually mottled green. One tube was under a red sponge and reached several inches from the surface.

Alpheus clypeatus Coutière

For full citation see Banner, 1958:167.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 2 specimens from BE 1; 2, BE 21; 4, BE 22b; 2, BE 22c. Bikini Atoll: 1 specimen from BA 200. Rongerik Atoll: 1 specimen from BAZI 206; 1, BAZI 207; 3, BAZI 209; 2, BAZI 210; 1, BAZI 225; 1, BAZI 246. Caroline Islands: Ifaluk Atoll: 1 specimen from BA 382; 1, BA 396; 1, BA 415.

DISCUSSION: At least three species of the Crinitus group occur in tubes they fabricate for themselves of filamentous blue-green algae identified by the older workers as *Oscillatoria*, and by modern algalogists as *Lyngbya sordida* (Zan.) Gomont. These species are *A. frontalis* H. Milne Edwards, *A. pachychirus* Stimpson and *A. clypeatus* Coutière. Because of the similarity of habitats and the great similarity of general form, a series of specimens of these species were closely examined to determine whether the separation of the species is valid.

The size range of mature specimens of each species differs, with *A. frontalis* reaching a carapace length of about 14 mm, *A. pachychirus* of 8-9 mm and *A. clypeatus* of about 6 mm. The mature specimens are distinct in form and younger specimens show no signs of intergradation. Of the three, the easiest to separate is *A. frontalis* in which the frontal margin of the carapace lacks a rostrum but carries the inter-orbital area protruding anteriorly before the eyes and slanting upwards towards the obtuse but definite medial carina like the roof of a house; it also lacks all trace of a tooth on the merus of the third leg.

The distinction between *A. pachychirus* and *A. clypeatus* is more subtle. The best characteristic for this separation is in the second leg: in *A. pachychirus* the first carpal article is about 1.5 times the length of the second, while in *A. clypeatus* the two articles are subequal, usually with the second slightly longer than the first; in both, these proportions vary but there does not seem to be any overlapping between the ratios of the two species. There is also a difference in the rostral front as emphasized by Coutière in his original description. This difference is difficult to put into words, but in *A. pachychirus* the orbital hoods and the interorbital carina reach down to the forward margin of the carapace, giving the front a bluntly rounded profile when seen in lateral view, while in *A. clypeatus*

the anteriomost margin of the carapace protrudes as a flattened shelf that curves upwards over the bases of the antennules. The rostrum in both species is variable but is usually present.

Other differences between the two species are so variable as to be unreliable; these included the presence or absence of a tooth on the basicerite and the differences in relative lengths of the antennular and antennal peduncle. In addition, there are many similarities among all three species, such as in the form of the distal article of the third maxilliped.

Thus in spite of the similarities, it appears that the three species are validly separated.

Alpheus ovaliceps Coutière

Alpheus ovaliceps Coutière, 1905. Fauna and Geog. Mald. and Laccad. 2(4): 888, pl. 77, fig. 27. Banner, 1956. Pac. Sci. 10(3):357, fig. 18.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 1 specimen from J 13. Bikini Atoll: 2 specimens from J 5; 2, J 6. Rongelap Atoll: 2 specimens from J 24.

Alpheus frontalis H. Milne Edwards

Alpheus frontalis H. Milne Edwards, 1837. Hist. Nat. Crust. 2, p. 356.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 1 specimen from BE 13; 2, BE 13a; 2, BE 18. Bikini Atoll: 1 specimen from BA 13; 5, MO 3110; 10, MO 3168; 29, J 2. Rongerik Atoll: 2 specimens from BAZI 226. Rongelap Atoll: 2 specimens from J 20; 11, J 23. Caroline Islands: Kapingamarangi Atoll: 7 specimens from H 75; 2, H 514.

DISCUSSION: The group of specimens represented in the collection were examined to see if any growth changes could be found, especially in the smaller specimens, similar to those found for *A. lottini* Guerin (Banner, 1958:164, fig. 4, as *A. ventrosus* Milne Edwards) The smallest specimens in the collection, a male and a non-ovigerous female from BE 13a, carapace lengths 4.2 mm and 4.6 mm, respectively, showed no marked differences from the largest specimens up to 16 mm carapace length. It is true there are slight differences in proportions, for example, the propodus of the third legs is more slender and the dactylus is longer in the young, and the interorbital portion of the carapace may be less angular or "roof-like". Yet these young could not be confused with any other species of the genus. The smaller males in the collection have not yet developed the sexual dimorphism. The dactylus of the small chela is not expanded but is similar in form to that of the adult female.

Dr. Cadet Hand who collected the shrimp from Kapingamarangi wrote in a personal letter, "These shrimp were taken from tubes of blue-green algae [*Lyngbia sordida*] under "micro-atolls" on the ocean-facing reef at the islet of Touhou. The "micro-atolls" were about 50 feet on the landward side of the weakly developed algae ridge of the outer reef. One tube was 15″ long by 1/3 to 2/3 inches in diameter. Each tube had 2 shrimp (we found most "micro-atolls" have several tubes) and each tube was branched irregularly. The shrimp were purple with a red tail and had blue spots on their bodies".

DIADEMA GROUP

Alpheus bidens (Olivier)

For full citation see Banner, 1957:203.

LOCALITIES: Marshall Islands: Rongelap Atoll: 1 specimen from TA 4707. Rongerik Atoll: 1 specimen from BAZI 227. Bikini Atoll: 3 specimens from J 1; 1 each from J 9 and J 10. Eniwetok Atoll: 1 specimen from BE 12.

DISCUSSION: De Man separated his species *A. praedator* (1911:373) from this species on the basis of a series of minor characteristics including 1) the relative proportions of the second antennular article, 2) the length of the blade of the scaphocerite, 3) the slightly heavier large chela (about 2.5 instead of 2.75 times as long as broad), 4) a larger chela on the second legs (twice as long as the fifth carpal article instead of 1.5 times), and 5) a slightly heavier third leg. By far the most important distinguishing characteristic, however, was in the posterior part of the rostral carina, which in his key he described as "Rostral carina, behind the median tubercle, continued in a straight, obtuse crest, bounded on either side by a shallow groove or depression that ends abruptly at the posterior extremity of the crest" in contrast to *A. bidens*, "Rostral carina, behind the median tubercle, gradually falling away, not bounded on either side by a shallow groove or depression."

On the basis of this last differentiation, all of these specimens are *A. bidens*. However, even in this group of 7 specimens variations were noticed in the other distinguishing characteristics sufficient to obliterate the differences; for example, the second antennular article varied from 1.2 to 1.8 times the length of the first; the merus of the third leg on the 5 specimens with these legs intact, varied from 4.6 to 5.8 times as long as broad. Moreover other variations were noticed in the length of the rostrum, which reached from the end of the first antennular article to the middle of the second; in the development of the teeth on the distal margin of the first antennular article, which in one specimen were completely lacking; the presence or lack of a strong spine on the merus of the large chela; and even in the dactylus of the third legs, which in two showed a trace of biunguiculation.

While the dorsal carina of the carapace varied from being completely absent to a low short ridge, it never approached the condition shown for *A. praedator*.

We believe that when there are enough specimens of this species examined all differences will be bridged; because these few specimens do no more than hint that there may be intergrading forms, *A. praedator* has been left standing.

Alpheus diadema Dana

Alpheus diadema Dana, 1852. U. S. Explor. Exped. 13:555, pl. 35 fig. 7. Banner, 1959. Pac. Sci. 13(2):141, fig. 7.

Alpheus insignis Heller, 1861. K. Akad. Wiss. Wien., Sitzungber. 44:269, pl. 3, fig. 17–18.

Crangon diadema Banner, 1953. Pac. Sci. 7(1):118, fig. 43.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 2 specimens from BE 5; 9, BE 6; 9, BE 11; 5, BE 19; 2, BE 27; 2, GZ 57-2; 2, GZ 57-6. Bikini Atoll: 3 specimens from TA 4418; 1, BA 13; 1, BA 195; 5, J 1; 3, J 5; 3, J 9; 3, S S-46-114. Rongelap Atoll: 7 specimens from J 23. Rongerik Atoll: 1 specimen from TA 4728; 3, BAZI 209; 1, BAZI 225. Caroline Islands: Ifaluk Atoll: 2 specimens from BA 786. Kapingamarangi Atoll: 2 specimens from H 786.

Alpheus percyi Coutière

For full citation see Banner, 1957:203.

LOCALITIES: Marshall Islands: Rongerik Atoll; 2 specimens from BAZI 210; 2, BAZI 245. Caroline Islands: Ifaluk Atoll: 1 specimen from HA 741.

DISCUSSION: These four specimens, together with two previously reported from Arno (Banner, 1957:203) were examined in detail. In general they had the same form and proportions, with slight variations noted in the length of the rostrum and in the proportions of the appendages. However variation was noticed in four characteristics: First, the female from BAZI 210 had a slight but definite biunguiculation on the third legs, while none of the other specimens showed more than a slight diagonal ridge across the surface of the article; this is similar to the variation already reported for the related *A. diadema* Dana (Banner, 1959:141). Second, none of the specimens, even the 25 mm male from BAZI 210 possessed a balaeniceps fringe on the dactylus of the small chela as was reported by Coutière; however, this characteristic has been found variable in *A. gracilipes* Stimpson (Banner, 1956:355) a related form, and may also be correlated with the maturity of the individual, for Coutière's specimen was 40 mm long. Third, the two specimens from BAZI 210 had a definite tooth above the dactylar articulation of the small chela, while none of the other specimens, all smaller, had even a rounded projection. Finally, the specimens from Ifaluk had a crimson spot on the lateral surface of the mandible and the male specimen from BAZI 210 had a reddish-brown spot in the same location; this mandibular spot was reminiscent of the more discrete black to brown spot found on the two species of the genus *Metabetaeus*. None of the other specimens showed a trace of this color. (All other color in the specimens was bleached from the long immersion in alcohol).

With so few specimens, it is not advisable to decide whether these variations should be considered as normal variation within the species, or whether these varient specimens should be separated into species or subspecies; however, in view of the variation reported in related species we believe that these are probably normal variations.

Alpheus dasycheles Coutière

Alpheus dasycheles Coutière, 1908. Soc. Philomath. Paris, Bull. 11(5):21; 1921. Linn Soc. London, Trans. 17(4):426, pl. 64, fig. 2. [same description as above with figs.].

LOCALITIES: Caroline Islands: Kapingamarangi Atoll: 3 specimens from H 174.

DISCUSSION: The three specimens, all fragmentary, are of larger than average size with the largest, a non-ovigerous female, 32 mm long; Coutière's largest specimen was but 22 mm long. The smallest specimen, which was the most similar to Coutière's type, carried a triangular rostrum that was 1.5 times as long as broad at the base. The rostrum of the second smaller specimen showed a slight trace of carina and was 2.5 times as long as broad at the base and the rostrum of the largest specimen was 2.2 times as long as broad at the base.

Otherwise the specimens agree well with Coutière's description except for the lack of a somewhat dense covering of long hair; in the two chelae intact, one large and one small, the hairs are long but sparse and scattered.

Alpheus ehlersi de Man

For full citation see Banner and Banner, 1964:91.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 2 specimens from BE 4; 1, BE 19; 2, BE 24.

Alpheus gracilipes Stimpson

For full citation and redescription see Banner and Banner, 1967:276.

LOCALITIES: Marshall Islands: Bikini Atoll: 1 specimen from BA 181; 1, S S-46-114. Rongerik Atoll: 1 specimen from BAZI 274. Caroline Islands: Ifaluk Atoll: 2 specimens from HA 484; 2 collected by natives, locality data lost. Kapingamarangi Atoll: 1 specimen from H 74.

DISCUSSION: The specimen from BA 181 has been assigned to this species with doubts. In it the second antennular article is too short, relative to both the first and third articles, and to itself, being only 1.5 instead of 2.0 times as long as broad, and the lengths of the first and second carpal articles of the second legs bear the ratio, on the right, of 10:4.5 and on the left 10:3.4, instead of the usual 10:6 to 10:10. However, as the other characteristics are well within the range of variation noted in the Society Islands, the specimen was assigned to this species.

The second specimen from Bikini is immature, and the rostrum and front of the carapace is similar to that described for an immature specimen from Tahiti (Banner and Banner, 1967:278). There is little doubt about its identity.

Alpheus paracrinitus Miers

For full citation see Banner and Banner, 1967:278.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 2 specimens from BE 1; 2, BE 7; 1, BE 13; 3, BE 20b; 2, J 16. Bikini Atoll: 7, J 1; 6, J 2; 9, J 4; 4, J 5; 2, J 6. Rongelap Atoll: 1 specimen from J 19; 3, J 20; 7, J, 21. Caroline Islands: Ifaluk Atoll: 3 specimens from A 113-H-1; 1, A 50-E-3; 1, AYA 76-H-6.

Alpheus alpheopsides Coutière

Alpheus alpheopsides Coutière, 1905. Fauna and Geog. Mald. and Laccad. 2(4): 901, pl. 83, fig. 40.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 1 specimen from BE 1; 44, J 15; 2, J 16.

DISCUSSION: This small group of specimens together with those previously recorded from Samoa was examined critically to see if the differences between this species and the related and variable *Alpheus paracrinitus* (Banner and Banner, 1967:278) were great enough and constant enough to warrant their separation.

In this group of specimens there are variations parallel to those of *A. paracrinitus*. The rostrum reaches one-quarter to one-half the length of the visible portion of the first antennular article, while in *A. paracrinitus* it usually reaches from half the length of the article to its end; however, the rostrum is always broader in reference to its length than it is in *A. paracrinitus*. The external spine of the squame in all cases slightly exceeds the length of the squamous portion while in *A. paracrinitus* it definitely exceeds the squamous portion.

The large chela is 3.4 to 3.7 times as long as broad and the strong tooth on the inferior internal margin of the merus is located some distance from the end and anteriorly preceded by 3 movable spines. In *A. paracrinitus* the large chela ranges from 2.5 to 3.0 times as long as broad and the inferior internal margin of

the merus lacks the movable spinules and the tooth is terminal. The second carpal article of the second legs is shorter (10:5–10:6) than those normally found in *A. paracrinitus*. The range of *A. paracrinitus* encompasses this ratio. The relative proportions of the articles of the third legs are similar in the two species.

These differences between *A. alpheopsides* and *A. paracrinitus* appear to be constant enough to warrant the continued separation.

BREVIROSTRIS GROUP

Alpheus species No. IV

LOCALITY: A single 11.7 mm female, non-ovigerous, Rongelap Anchorage (J 17) 23 fathoms, 16 June 1946. Specimen lacking large chela, both second legs and one each, third, fourth and fifth legs.

DESCRIPTION: Orbital hoods inflated, smooth and extending as characteristic for the Brevirostris group; rostrum triangular, short, flattened, not reaching over one-quarter the length of the visible portion of the first antennular article; interorbital area behind rostrum flat, depressed, without trace of rostral carina.

Second antennular article almost 3 times as long as wide and twice as long as visible portion of first article; third article shorter than first; stylocerite of normal development, small anterior tooth not reaching over one-quarter length of visible portion of the first antennular article; lateral spine of scaphocerite extending by 0.2 of its length beyond the end of antennular peduncle; carpocerite sub-equal in length to antennular peduncle. Basicerite with lateral tooth.

Penultimate article of third maxillipeds bearing tuft of setae that far exceeds length of ultimate article.

Large cheliped lacking. Ischium of small cheliped armed with feeble spine. Merus 4.5 times as long as broad, rounded at superior distial margin, armed with 5 short, slender spines on inferior internal margin, margin distally armed. Carpus slender. Chela 4.5 times as long as broad; fingers occupying slightly more than distal 0.3, with curved tips, but meeting along entire length; dactylus with slight thickening in middle portion. Distal portion of merus and especially margins of chela armed with long but not dense setae.

Carpal articles of second leg with ratio 10:7:3:4:5; first article the most slender, 4 times as long as broad.

Third legs with ischium armed with slender spine; merus unarmed, 5.6 times as long as broad; carpus almost 0.4 as long as merus, with superior and inferior margins terminating distally in small teeth; propodus 0.57 as long as merus, armed with four feeble spines on inferior margin and similar spine distally; dactylus 0.6 as long as propodus, inferior margins flattened but not markedly broadened, tip acute, simple. Only inferior margin of propodus and distal end of carpus bearing setae; setae long but sparse.

Telson as usual form for the group, 3.3 times as long as broad distally, 1.5 times as broad proximally as distally; lateral margins anteriorly slightly convex, posteriorly straight; tip broadly rounded; dorsal spinules long and slender; posterolateral spines poorly developed; tip armed with a series of spinules. Inner uropod with fossa similar to that described for *A. malabaricus mackayi* (Banner 1959:151); distal margin armed with spinules similar to those of telson; outer uroped with lateral distal spines poorly developed and unarmed along distal margin.

DISCUSSION: This form has been assigned to the Brevirostris group with some doubts. The development of the anterior region of the carapace, the third maxillipeds, the small chela, the third legs and the telson are all like the development found in the Brevirostris group. Some of these characteristics are like *A. malabaricus* Fabricius, expecially in development of the front of the carapace. However, the third maxilliped and the small chela do not resemble *A. malabaricus*. Without the large chela the assignment of this species to a even subgeneric group is questionable.

This species has been left unnamed because, first, it is a female and the characteristics of the small cheliped of the male are important; second, because it is fragmentary; third, because it is probably immature.

Alpheus rapax Fabricius

Alpheus rapax Fabricius, 1798. Suppl. Ent. Syst., p. 405.

LOCALITY: Caroline Islands: Ifaluk Atoll: 1 specimen from BA 530.

Alpheus miersi Coutière

Alpheus rapax var *miersi* Coutière, 1898. Soc. Ent. de France, Bull. (7):166, fig. 1.

Alpheus miersi Coutière, 1905. Fauna and Geog. Mald. and Laccad. 2(4):903, pls. 83-84, fig. 42.

LOCALITY: Marshall Islands: Bikini Atoll: 1 ovigerous female from MO 4358.

DISCUSSION: This sole specimen agrees very well in general configuration with the description and figures of Coutière. However, there are a series of minor differences: On the third maxilliped there are 8 heavy bristles on the penultimate article, the longest of which reaches to the tip of the final article, while Coutière depicts only two bristles which reach to the middle of the ultimate article. On this specimen the supero-lateral margin of the basal article of the maxilliped continues into a strong rounded lobe that is a third the length of the middle article, while Coutière neither described nor depicted such a lobe. On the large cheliped, both the chela and merus are more slender than those in the female described by Coutière, the chela being 3.6 times as long as broad, the merus 3.0 in contrast to Coutière's proportions of 3.0 and 2.3 respectively. The chela was also described as bearing a superior longitudinal crest which is lacking in this specimen. A similar difference in proportions is found in the merus of the small cheliped. On the third legs the dactylus is possibly slightly more curved, but when viewed from the aspect shown by Coutière in his drawing, the curves are similar. Finally, it is notable that the telson has only the anterior pair of dorsal spines.

Of these differences the only ones likely to be of any significance are those of the maxillipeds and dorsal spinules of the telson, but even these may be merely individual variations.

EDWARDSII GROUP

Alpheus crassimanus Heller

For complete citation see Banner and Banner, 1966:181.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 5 specimens from BE 16; 3, BE 20; 3, BZ 57-1.

Alpheus strenuus Dana

For full citation see Banner and Banner, 1966:181.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 25 specimens from BE 16; 32, BE 20; 3, BE 20b; 5, GZ 57-2; 4, GZ 57-4; 4, GZ 57-6; 2, GZ 57-7; 1, GZ 57-8; 2, GZ 57-9; 1, G 42; 1, G 46; 1, G 50; 2, MO 4461. Bikini Atoll: 2 specimens from J 4; 8, J 6. Rongelap Atoll: 2 specimens from TA 4780; 2, J 18; 4, J 19. Caroline Islands: Kapingamarangi Atoll: 1 specimen from H 77; 8, H 80; 1, H 465; 1, H 514.

Alpheus pacificus Dana

Alpheus pacificus Dana, 1852. Acad. Nat. Sci. Philadelphia, Proc. 6:21; 1852. U. S. Exploring Exped. 13:541, pl. 34, fig. 5.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 5 specimens from BE 20; 6, J 11; 4, J 12; 22, J 14. Bikini: 1 specimen from MO 4089; 1, S S-46-95; 5, J 4; 2, J 6. Rongelap Atoll: 2, J 18; 11, J 19; 7, J 21; 1, J 23; 2, J 24. Rongerik Atoll: 2 specimens from MO 4752. Caroline Islands: Ifaluk Atoll: 2 specimens from BA 454; 11, BA 530; 2, WO 456.

Alpheus dolorus Banner

Alpheus dolorus Banner, 1956. Pac. Sci. 10(3):362, fig. 21 a-j.

LOCALITIES: Marshall Islands: Bikini Atoll: 3 specimen from J 2. Eniwetok Atoll: 2 specimens from BE 5; 2, BE 10; 1, BE 22. Rongelap Atoll: 1 specimen from J 18.

Alpheus parvirostris Dana

Alpheus parvirostris Dana, 1852. Acad. Nat. Sci. Philadelphia, Proc. 6:22; 1852. U. S, Exploring Exped. 13:551, pl. 35, fig. 3.

LOCALITIES: Marshall Islands: Eniwetok Atoll: 2 specimens from BE 1; 3, BE 3; 4, BE 5; 3, BE 6; 1, BE 7; 3, BE 9; 4, BE 10; 10, BE 11; 4, BE 13; 2, BE 15; 2, BE 19; 6, BE 21; 2, BE 22; 2, BE 25; 2, BE 27; 2, MO 4539; 1, S S-46-95; 56, J 1; 9, J 5; 1, J 6; 16, J 13; 1, J 14; 1, J 15. Bikini Atoll: 1 specimen from BA 68; 1, BA 194. Rongelap Atoll: 1 specimen from BA 784. Kapinamarangi Atoll: 2 specimens from H 174; 5, H 333; 4, H 668.

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Printed at
Kokusai Bunken Insatsusha
International Academic Printing Co., Ltd.)
No. 7-17 Fujimi 2-chome, Chiyoda-ku
Tokyo. Japan