The marine Heteroptera of Far Eastern New Guinea and adjacent Archipelagoes (Insecta, Gerromorpha)[1]

J.T. Polhemus & D.A. Polhemus

Abstract: Marine Heteroptera, or true bugs, are ubiquitous but rarely recognized elements of tropical marine ecosystems worldwide, reaching their highest level of diversification in the southwestern Pacific. During the current study, collections of marine Heteroptera were made at 41 sampling stations in Milne Bay Province of far eastern Papua New Guinea between April 2002 and January 2004. The sampling stations included sites in and around Milne Bay itself and on the immediately adjacent islands of Killerton, Iabama, Nuakata, Sariba, Lesimano, Sideia, and Basilaki, as well as in the D'Entrecasteaux Islands (Fergusson, Normanby), the Louisiade Archipelago (Panatinane, Tagula, Rossel, Wola, Misima), the Engineer Group (Tubetube), the Conflict Group (Irai), the Marshall Bennett Islands (Woodlark), and Egum Atoll (Yanaba). A total of 29 species in 10 genera of marine Heteroptera were collected, including the following new taxa described herein: *Ocheovelia* nov.gen., with type species *Ocheovelia heissi* nov.sp.; *Hermatobates kula* nov.sp.; *Halovelia huniye* nov.sp.; *Halovelia misima* nov.sp.; and *Xenobates kanakopi* nov.sp. In addition, a male neotype from the Zamboanga area of Mindanao, Philippines, is designated for *Hermatobates marchei* Coutiére & Martin, and the following new combinations are proposed: *Ocheovelia anderseni* (Lansbury) and *Ocheovelia solomon* (Andersen); both of these species were previously held in the genus *Halovelia*. Based on these surveys, Milne Bay Province supports one of the most diverse marine Heteroptera biotas recorded from any area on earth. With an area of 265,000 km^2, this province occupies only 0.037 % of the earth's total area (and only 0.052 % of earth's water area), yet it supports 16.5 % of the world's known marine Gerromorpha. In terms of local species richness, Milne Bay proper, the islands east of China Strait, Fergusson and Normanby islands in the D'Entrecasteaux group, and Rossel Island in the Louisiades supported the highest number of species (16, 16, 12 and 11 respectively), apparently due to their habitat complexity resulting from a combination of large, reef-bound lagoons or platform reefs coupled with rocky island shores bearing fringing mangrove estuaries. By contrast, richness was lowest at Egum and Conflict atolls (3 and 4 species respectively), which have large lagoons and fringing reefs, but lack estuarine and mangrove habitats or steep rocky shores. Species richness was intermediate at sites on Tagula (9 species), Misima (9 species), and Woodlark (7 species), all of which uniformly support mangrove estuaries and have varying degrees of fringing reef and lagoon development, but are more isolated from the main body of New Guinea. Beta diversity was moderately high within Milne Bay Province, with no one site supporting more than 16 of the 29 aggregate species collected during this marine survey program. The collections reported here substantially extend the known ranges of a many marine Heteroptera species. Our collections of *Halobates proavus* White apparently represent a new island record for New Guinea. Within Papua New Guinea, the ranges of *Halobates calyptus* Herring, *Halobates hayanus* White, *Halobates maculatus* Schadow, *Halobates princeps* White, *Thetibates serena* (Lansbury), *Halovelia annemariae* Andersen, *Halovelia bergrothi* Esaki, and *Haloveloides papuensis* (Esaki) are extended far to the southeast, by approximately 800-1000 km. The ranges of *Halovelia corallia* Andersen, *Halovelia novoguinensis* Andersen, and *Xenobates caudatus* Andersen & Weir, all of which were previously known only from Motupore Island near Port Moresby, are extended approximately 800 km eastward. The ranges of *Xenobates mangrove* Andersen & Weir and *Xenobates ovatus* Andersen & Weir, known until now only from coastal Queensland, are extended approximately 800-1000 km northeastward. The documented range of *Hermatobates marchei* Coutiére & Martin, previously reported only from the type locality Palawan in the Philippines, is extended to the southeast by more than 4000 km; previous surveys by the authors had also revealed the presence of this species on Mindanao and Palau, and these records are provided herein. A biogeographic discussion

[1]This paper is dedicated to our colleague Ernst Heiss, an excellent scientist and wonderful friend, whose efforts have greatly enriched the study of Heteroptera in terms of both scientific results and an enduring spirit of collegiality.

Denisia 19, zugleich Kataloge der OÖ. Landesmuseen Neue Serie 50 (2006), 927–982

identifies four major patterns of distribution among the marine Heteroptera of eastern New Guinea: south coast taxa that extend eastward along the northern margin of the Coral Sea; north coast taxa that extend southeastward from the Huon Peninsula area to the D'Entrecasteaux Islands, the Louisiade Archipelago, and occasionally the Bismarcks and Solomons; regionally endemic taxa that occur in the Bismarcks, Solomons, and on the northeast coast of New Guinea; and locally endemic taxa confined to the region between Milne Bay and the Louisiade Archipelago. Tables are provided giving a checklist of all taxa, and their individual island distributions within the region under study.

Key words: Gerromorpha, Heteroptera, Marine insects, Milne Bay, New Guinea.

Introduction

Marine Heteroptera, or true bugs, are ubiquitous but rarely recognized elements of tropical marine ecosystems worldwide, and reach their highest level of diversification in the southwestern Pacific. They include species which skate upon the surface of the sea, and others which inhabit intertidal rocks or coral blocks. Unlike many marine fishes and invertebrates, these aquatic insects lack planktonic larvae, and as a consequence frequently undergo localized speciation, making them an excellent group for delineating patterns of marine endemism within the Indo-Pacific region.

New Guinea and immediately adjacent archipelagoes support the richest assemblage of such marine Heteroptera in the world. This is partly due to New Guinea's location in a tectonically complex region that represents an intersection zone for various regional marine Heteroptera faunas, including those of the Coral Sea, Solomon Islands, Bismarck Islands, Moluccas and Philippines (POLHEMUS & POLHEMUS 1996). In addition, the warm seas and coral reefs that surround the island have also provided excellent habitats for insular endemic speciation on New Guinea itself, and the great length of the island has allowed differing suites of taxa to develop on its northern and southern coasts.

Local richness of marine Heteroptera in the New Guinea region in turn reaches its highest levels at the western and eastern ends of the island, where the north and south coast faunas intermix amid certain proximal archipelagoes. This pattern was noted by POLHEMUS & POLHEMUS (1996) in regard to the gerrid tribe Stenobatini in the Raja Ampat Islands off the western tip of New Guinea, and recent surveys have shown that a similar situation prevails in the east, amid the islands of the Louisiade, D'Entrecasteaux, and Marshall Bennett groups. This latter area remains a remote and largely undeveloped region that is difficult to reach except by chartered boats or aircraft. In this report we provide the results of three years of intensive survey work on the marine Heteroptera of these islands, all of which lie in Milne Bay Province, a political subdivision of Papua New Guinea.

Milne Bay Province occupies the far eastern extremity of the Papuan Peninsula, or "bird's tail", of eastern New Guinea. The province consists of an onshore section extending from the Mt. Suckling area in the west to Milne Bay in the east, encompassing the eastern terminus of the Owen Stanley Range. To the north and east of Milne Bay, the province continues as a maritime sector for another 400 kilometers, encompassing a vast array of tropical islands and reefs extending around the northern margin of the Coral Sea (Fig. 1). Within this latter area are found high islands with volcanic and metamorphic petrology (Goodenough, Fergusson, Normanby, Tagula, and Rossel), secondarily raised high islands with metamorphic cores surrounded by limestone terraces (Misima, Deboyne, Woodlark, Alcester), low islands composed primarily of sand and limestone (the Trobriands), and true atolls (Egum Atoll and the Conflict Group). Intermixed with these various island types are dozens of reefs, many of them extensive, and some forming barrier reefs and lagoons surrounding some of the high islands (Rossel, Tagula, and the Calvados Chain; see Fig. 1). Well developed mangrove estuaries also occur inside these barrier reefs, particularly along the shores of the larger islands in the Louisiade Archipelago. As a result of this habitat complexity, the maritime sector of Milne Bay Province represents one of the richest areas for marine biodiversity on earth.

Fig. 1: A satellite view of far eastern New Guinea and nearby islands. Note the extensive barrier reefs and lagoons surrounding the islands of the Louisiade Archipelago. For geographical reference and feature names see Figure 3.

Material and Methods

The collections upon which the current study is based were obtained primarily from three research cruises undertaken between 2002 and 2004. These expeditions, which utilized the chartered research vessel Marlin 1 (Fig. 2), were referred to as Kula Ring 1, Kula Ring 2, and Kula Ring 3, in reference to a traditional circuit of ritual trade that circulates among the islands of eastern Papua New Guinea. The cruise tracks for these three expeditions are shown in Figure 3, and their general itineraries are outlined below. Limited samples of marine Heteroptera, primarily from the Killerton Islands, were also made during a preceding land-based expedition centered out of Alotau from 4-13 April 2002.

The Kula Ring 1 expedition was undertaken from 23 August till 5 September 2002. It consisted of an initial foray to the D'Entrecasteaux Islands (Figs 4-6) of Fergusson and Goodenough using the hired work boat John Luke, conducted while the Marlin 1 was in transit to Misima. Following an air transit from Goodenough to Misima via Alotau, the Marlin 1 was used to conduct sampling in the Louisiades, reaching Panatinane, Tagula (Fig.

Fig. 2: The research vessel Marlin 1, shown here at anchor near Mole on Choiseul Island, in the Solomons. Night collections of marine Heteroptera were made by netting insects attracted to an incandescent light attached to the stern rail, while standing on the metal duckboard visible just above water level at the stern of the vessel.

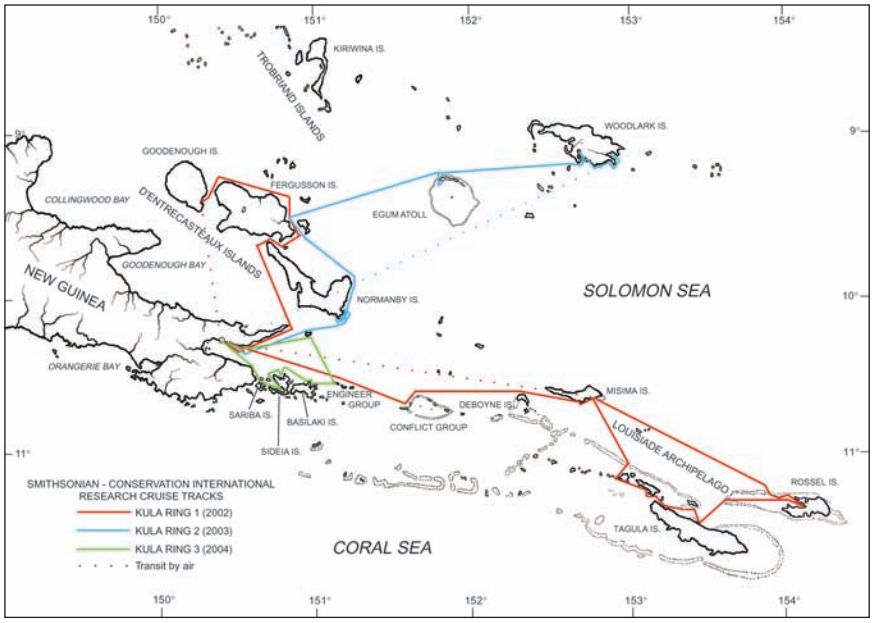


Fig. 3: Research cruise tracks in Milne Bay Province, 2002-2004.

Fig. 4: The north shore of Fergusson Island in the D'Entrecasteaux Islands, looking east toward the Mt. Kilkarran massif. Note the steeply plunging slopes, the absence of a mangrove zone along the shoreline, and the lack of extensive reef or lagoon development.

Fig. 5: A fringing platform reef exposed during low tide at Mebulibuli Point (Station 5), on the eastern shore of Fergusson Island. This area provides habitat for *Halobates hayanus*, *Halobates maculatus*, *Halovelia bergrothi* and *Haloveloides browni*.

Fig. 6: Fringing reefs, like this one in the Amphlett Group near Fergusson Island, are common features of many islands in Milne Bay Province, exposing to various degrees at low tide and providing rich habitats for numerous species of marine Gerridae, Hermatobatidae, and Veliidae.

7), Rossel, and Misima, as well as a stop at Conflict Atoll on the return leg to Alotau.

The Kula Ring 2 expedition extended from 22-31 January 2003, with the research team flying to Woodlark Island (Figs 8-10), where the Marlin 1 had been pre-positioned. Extensive sampling was conducted on Woodlark, followed by a transit to Egum Atoll, then onward to Basima on Fergusson Island. From here, the vessel circuited the northern and eastern sides of Normanby Island, anchoring at both Bumana and Kasikasi bays, before returning to Alotau via Nuakata and Iabama islands.

The Kula Ring 3 expedition took place from 13-24 January 2004, beginning in Alotau and heading eastward to the China Strait, then sampling amid the islands immediately beyond (Figs 11-12), including Sariba, Lesimano, Sideia, and Basilaki. From here the Marlin 1 sailed to Tubetube in the Engineer Group, finally returning to Alotau via Nuakata Island.

A subsequent expedition in March of 2005, dubbed "Beyond the Kula Ring," used the Marlin 1 to sample marine habitats in the Solomon Islands, reaching Gizo, Ranongga, Vella Lavella, Choiseul, Kolombangara, Rendova and New Georgia. Although peripheral to the current report, certain samples from this latter expedition are treated herein when they have direct bearing on taxonomic interpretations for the Milne Bay Province biota.

Overall, collections of marine Heteroptera, or true bugs, were made at 41 sampling stations in Milne Bay Province between April 2002 and January 2004. These

Fig. 7: Tagula Island in the Louisiade Archipelago, seen from offshore at Mohuwo Point (Station 9). Note the hilly interior with relatively low relief, making an abrupt transition to a dense, nearly unbroken fringe of low stature mangroves along the shoreline. Marine Heteroptera at this locality included *Halobates hayanus*, *Halobates murphyi*, *Halobates sericeus*, and *Halovelia novoguinensis*.

sampling stations included sites in and around Milne Bay itself and on the immediately adjacent islands of Killerton, Iabama, Nuakata, Sariba, Lesimano, Sideia, and Basilaki, as well as sites in the D'Entrecasteaux Islands (Fergusson and Normanby islands), the Louisiades (Panatinane, Tagula, Rossel, Wola, and Misima islands), the Engineer Group (Tubetube Island), the Conflict Group (Irai Island), the Marshall Bennett Islands (Woodlark Island), and Egum Atoll (Yanaba Island). The locations of these sampling stations are shown in Figures 13 and 14. In addition, ancillary collections of marine Heteroptera were made from sites further west on New Guinea proper, including Tufi and Kamiali on the northern coast of the Papuan Peninsula, and at Bootless Inlet near Port Moresby on the southern coast, to provide regional faunal context for the current study.

The individual sites sampled are listed below; all lie within the Milne Bay Province of Papua New Guinea. Data for additional material from areas beyond Milne Bay Province, which is provided for certain species in order to clarify geographic ranges or ecological preferences, is listed as "Extralimital material examined" for the purposes of this study. All GPS readings are in WGS 84 datum, and were taken using Garmin GPS 48 and Garmin GPSmap 76S hand held GPS units. Salinity values are given in parts per thousand (ppt) and were taken at the water surface using a Fischer

Fig. 8: Suloga Harbor (Station 22), a nearly landlocked embayment on Woodlark Island. The margins of the bay are lined with low, dense mangrove forest (see Fig. 9), backed by lowland freshwater swamp forest. The calm waters of the bay itself supported *Halobates calyptus* and *Xenobates seminulum*.

Fig. 9: Low, dense mangrove forest along a tidal creek draining to Suloga Harbor (Station 21) on Woodlark Island. Areas such as this are prime habitat for *Xenobates* species, in this case supporting *Xenobates seminulum* along the channel margins. The open waters of the mid-channel provided habitat for *Halobates murphyi* and *Rheumatometroides browni.*

Fig. 10: The Sinkwarai River estuary on eastern Woodlark Island (Station 19). Long, horizontally stratified estuaries such as this produce complex mixohaline habitats in which taxa typical of both marine and freshwater systems intermingle, creating unique species assemblages. Aquatic Heteroptera collected at this site included *Rheumatometroides browni*, *Halobates murphyi*, *Xenobates seminulum*, *Haloveloides papuensis* and *Mesovelia vittigera*.

Scientific hand refractometer. Temperatures were similarly taken at the water surface using a hand-held thermometer. The 7000-series CL numbers indicate collection locality numbers used by the authors to catalog sampling sites in New Guinea as a whole. Collections at each locality were made by both J.T. Polhemus and D.A. Polhemus unless otherwise noted. Alternate names for geographical features are provided in brackets.

Fig. 11: Hemoe Bay on the northern shore of Basilaki Island (Station 38), east of the China Strait. Note the mountainous interior topography, and the partial fringe of mangroves along the shoreline. The calm waters provide habitat for *Hermatobates kula* nov.sp., *Halobates princeps*, *Halobates murphyi*, *Halovelia bergrothi*, *Haloveloides papuensis*, *Xenobates caudatus*, *Xenobates kanakopi* nov.sp. and *Ocheovelia heissi* nov.sp.

In the subsequent Material Examined sections under each species, only abbreviated citations for these collecting localities are provided (except in the case of new species described herein), in order to avoid needless duplication of text. In every case, the cited station number corresponds to the same station number in the list below.

Station 1: New Guinea, Upalai River at Haluwia, 8.5 mi. E of Alotau on East Cape road, terminal reach, 0 m [sea level], water temp. 26-26.5° C, salinity in estuary 2-10 ppt, 4 April 2002, 09:30-12:00 hrs., CL 7162, 10°20'28"S, 150°34'23"E.

Station 2: Killerton Islands, N side of Milne Bay, E of Alotau, 0 m [sea level], sea temp. 31° C, salinity 34 ppt, 8 April 2002, CL 7167, 10:00-13:00 hrs., 10°21'03"S, 150°38'14"E.

Station 3: New Guinea, sea offshore of W side of Lihitabu Point, N side of Milne Bay, E of Alotau, 0 m [sea level], sea temp. 29° C, salinity 33 ppt, 8 April 2002, 16:00-16:30 hrs., CL 7168, 10°21'13"S, 150°35'05"E.

Station 4: New Guinea, wetland at mouth of Budo Creek, W side of Alotau, 0 m [sea level], water temp. 29.5° C (creek), 28° C (ponds), 31° C (sea), salinity 1 ppt (ponds), 31 ppt (sea), 13 April 2002, 09:00-09:45 hrs., CL 7177, 10°18'24"S, 150°26'16"E.

Station 5: D'Entrecasteaux Islands, Fergusson Island, east coast, exposed reef flat at Mebulibuli Point, 0 m [sea level], sea temp. 33° C, salinity 32 ppt, 23 August 2002, 14:30-15:45 hrs., CL 7179, 9°30'18.8"S, 150°52'58.5"E.

Station 6: D'Entrecasteaux Islands, Fergusson Island, east coast, Mebulibuli Creek estuary, S. of Basima, 0 m [sea level], water temp. 24-28° C, salinity 5 ppt, 24 August 2002, 15:30-15:45 hrs., CL 7182, 9°30'14.1"S, 150°52'18.0"E.

Station 7: Louisiade Archipelago, Calvados Chain, Panatinane Island, Huniye Bay, 0 m [sea level], sea temp. 26° C, salinity 36 ppt, 28 August 2002, 19:00-20:00 hrs., at light, CL 7189, 11°16'22.0"S, 153°10'49.7"E.

Station 8: Louisiade Archipelago, Tagula [Sudest] Island, Kalitau Creek estuary, 4 km W of Mohuwo Point [Nepenthes Point], 0 m [sea level], sea temp. 29° (head of estuary)-26.5° C (mouth of estuary), salinity 12 ppt (head of estuary)-32 ppt (mouth of estuary), 29 August 2002, 14:30-15:00 hrs., CL 7191, 11°21'20.2"S, 153°14'55.8"E.

Station 9: Louisiade Archipelago, Tagula [Sudest] Island, sea offshore of Mohuwo Point [Nepenthes Point], 0 m [sea level], sea temp. 25.5° C, salinity 36 ppt, 29 August 2002,

19:00-20:00 hrs., at light, CL 7193, 11°21'58.7"S, 153°16'29.3"E.

Station 10: Louisiade Archipelago, Tagula [Sudest] Island, Kolukolu Creek estuary, near Araeda [Araetha] village, 0 m [sea level], sea temp. 25.5°C, salinity 8-10 ppt, 30 August 2002, 16:00-20:00 hrs., CL 7195, 11°26'14.7"S, 153°26'07.5"E.

Station 11: Louisiade Archipelago, Rossel [Yela] Island, Woa River estuary near Wulanga Bay, 0 m [sea level], 1 September 2002, 12:00-13:00 hrs., CL 7197, 11°19'48.6"S, 154°07'31.7"E.

Station 12: Louisiade Archipelago, Rossel [Yela] Island, head of Yonga Bay [Ionga Bay], 0 m [sea level], sea temp. 25.5°C (mangrove creek)-27°C (along shoreline of bay), salinity 5 ppt (mangrove creek)-32 ppt (bay), 31 August 2002, 19:00-20:00 hrs., CL 7198, 11°20'44.6"S, 154°06'55.8"E.

Station 13: Louisiade Archipelago, Wola [Wula] Island, Rossel Lagoon, north side, 0 m [sea level], sea temp. 25.5°C, salinity 36 ppt, 1 September 2002, 19:00-22:30 hrs., at light, CL 7199, 11°18'05.4"S, 154°00'51.6"E.

Station 14: Louisiade Archipelago, Misima Island, Bwagoia harbor, 0 m [sea level], sea temp. 26°C, salinity 36 ppt, 2 September 2002, 19:00-20:00 hrs., at light, CL 7200, 10°41'15.7"S, 152°50'45.6"E.

Station 15: Louisiade Archipelago, Misima Island, south coast, small bay 0.5 km NW of Tabula Point, 0 m [sea level], sea temp. 26°

Fig. 12: Tall mangrove forest at the mouth of the Kwabunamoa River on Sideia Island (Station 36); high stature mangrove forests of this type are typical of New Guinea and the nearby islands surrounding the China Strait, but rarely encountered in the more remote islands of the D'Entrecasteaux, Louisiade and Marshall Bennett groups (see Figs 9 and 10). This estuary supported *Rheumatometroides browni*, *Halobates murphyi*, *Xenobates kanakopi* nov.sp. and *Xenobates ovatus*.

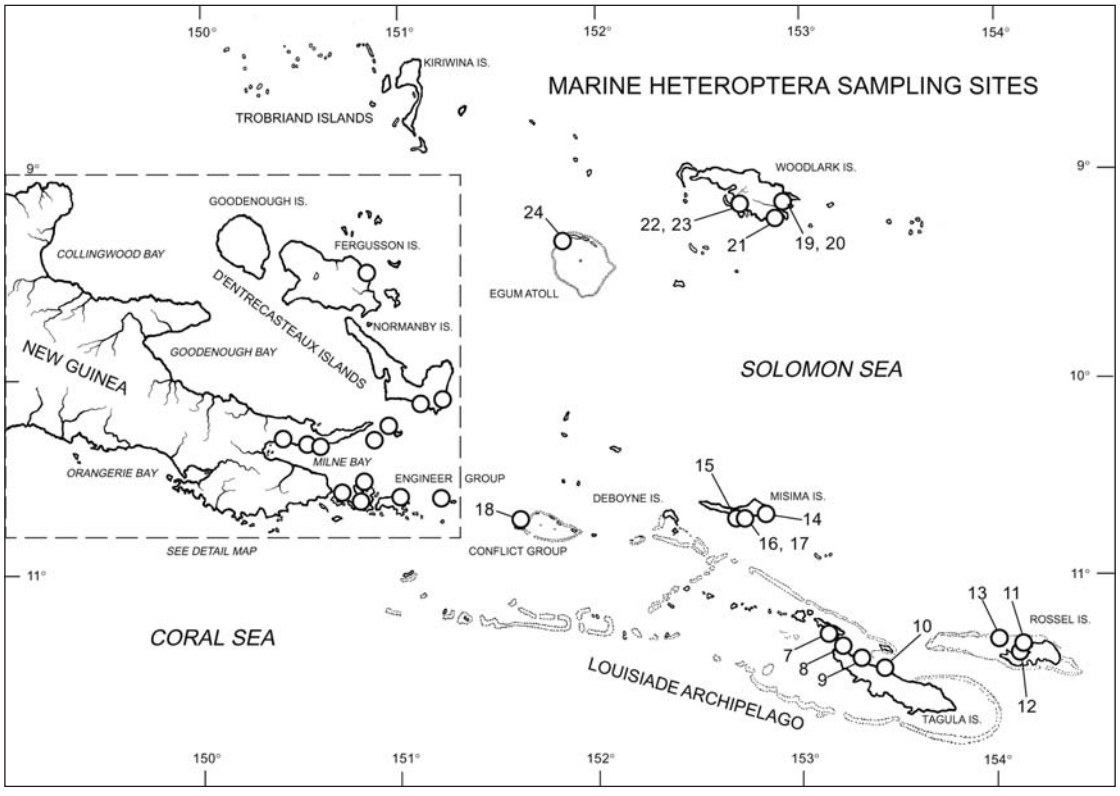


Fig. 13: Marine Heteroptera sampling sites in Milne Bay Province, Papua New Guinea, 2002-2004. For details of sites on New Guinea and in the D'Entrecasteaux Islands see inset map in Figure 14. For a key to the station numbering see the Materials and Methods section.

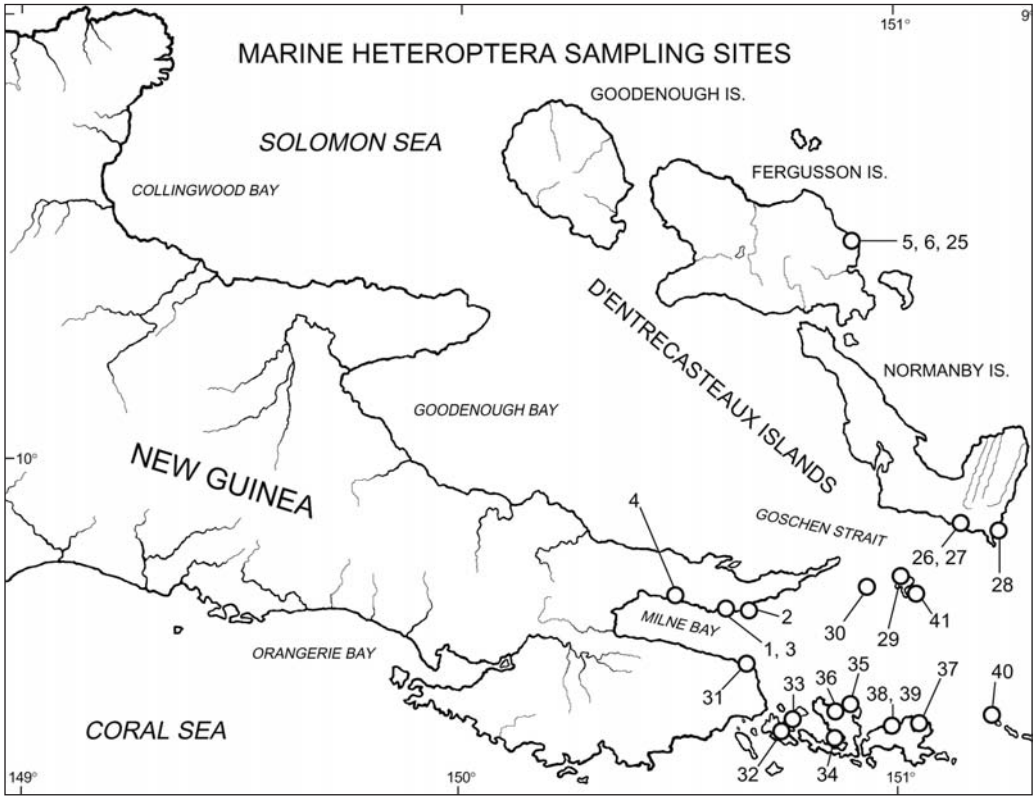


Fig. 14: Marine Heteroptera sampling sites in Milne Bay Province, Papua New Guinea, 2002-2004, providing detail on sampling stations in Milne Bay proper and the D'Entrecasteaux Archipelago. For a key to the station numbering see the Materials and Methods section.

C, salinity 36 ppt, 4 September 2002, 19:00-20:00 hrs., at light, CL 7207, 10°40'34.7"S, 152°37'14.8"E.

Station 16: Louisiade Archipelago, Misima Island, south coast, Lowaga Bay, W of Patnai village, 0 m [sea level], sea temp. 26°C, salinity 36 ppt, 4 September 2002, 12:00-12:30 hrs., CL 7209, 10°41'41.0"S, 152°40'51.2"E.

Station 17: Louisiade Archipelago, Misima Island, south coast, bay at Bwagabwaga village, 0 m [sea level], sea temp. 26°C, salinity 36 ppt, 4 September 2002, 10:30-11:30 hrs., CL 7212, 10°41'11.3"S, 152°40'24.4"E.

Station 18: Conflict Group, Irai Island, north side, 0 m [sea level], sea temp. 26°C, salinity 36 ppt, 4 September 2002, 15:00-20:00 hrs., CL 7213, 10°45'57.5"S, 151°42'29.0"E.

Station 19a: Woodlark Island, upper Sinkwarai River estuary, 0 m [sea level], water temp. 28°C (upper estuary)-29°C (middle estuary), salinity 5 ppt (upper estuary)-17 ppt (middle estuary), 22 January 2003, 14:00-15:30 hrs., CL 7214a, 9°11'28.1"S, 152°51'46.9"E (= far upper estuary) and 9°11'50.6"S, 152°54'53.4"E (= middle estuary).

Station 19b: Woodlark Island, lower Sinkwarai River estuary at head of Kumrau Bay [Kumarau Bay], 0 m [sea level], sea temp. 31°C, salinity 31 ppt, 22 January 2003, 16:00-16:30 hrs., CL 7214b, 9°12'02.5"S, 152°56'17.0"E.

Station 20: Woodlark Island, sea 400 m offshore of Reu Island, near Main Point, E of Guasopa, 0 m [sea level], sea temp. 30°C, salinity 36 ppt, 22 January 2003, 22:00-23:00 hrs., at light, CL 7215, 9°14'46.6"S, 152°56'31.2"E.

Station 21: Woodlark Island, Suloga Peninsula, mangrove estuary on W side of Suloga Harbor, 0 m [sea level], water temp. 28°C (at head of estuary, interface of mangrove to freshwater swamp forest), salinity 5 ppt (at head of estuary), 23-24 January 2003, 16:30-18:00 hrs. (23 January 2003) and 07:30-15:30 hrs. (24 January 2003), CL 7218, 9°12'33.6"S, 152°43'32.4"E.

Station 22: Woodlark Island, Suloga Peninsula, sea 400 m offshore of W side of Suloga Harbor, 0 m [sea level], sea temp. 31°C, salinity 36 ppt, 23-24 January 2003, 19:00-22:00 hrs. each day, at light, CL 7219, 9°12'23.1"S, 152°44'06.3"E.

Station 23: Woodlark Island, Suloga Peninsula, mouth of rocky stream entering NE side of Suloga Harbor, 0 m [sea level], water temp. 26°C, salinity (offshore) 36 ppt, 24 January 2003, 12:00-14:00 hrs., CL 7220, 9°11'18.8"S, 152°44'51.0"E (JTP only).

Station 24: Egum Atoll, sea 100 m offshore of Yanaba Island, 0 m [sea level], sea temp. 30°C, salinity 36 ppt, 25 January 2003, 18:30-22:00 hrs., at light, CL 7222, 9°16'46.9"S, 151°53'00.9"E.

Station 25: D'Entrecasteaux Islands, Fergusson Island, east coast, sea 100 m offshore of N side of Mebulibuli Point, 0 m [sea level], sea temp. 29°C, salinity 36 ppt, 26-27 January 2003, 18:30-00:30 hrs. each night (low tide near midnight), CL 7223, 9°30'18.5"S, 150°52'52.8"E.

Station 26: D'Entrecasteaux Islands, Normanby Island, south coast, mixohaline pool behind beach near mouth of Apatabuia River at Bunama, 0 m [sea level], water temp. 28° C, salinity 11 ppt, 28 January 2003, 16:00-18:00 hrs., CL 7226, 10°08'21.8"S, 151°08'47.7"E.

Station 27: D'Entrecasteaux Islands, Normanby Island, Bunama Bay, sea 60 m offshore, 0 m [sea level], sea temp. 29°C, salinity 36 ppt, 28 January 2003, 18:30-23:00 hrs., CL 7227, 10°08'37.9"S, 151°09'12.4"E.

Station 28: D'Entrecasteaux Islands, Normanby Island, east coast, Kasikasi Bay, sea 200 m offshore, 0 m [sea level], sea temp. 28°C, salinity 36 ppt, 29 January 2003, 19:00-00:30 hrs., CL 7229, 10°09'04.5"S, 151°13'56.2"E.

Station 29: Nuakata Island, north coast, Haliwa Una Bay, sea 150 m offshore, 0 m [sea level], sea temp. 28°C, salinity 36 ppt, 30 January 2003, 19:00-00:00 hrs, CL 7233, 10°16'20.4"S, 151°00'34.9"E.

Station 30: Iabama Island, northeast coast, sea 100 m offshore, 0 m [sea level], sea temp. 28°C, salinity 36 ppt, 31 January 2003, 08:00-09:00 hrs, CL 7234, 10°16'44.7"S, 150°55'59.5"E.

Station 31: New Guinea, Kana Kopi Bay, ESE of Alotau, 0 m [sea level], sea temp. 29°C, salinity 36 ppt, 13 January 2004, 19:30-22:00 hrs., CL 7283, 10°28'54.3"S, 150°39'10.2"E.

Station 32: Sariba Is., mangrove estuary at head of Tanabuibuina Bay, 0 m [sea level], sea temp. 28°C, salinity 2 ppt (head of estuary)-33 ppt (mouth of estuary), 14 January 2004, 09:30-09:45 hrs., CL 7284, 10°35'14.2"S, 150°42'25.9"E.

Station 33: Lesimano Is., N of Sariba Is., south shore, 0 m [sea level], sea temp. 29°C, salinity 36 ppt, 14 January 2004, 21:00-22:00 hrs., CL 7286, 10°34'36.1"S, 150°42'49.4"E.

Station 34: Sideia Is., Jenkin's Bay, 0 m [sea level], sea temp. 31°C, salinity 36 ppt, 15 January 2004, 10:00-14:00 hrs., CL 7289, 10°36'45"S, 150°45'35"E.

Station 35: Sideia Is., Wiwiyai Bay, 0 m [sea level], sea temp. 30°C, salinity 36 ppt, 15 January 2004, 20:00-21:30 hrs., CL 7290, 10°32'50"S, 150°49'28.5"E.

Station 36: Sideia Is., mangrove estuary at head of Kwabunamoa Bay, 0 m [sea level], water temp. 31°C, salinity 6 ppt (head of estuary)-34 ppt (mouth of estuary), 16 January 2004, 10:45-11:00 hrs. and 13:30-13:45 hrs., CL 7291, 10°34'19.7"S, 150°50'41.8"E.

Station 37: Basilaki Is., Babana Bay, E of North Point, 0 m [sea level], sea temp. 30°C, salinity 36 ppt, 16 January 2004, 20:30-23:00 hrs., CL 7293, 10°35'58.0"S, 151°02'01.4"E.

Station 38: Basilaki Is., Hemoe Bay, 0 m [sea level], sea temp. 29.5°C, salinity 36 ppt, 17 January 2004, 20:30-23:00 hrs., CL 7295, 10°35'41.5"S, 150°59'57.5"E.

Station 39: Basilaki Is., Guiagoila River estuary, head of Hemoe Bay, 0 m [sea level], water temp. 27°C (head of estuary)-29°C (mouth of estuary) salinity 4 ppt (head of estuary)-29 ppt (mouth of estuary), 18 January 2004, 08:30-08:45 hrs., CL 7297, 10°36'01.7"S, 150°59'44.7"E.

Station 40: Tubetube Is., Engineer Group, bay on NE side, 0 m [sea level], sea temp. 29°C, salinity 36 ppt, 18 January 2004, 20:00-24:00 hrs., CL 7298, 10°35'13.1"S, 151°12'12.4"E.

Station 41: Nuakata Is., Dudawali Bay, 0 m [sea level], sea temp. 30°C, salinity 36 ppt, 19 January 2004, 20:00-24:00 hrs., CL 7301, 10°17'35.9"S, 151°00'33.4"E.

Marine Heteroptera were collected intensively at each of the above sampling stations. Collections were made by visual searching and hand netting on exposed reef flats at low tide; trolling of nets from an inflatable dinghy on deep mangrove creeks; and hand netting of insects attracted to a incandescent lamp attached to the stern of Marlin 1 while moored offshore at night. In the latter case, a researcher would stand at water level on a duckboard made of metal grating and attached to the stern of the boat (Fig. 2), and then net insects from the surface as they skated through the circle of light cast by the lamp. Specimens collected by all the above methods were preserved in 75 % ethanol, then transported to the Bishop Museum and Smithsonian Institution for detailed analysis and identification.

The majority of the specimens from these collections are deposited in the U.S. National Museum of Natural History, Washington, DC (USNM), with synoptic series held in the Bishop Museum, Honolulu

(BPBM), and the Polhemus Collection, Colorado Entomological Institute, Englewood, Colorado (JTPC); the latter will eventually be placed in the USNM. Duplicates will also eventually be provided to an appropriate specimen depository specified by the Papua New Guinea Department of Environment and Conservation (DEC).

In the following taxonomic section the descriptions of new taxa of water striders in the subfamily Haloveliinae follow the basic format of ANDERSEN (1989a, 1989b) for *Halovelia*, ANDERSEN & WEIR (1999) for *Xenobates*, and ANDERSEN & WEIR (2000) for *Hermatobates*. The generic descriptions given in these works are not repeated here, so the reader is directed to them for guidance in species concepts and discrimination, as well as keys and comparisons. Our objective in following the format established by Andersen is to facilitate comparison between the new taxa described herein and those previously described. In addition, the illustrated key to the *Halobates* species of the world recently published by ANDERSEN & CHENG (2004) is considered adequate, therefore only diagnostic notes for species are given here. All measurements in are given in mm.

All of the truly marine species treated here are apterous, with no wings or wing rudiments, as is true for all obligate marine water striders. By contrast, certain predominantly freshwater genera that commonly invade mixohaline habitats (e.g. *Mesovelia*, *Rhagadotarsus*) may be winged, and sometimes occur intermixed with truly marine or estuarine Gerridae and Veliidae. Records of these taxa are included here, but with the recognition that such taxa are not part of the truly marine Heteroptera fauna of the region.

Taxonomy

Family Gerridae
Subfamily Halobatinae

The Halobatinae exhibit a high diversity in Milne Bay Province, with eight *Halobates* species represented in our collections.

Genus *Halobates* ESCHSCHOLTZ 1822 (Figs 15-20)

Halobates calyptus HERRING (Fig. 15)

Discussion. *Halobates calyptus* is closely related to *Halobates hayanus*, and the species are easily confused. HERRING (1961) states that *H. calyptus* has a completely dark first antennal segment, whereas in most specimens we have examined the antennal base is narrowly yellowish (vs. *H. hayanus* which has the base variably yellowish, but often as narrowly as in *H. calyptus*). Apart from the male genitalia, the key character separating the two species is the ventral surface of the female fore femur, which in *H. hayanus* is entirely bright clear yellow, while in *H. calyptus* is at most an elongate yellowish stripe tapering distally, although sometimes extending almost the entire length of the femur. ZETTEL (2005) uses different characters to separate these species in the Philippines, but they are only marginally useful in regard to the New Guinea material.

This species, in company with *H. maculatus* and *H. proavus*, forms part of a *Halobates* assemblage that occurs in proximity to periodically exposed reef crests and over the fore reef waters immediately beyond. In the Kamiali area, southeast of Lae, it was often the numerically dominant species within this assemblage, foraging near mats and windlines of floating debris. Individuals have also been collected further inshore along the margins of sheltered bays lined by both rocky shores and mangroves, indicating that this species can utilize a broad range of nearshore habitats.

Distribution. *Halobates calyptus* was originally described from Mindoro Island in the Philippines, and occurs widely in that archipelago, with additional records from Sulawesi, New Guinea and the Solomon Islands (HERRING 1961; ANDERSEN & CHENG 2004). Our surveys have extended the range of this species far to the south, demonstrating that it occurs in Milne Bay, the islands near China Strait, the D'Entrecasteaux Islands, the Marshall Bennett Islands, the Louisiade Archipelago, and New Britain.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 1♂, 7♀♀, New Guinea, Station 1, Upalai River terminal reach at Haluwia;

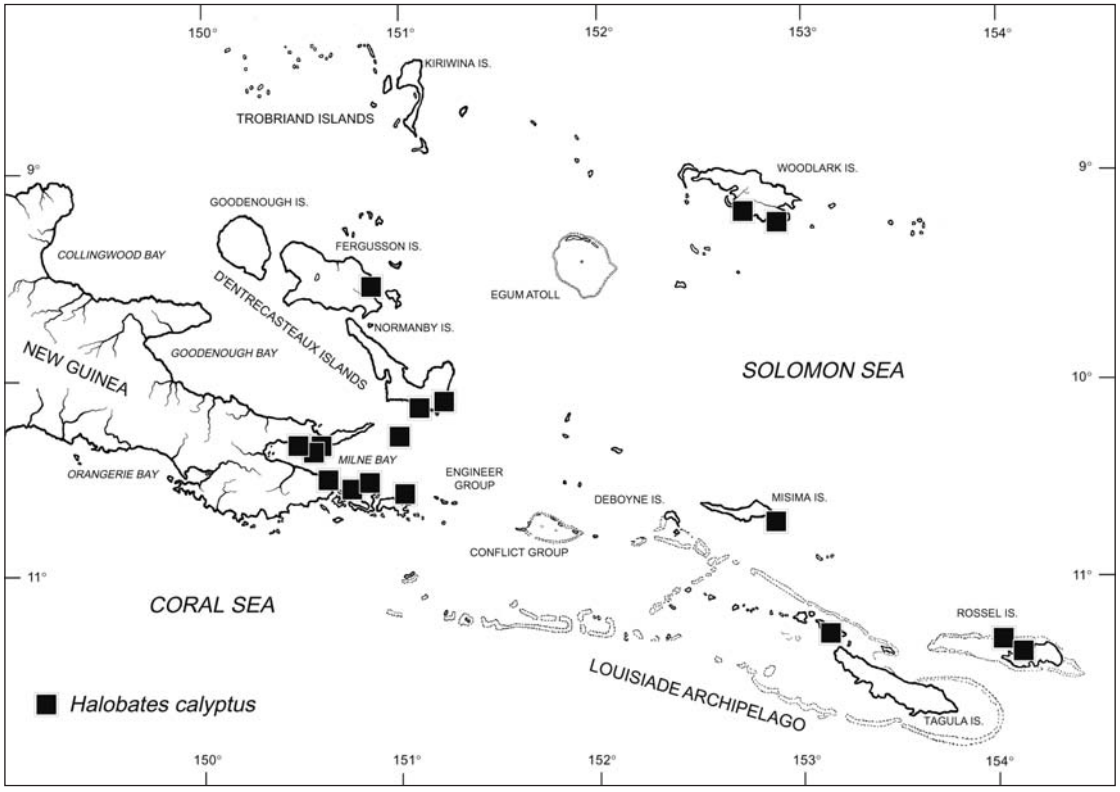


Fig. 15: Distribution of *Halobates calyptus* on far eastern New Guinea and nearby islands.

5♂♂, 5 ♀♀, New Guinea, Station 2, Killerton Islands; 19♂♂, 17 ♀♀, New Guinea, Station 3, offshore of Lihitabu Point; 4♂♂, 8 ♀♀, Panatinane Island, Station 7, Huniye Bay; 7♂♂, 8 ♀♀, Rossel Is., Station 12, head of Yonga Bay; 18♂♂, 32 ♀♀, Wola Island (Rossel Lagoon), Station 13, north side; 2 ♀♀, 2 nymphs, Misima Island, Station 14, Bwagoia harbor; 1♂, 1 ♀, Woodlark Is., Station 20, sea offshore of Main Point; 2♂♂, 5 ♀♀, Woodlark Is., Station 21, mangroves on W side of Suloga Harbor; 10♂♂, 12 ♀♀, Woodlark Is., Station 23, rocky creek on NW side of Suloga harbor; 29♂♂, 22 ♀♀, Normanby Is., Station 27, Bunama Bay; 89♂♂, 59 ♀♀, Normanby Is., Station 28, Kasikasi Bay; 1♂, New Guinea, Station 31, Kana Kopi Bay; 12♂♂, 13 ♀♀, Lesimano Is., Station 33, south shore; 2♂♂, Sideia Is., Station 35, Wiwiyai Bay; 3♂♂, 2 ♀♀, Basilaki Is., Station 37, Babana Bay; 3 ♀♀, Nuakata Is., Station 41, Dudawali Bay (USNM, BPBM, JTPC).

Extralimital material examined: PAPUA NEW GUINEA, **Morobe Prov.**: 47♂♂, 37 ♀♀, Cape Roon, 150 m offshore, 0 m [sea level], 7°20'44.8"S, 147°09'33.4"E, sea temp. 30°C, salinity 29 ppt, 2 May 2003, 10:00-10:30 hrs., CL 7237, D.A. Polhemus (USNM); 12♂♂, 7 ♀♀, Jawani Island, SW side, 0 m [sea level], 7°20'38.7"S, 147°12'16.2"E, sea temp. 33°C, salinity 27 ppt, 2 May 2003, 14:00-15:00 hrs., CL 7239, D.A. Polhemus (USNM); 1♂, mangrove creek SW of Cape Roon, 0 m [sea level], 7°20'52.1"S, 147°08'31.6"E, water temp. 27°C, salinity 3 ppt, 3 May 2003, 10:00-11:00 hrs., CL 7240, D.A. Polhemus (USNM); 20♂♂, 4 ♀♀, rocky point N of Cape Dinga [= Yaraku Point], 0 m [sea level], 7°18'03.8"S, 147°08'35.3"E, sea temp. 30°C, salinity 30 ppt, 4 May 2003, 10:00-12:30 hrs., CL 7242, D.A. Polhemus (USNM). **Oro Prov.**: 3♂♂, Tufi Harbor, cliff-bound rocky shore near village dock, 0 m [sea level], 9°04'57.0"S, 149°19'15.0"E, 24 January 2004, 23:00-24:00 hrs., CL 4468, J.T. Polhemus (JTPC). **West New Britain Prov.**: 28♂♂, 21 ♀♀, New Britain, Wilaumez Peninsula, nearshore sea at Walindi Plantation, N of Kimbe, 0 m [sea level], sea temp. 28°C, 11 January 2005, 20:00-21:00 hrs., at light from stern of boat at night, CL 7342, D.A. Polhemus (USNM); 9♂♂, 12 ♀♀, New Britain, Kimbe Bay, Restorff Island, calm sea on W side, 0 m [sea level], 5°17'35.7"S, 150°06'15.6"E, sea temp. 29°C, salinity 35 ppt, 16 January 2005, 10:45-13:45 hrs., CL 7347, D.A. Polhemus (USNM, BPBM).

Halobates germanus White (Fig. 16)

Discussion. This pelagic *Halobates* species is widespread throughout the Indian and southwest Pacific oceans. It was taken in Milne Bay Province on only one occasion, in Bwagoia Harbor on Misima Island in the Louisiade Archipelago on a rather rough and windy night.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 10♂♂, 19 ♀♀, 1 nymph, Misima Island, Station 14, Bwagoia harbor (USNM, JTPC).

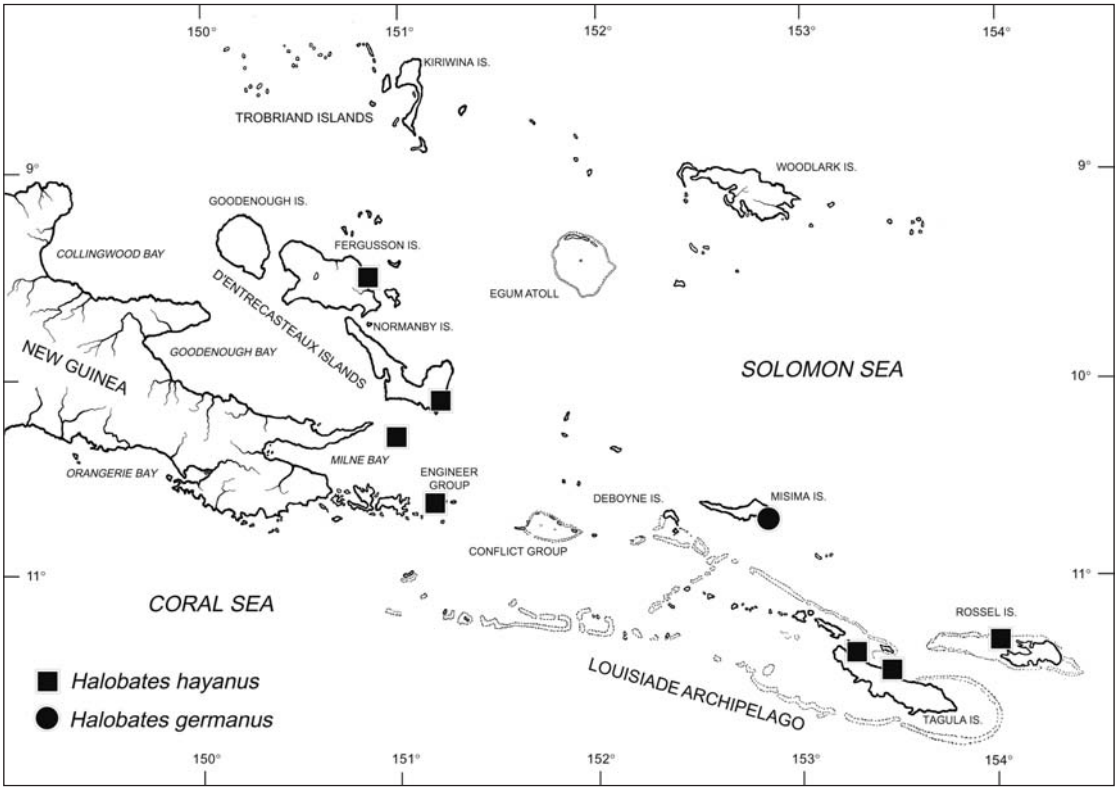


Fig. 16: Distribution of *Halobates hayanus* and *Halobates germanus* on far eastern New Guinea and nearby islands.

Halobates hayanus WHITE (Fig. 16)

Discussion. *Halobates hayanus* is most closely related to *H. calyptus*, and the two are easily confused, however the female fore femur of *H. hayanus* has the entire ventral side entirely clear bright yellow; see discussion under *H. calyptus* for additional notes.

Halobates hayanus is most commonly found close inshore, in backreef lagoon areas, where it is often encountered skating above seagrass beds at low tide. Stray individuals are also occasionally found further offshore on the waters at or beyond the reef crest, where they form part of a mixed species assemblage including *H. maculatus* and *H. princeps*, with the latter two species dominating numerically; in deep, sheltered bays protected by reefs this same assemblage may also be present, but with *H. hayanus* numerically dominant instead. *Halobates hayanus* is also sometimes present at the mouths of mangrove estuaries, where it may be syntopic with *H. murphyi*, but it does not range far up the mixohaline waters of such estuaries as does the latter species.

Distribution. *Halobates hayanus* has a broad range in the Indo-Pacific, being found from the Red Sea eastward through the Nicobar Islands, Thailand, Malaysia, the coasts of the South China Sea, Java, Bali, Sulawesi, the Philippines and the Moluccas to New Guinea (HERRING 1961; ANDERSEN & CHENG 2004). Our surveys have extended this distribution to Milne Bay, the Engineer Group, the D'Entrecasteaux Islands, and the Louisiade Archipelago.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 2♂♂, 3 ♀♀, Fergusson Is., Station 5, reef flat at Mebulibuli Point; 1♂, 5 ♀♀, Tagula Is., Station 9, Mohuwo Point; 2♂♂, 2 ♀♀, Tagula Is., Station 10, Kolukolu Creek estuary; 14♂♂, 31 ♀♀, Wola Island (Rossel Lagoon), Station 13, north side; 3♂♂, 8 ♀♀, Fergusson Is., Station 25, offshore of Mebulibuli Point; 5♂♂, 9 ♀♀, Normanby Is., Station 28, Kasikasi Bay; 14♂♂, 32 ♀♀, Nuakata Is., Station 29, Haliwa Una Bay; 7♂♂, 21 ♀♀, Tubetube Is., Station 40, bay on NE side (USNM, BPBM, JTPC).
Extralimital material examined: PAPUA NEW GUINEA, **Morobe Prov.**: 2♂♂, nearshore seagrass beds at Nasau Bay, nr. Lababia village, 0 m [sea level], 7°18'02.0"S, 147°08'01.4"E, sea temp. 30° C, 2 May 2003, 09:00-09:15 hrs., CL 7236, D.A. Polhemus (USNM). EAST TIMOR, **Dili Dist.**: 11♂♂, 11 ♀♀, exposed reef crest at Bekarit, Areia Branca Bay, 4.5 km E of Dili, 0 m [sea level], 8°32'20.6"S, 125°36'48.0"E, sea temp. 34 °C, 11 November 2003, 08:30-09:30 hrs., CL 7265, D.A. Polhemus (USNM). **Lautem Dist.**: 11♂♂, 9 ♀♀, nearshore mangroves and exposed reef crest 16 km SW of Lautem, 0 m [sea level],

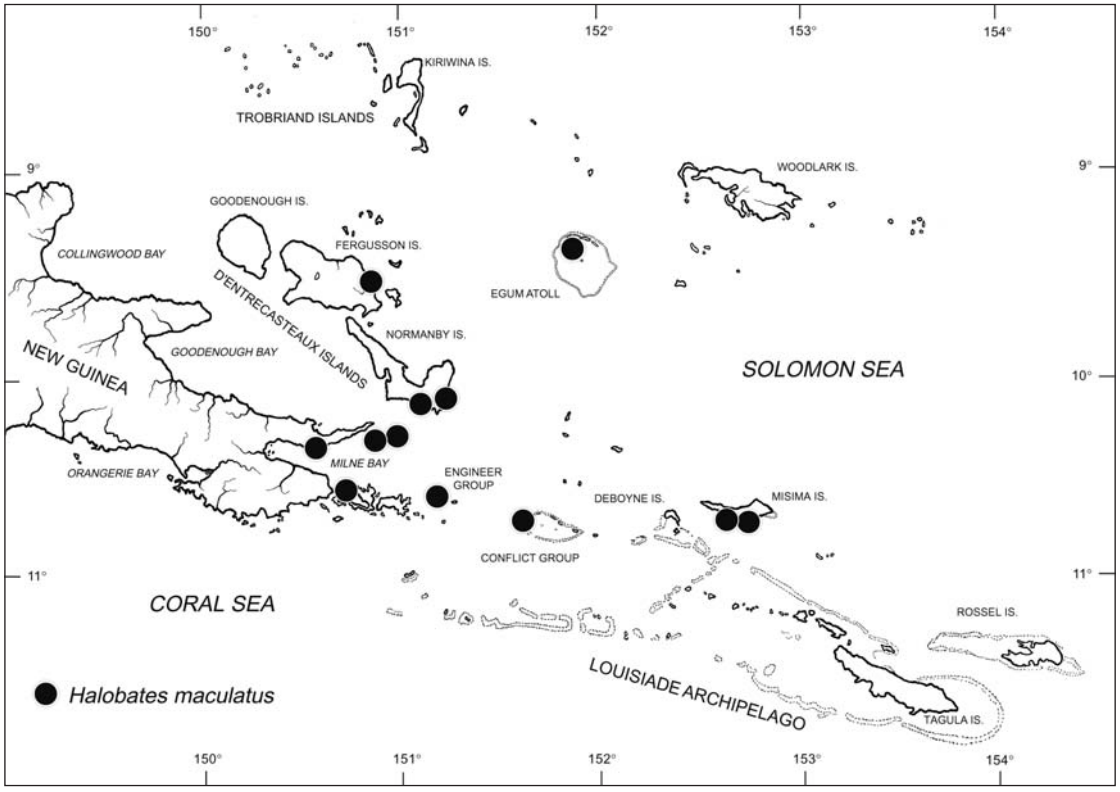


Fig. 17: Distribution of *Halobates maculatus* on far eastern New Guinea and nearby islands.

8°25'19.9"S, 126°46'01.7"E, sea temp. 33 °C, 17 November 2003, 15:00-16:00 hrs., CL 7275, D.A. Polhemus (USNM).

Halobates maculatus Schadow (Fig. 17)

Discussion. *Halobates maculatus* is a member of the local *Halobates* assemblage that is commonly found in fore-reef habitats immediately seaward of the reef crest. It is also one of the limited assemblage of *Halobates* species occurring around the atolls of Milne Bay Province, such as Egum and Conflict, where it co-occurs with *H. princeps* and *H. sericeus*, although it ranges closer inshore than these latter two species. In sandy areas where seagrass beds are absent, such as at Mebulibuli Point on Fergusson Island, or Irai Island at Conflict Atoll, *H. maculatus* may skate abundantly in the nearshore shallows, essentially replacing *H. hayanus*.

Distribution. This species was originally described from the St. Matthias Group in the Bismarck Archipelago, and was also previously recorded from Sulawesi, the Philippines, the Madang area of northeastern New Guinea, and the Solomon Islands (Herring 1961; Andersen & Cheng 2004; Zettel 2005). The current surveys have extended the distribution of this species well to the south, with new records from Milne Bay, the D'Entrecasteaux Islands, the Engineer Group, the Conflict Group, and the Louisiade Archipelago, as well as from New Britain. The distribution of this species is largely congruent with that of *Rheumatometroides browni*, suggesting that these species may be part of a regional marine Heteroptera biota influenced by similar tectonic or ecological processes (Polhemus & Polhemus 1998).

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 2 ♀♀, New Guinea, Station 3, offshore of Lihitabu Point; 52♂♂, 37 ♀♀, Fergusson Is., Station 5, reef flat at Mebulibuli Point; 8♂♂, 5 ♀♀, Misima Island, Station 16, Lowaga Bay; 6♂♂, 3 ♀♀, Misima Island, Station 17, bay at Bwagabwaga village; 6♂♂, 11 ♀♀, Irai Island (Conflict Atoll), Station 18, north side; 29♂♂, 34 ♀♀, Yanaba Is. (Egum Atoll), Station 24, sea, offshore of S side; 6♂♂, 3 ♀♀, Fergusson Is., Station 25, offshore of Mebulibuli Point; 5♂♂, 3 ♀♀, Normanby Is., Station 27, Bunama Bay; 1♂, Normanby Is., Station 28, Kasikasi Bay; 3♂♂, Nuakata Is., Station 29, Haliwa Una Bay; 4♂♂, 9 ♀♀, Iabama Is., Station 30, northeast side; 1♂, Lesimano Is., Station 33, south shore; 22♂♂, 27 ♀♀, Tubetube Is., Station 40, bay on NE side; 1 ♀, Nuakata Is., Station 41, Dudawali Bay (USNM, BPBM, JTPC).

Extralimital material examined: PAPUA NEW GUINEA, **Morobe Prov.**: 7♂♂, 6 ♀♀, Cape

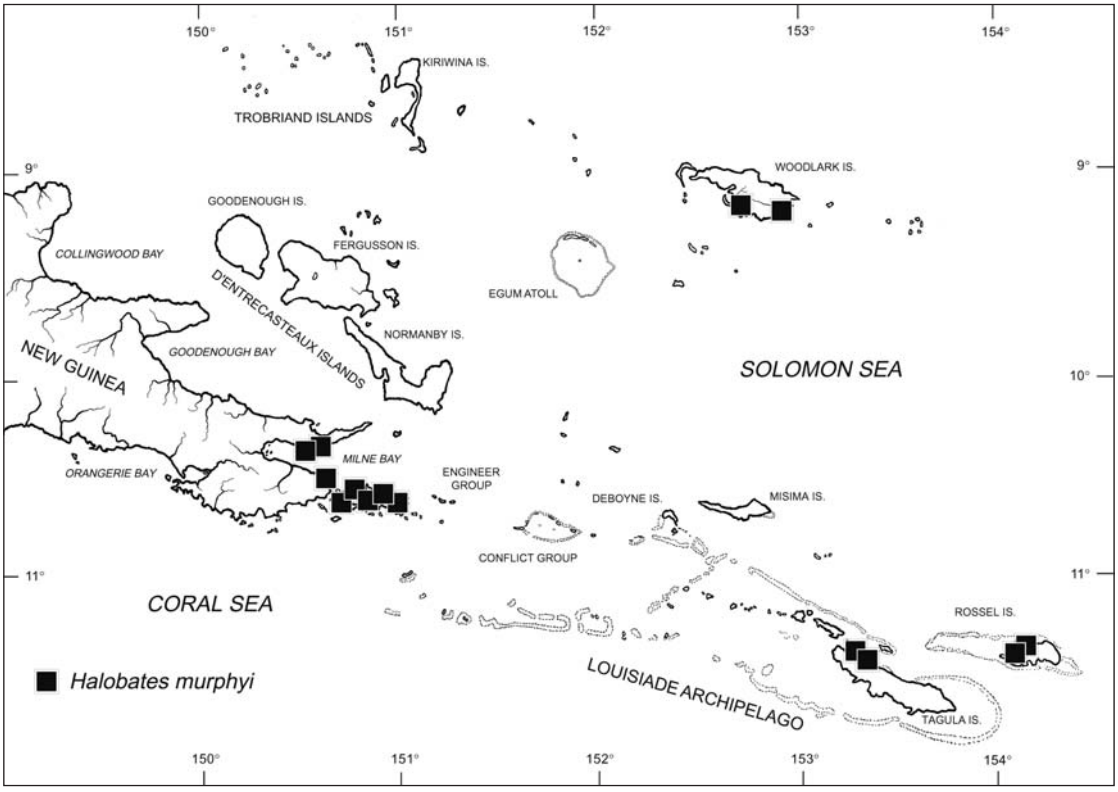


Fig. 18: Distribution of *Halobates murphyi* on far eastern New Guinea and nearby islands.

Roon, 150 m offshore, 0 m [sea level], 7°20'44.8"S, 147°09'33.4"E, sea temp. 30° C, salinity 29 ppt, 2 May 2003, 10:00-10:30 hrs., CL 7237, D.A. Polhemus (USNM); 15♂♂, 4♀♀, Jawani Island, SW side, 0 m [sea level], 7°20'38.7"S, 147°12'16.2"E, sea temp. 33° C, salinity 27 ppt, 2 May 2003, 14:00-15:00 hrs., CL 7239, D.A. Polhemus (USNM); 1♀, rocky point N of Cape Dinga [= Yaraku Point], 0 m [sea level], 7°18'03.8"S, 147°08'35.3"E, sea temp. 30° C, salinity 30 ppt, 4 May 2003, 10:00-12:30 hrs., CL 7242, D.A. Polhemus (USNM). **West New Britain Prov.**: 5♂♂, 1♀, New Britain, Kimbe Bay, Restorff Island, calm sea on W side, 0 m [sea level], 5°17'35.7"S, 150°06'15.6"E, sea temp. 29° C, salinity 35 ppt, 16 January 2005, 10:45-13:45 hrs., CL 7347, D.A. Polhemus (USNM, BPBM). EAST TIMOR, **Dili Dist.**: 6♀♀, exposed reef crest at Bekarit, Areia Branca Bay, 4.5 km E of Dili, 0 m [sea level], 8°32'20.6"S, 125°36'48.0"E, sea temp. 34 °C, 11 November 2003, 08:30-09:30 hrs., CL 7265, D.A. Polhemus (USNM).

Halobates murphyi J. Polhemus & D. Polhemus (Fig. 18)

Discussion. *Halobates murphyi* is a typical associate of mangroves, and is often collected in sheltered bays with a mangrove fringe. It is also the only *Halobates* species in the Milne Bay region to be found at any distance up mixohaline mangrove creeks, where we have taken it on waters with salinities as low as 17 ppt. Further northwest, along the northern coast of New Guinea proper, one of us (DAP) collected *H. murphyi* on a mangrove creek near Cape Roon with a recorded salinity of 3 ppt, indicating that this species is capable of tolerating nearly limnetic conditions, similar to certain *Halobates* species occurring on the rivers of northern Australia.

Distribution. Originally described from the Wom Point mangrove estuary at Wewak, and one collection from Rossel Island, our collections now reveal that this species ranges widely along the northern coast of New Guinea and into the adjacent archipelagoes, occurring at Tufi; in Milne Bay proper (Kana Kopi); on Sariba, Sideia, Lesimano and Basilaki islands east of the China Strait; in the Louisiades (Rossel and Tagula islands); and on remote Woodlark Island in the Marshall Bennett group. Andersen & Cheng (2004) included Irian Jaya (the current Papua Province of Indonesian New Guinea) in the distribution of *H. murphyi* without providing a definite locality - we have collected this species at Etna Bay, and give the record below to validate the western New Guinea distribution.

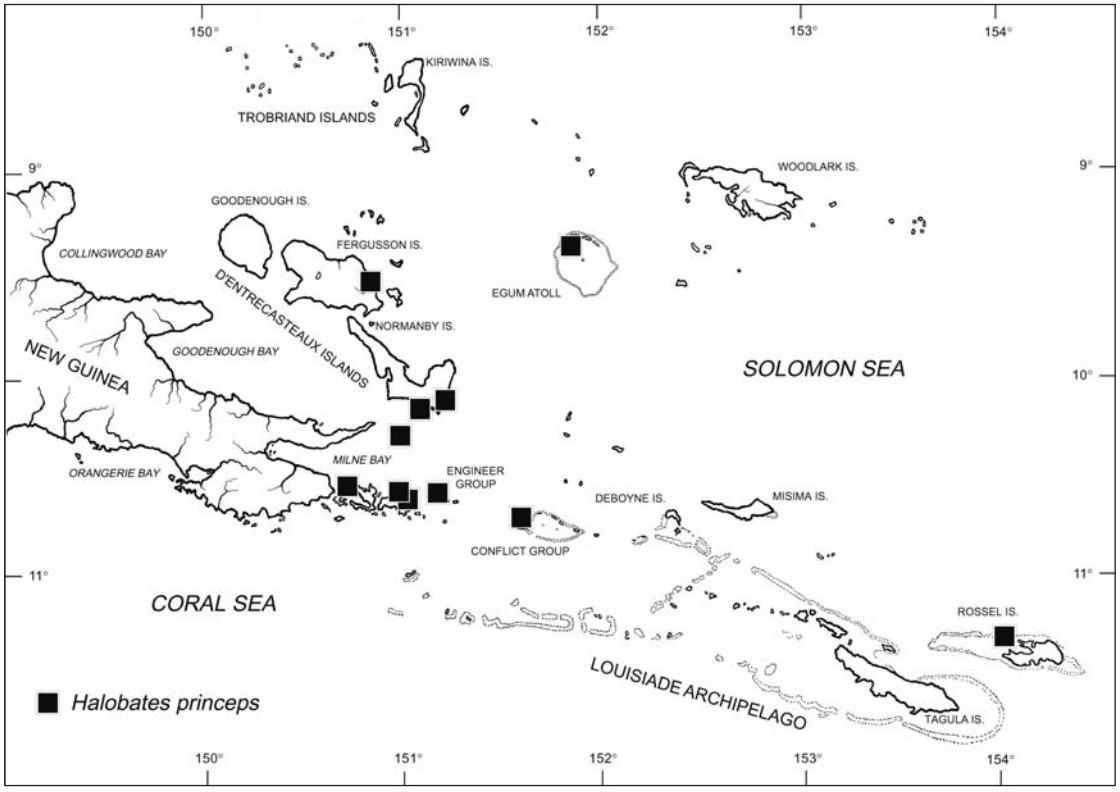


Fig. 19: Distribution of *Halobates princeps* on far eastern New Guinea and nearby islands.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 1♂, 15 ♀♀, New Guinea, Station 2, Killerton Islands; 9♂♂, 5 ♀♀, New Guinea, Station 3, offshore of Lihitabu Point; 2♂♂, Tagula Is., Station 8, Kalitau Creek estuary; 3♂♂, 13 ♀♀, Tagula Is., Station 9, Mohuwo Point; 7♂♂, 4 ♀♀, Rossel Is., Station 11, Woa River estuary; 2♂♂, 5 ♀♀, Rossel Is., Station 12, head of Yonga Bay; 27♂♂, 15 ♀♀, Woodlark Is., Station 19a, middle Sinkwarai River estuary; 13♂♂, 2 ♀♀, Woodlark Is., Station 21, mangroves on W side of Suloga Harbor; 12♂♂, 3 ♀♀, Woodlark Is., Station 23, rocky creek on NW side of Suloga harbor; 4♂♂, 4 ♀♀, New Guinea, Station 31, Kana Kopi Bay; 13♂♂, 16 ♀♀, Sariba Is., Station 32, estuary at head of Tanabuibuina Bay; 3♂♂, 4 ♀♀, Lesimano Is., Station 33, south shore; 21♂♂, 6 ♀♀, Sideia Is., Station 35, Wiwiyai Bay; 14♂♂, 5 ♀♀, Sideia Is., Station 36, Kwabunamoa Bay mangrove estuary; 4♂♂, 1 ♀, Basilaki Is., Station 37, Babana Bay; 9♂♂, 3 ♀♀, Basilaki Is., Station 38, Hemoe Bay; 2♂♂, Basilaki Is., Station 39, Guiagoila River estuary (USNM, BPBM, JTPC).

Extralimital material examined: PAPUA NEW GUINEA, **Morobe Prov.**: 2♂♂, 1 ♀, mangrove creek SW of Cape Roon, 0 m [sea level], 7°20'52.1"S, 147°08'31.6"E, water temp. 27°C, salinity 3 ppt, 3 May 2003, 10:00-11:00 hrs., CL 7240, D.A. Polhemus (USNM); 4♂♂, 1 ♀, Tabare River estuary, nr. Lababia village, 0 m [sea level], 7°18'08.4"S, 147°07'22.2"E, water temp. 26°C, 5 May 2003, 09:00-09:30 hrs., CL 7244, D.A. Polhemus (USNM). **West New Britain Prov.**: 1♂, Kimbe Bay, mangrove bay approx. 3 mi. S of Talasea, 0 m [sea level], 5°21'35.0"S, 150°02'43.0"E, sea temp. 29°C, salinity 13 ppt,14 January 2005, 16 January 2005, 09:45-10:30 hrs., CL 7348, D.A. Polhemus (USNM). INDONESIA, **Irian Jaya Prov.**: 1♂, 2 ♀♀, New Guinea, Etna Bay, near Freeport Exploration Camp, across bay near mangroves, trolling from boat, 0 m [sea level], sea temp. 32.2°C, CL 3003, 28 March 1997, J.T. & D.A. Polhemus (JTPC).

Halobates princeps White (Fig. 19)

Discussion. *Halobates princeps* was described from the Celebes Sea, and has until the present time remained an infrequently collected species, usually taken as single individuals at widely separated localities in the Indo-Australian region. Individuals of this large, silvery *Halobates* are typically found skating on shallow pools amid coral blocks on exposed reef crests at low tide, and have an interesting habit of climbing out of the water and onto the sides of such blocks in order to rest, a behavior observed by one of us (DAP) at both Areia Branca Bay in East Timor, and near Auki on the island of Malaita in the Solomons.

Distribution. The range of this species is extensive, including Malaysia, Borneo, Java, Sumbawa, Sulawesi, the Philippines, north-

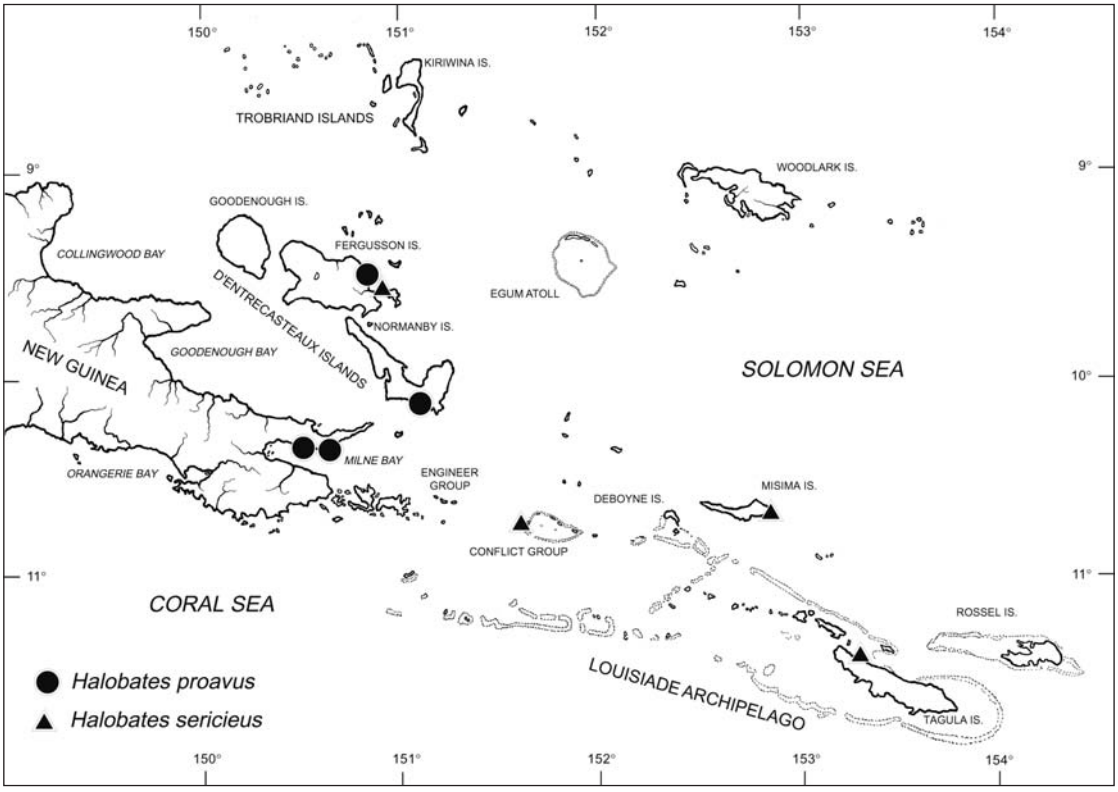


Fig. 20: Distribution of *Halobates proavus* and *Halobates sericeus* on far eastern New Guinea and nearby islands.

ern Australia, New Guinea, Palau, and the Solomon Islands. We can now add records from the Engineer Group, the Conflict Group, the D'Entrecasteaux Islands, and the Louisiade Archipelago, as well as from New Britain and East Timor.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 1 ♀, Wola Island (Rossel Lagoon), Station 13, north side; 1♂, 2 ♀♀, Irai Island (Conflict Atoll), Station 18, north side; 11♂♂, 63 ♀♀, Yanaba Is. (Egum Atoll), Station 24, sea, offshore of S side; 6♂♂, Fergusson Is., Station 25, offshore of Mebulibuli Point; 4♂♂, 40 ♀♀, Normanby Is., Station 27, Bunama Bay; 16♂♂, 5 ♀♀, Normanby Is., Station 28, Kasikasi Bay; 1♂, 15 ♀♀, Nuakata Is., Station 29, Haliwa Una Bay; 2♂♂, Lesimano Is., Station 33, south shore; 2 ♀♀, Basilaki Is., Station 37, Babana Bay; 9 ♀♀, Basilaki Is., Station 38, Hemoe Bay; 3♂♂, 10 ♀♀, Tubetube Is., Station 40, bay on NE side; 1♂, 3 ♀♀, Nuakata Is., Station 41, Dudawali Bay (USNM, BPBM, JTPC).

Extralimital material examined: PAPUA NEW GUINEA, **West New Britain Prov.**: 1♂, 1 ♀, New Britain, Kimbe Bay, Restorff Island, calm sea on W side, 0 m [sea level], 5°17'35.7"S, 150°06'15.6"E, sea temp. 29° C, salinity 35 ppt, 16 January 2005, 10:45-13:45 hrs., CL 7347, D.A. Polhemus (USNM, BPBM). EAST TIMOR, **Dili Dist.**: 1 ♀, exposed reef crest at Bekarit, Areia Branca Bay, 4.5 km E of Dili, 0 m [sea level], 8°32'20.6"S, 125°36'48.0"E, sea temp. 34 °C, 11 November 2003, 08:30-09:30 hrs., CL 7265, D.A. Polhemus; 2 ♀♀, same locality and collector, 31 August-1 September, 2004 (USNM). **Lautem Dist.**: 1 ♀, limestone coast 1 km W of Com, 0 m [sea level], sea temp. 32 °C, 20 November 2003, 16:00-16:30 hrs., 8°20'42.0"S, 127°02'49.3"E, CL 7280, D.A. Polhemus (USNM).

Halobates proavus White (Fig. 20)

Discussion. *Halobates proavus* is a sister species to *Halobates maculatus*. The two species are very similar, but both sexes are easily separated by the mid-dorsal longitudinal thoracic groove present in *H. proavus*, but absent in *H. maculatus*.

Halobates proavus was not encountered in the Louisiade Archipelago during the current surveys, and was infrequently collected in the remainder of Milne Bay Province. This stands in contrast to the situation further northwest along the northern coast of New Guinea, between Lae and Morobe, where *H. proavus* forms a predictable component of an offshore *Halobates* assemblage that also includes *H. maculatus* and *H. calyptus*. These three species are often found syntopically on relatively deep waters over fore-reef zones, and in proximity to windlines of offshore debris. Within this assemblage, however, *H. proavus* is generally the least abundant species at any given site.

This species may also sometimes be encountered close inshore, as at Sachsen Bay on the coast of Morobe Province south of Kamiali, where it was found skating above seagrass beds at low tide.

Distribution. Originally described from the New Hebrides (now known as Vanuatu), *H. proavus* has a broad distribution running west to east through the Malay Archipelago and Melanesia, with previous records from the Nicobar Islands, Thailand, Malaysia, Java, Sulawesi, the southern Philippines (Mindanao), the Moluccas (Ceram), and the Solomon Islands (HERRING 1961; ANDERSEN & CHENG 2004). Our surveys have now shown that *H. proavus* also occurs along the coast of northeastern New Guinea and in the D'Entrecasteaux Islands; we did not encounter this species in the Louisiade Archipelago or the Marshall Bennett Islands. Our New Guinea collections apparently represent a new island record. Zettel (in litt.) has also added Luzon (Batangas) to the Philippine distribution.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 7♂♂, 9 ♀♀, New Guinea, Station 1, Upalai River terminal reach at Haluwia; 26♂♂, 12 ♀♀, New Guinea, Station 3, offshore of Lihitabu Point; 5♂♂, 5 ♀♀, Fergusson Is., Station 25, offshore of Mebulibuli Point; 11♂♂, 9 ♀♀, Normanby Is., Station 27, Bunama Bay (USNM, BPBM, JTPC).
Extralimital material examined: PAPUA NEW GUINEA, **Morobe Prov.**: 7♂♂, 2 ♀♀, Cape Roon, 150 m offshore, 0 m [sea level], 7°20'44.8"S, 147°09'33.4"E, sea temp. 30°C, salinity 29 ppt, 2 May 2003, 10:00-10:30 hrs., CL 7237, D.A. Polhemus (USNM); 10♂♂, 8 ♀♀, Sachsen Bay, mangrove shore on S side, 0 m [sea level], 7°20'21.6"S, 147°08'41.6"E, sea temp. 30° C, salinity 23 ppt, May 2003, 11:00-12:00 hrs., CL 7238, D.A. Polhemus (USNM); 2♂♂, Jawani Island, SW side, 0 m [sea level], 7°20'38.7"S, 147°12'16.2"E, sea temp. 33°C, salinity 27 ppt, 2 May 2003, 14:00-15:00 hrs., CL 7239, D.A. Polhemus (USNM); 5♂♂, rocky point N of Cape Dinga [= Yaraku Point], 0 m [sea level], 7°18'03.8"S, 147°08'35.3"E, sea temp. 30°C, salinity 30 ppt, 4 May 2003, 10:00-12:30 hrs., CL 7242, D.A. Polhemus (USNM).

Halobates sericeus ESCHSCHOLTZ (Fig. 20)

Discussion. This pelagic *Halobates* species is widespread across the tropical Pacific, but is not commonly found near shore or in bays except after storms. It was encountered sporadically throughout the island groups of Milne Bay Province, as scattered individuals intermixed within assemblages of more numerous nearshore species.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 1 ♀, Tagula Is., Station 9, Mohuwo Point; 8♂♂, 24 ♀♀, Misima Island, Station 14, Bwagoia harbor; 2♂♂, 2 ♀♀, Irai Island (Conflict Atoll), Station 18, north side; 3♂♂, 1 ♀, Fergusson Is., Station 25, offshore of Mebulibuli Point (USNM, JTPC).

Subfamily Rhagadotarsinae

The subfamily Rhagadotarsinae is represented in both the New World and Old World, by the genera *Rheumatobates* and *Rhagadotarsus* respectively. Although predominantly occurring on freshwater, members of both of these groups may also occur at, or even cross, the limnetic-saline interface in horizontally stratified estuaries, and may thus also be considered components of the marine biota to some extent.

Genus *Rhagadotarsus* BREDDIN 1905

Rhagadotarsus kraepelini BREDDIN (Fig. 21, 22)

Discussion. Populations of *R. kraepelini* BREDDIN are occasionally found on the mixohaline waters of the middle and upper reaches of elongate, horizontally stratified estuaries throughout Melanesia, a pattern especially evident in the Solomon Islands. In the lower reaches of such estuaries, near the true euhaline interface, they are replaced by species of *Rheumatometroides* and *Stenobates* (members of the Trepobatinae) and *Halobates* (a member of the Halobatinae).

A similar sequential replacement of taxa along salinity gradients may also be seen in the New World, but in the latter case all of the taxa involved are members of a single genus, *Rheumatobates*, which contains both freshwater species (which are wing polymorphic) and obligate marine species (which are always apterous). An unpublished study by one of us (DAP) in a single Florida mangrove estuary has demonstrated the presence of four *Rheumatobates* species, two freshwater and two marine, with distributions sequentially arrayed along a gradient of increasing salinity. No such phenomenon

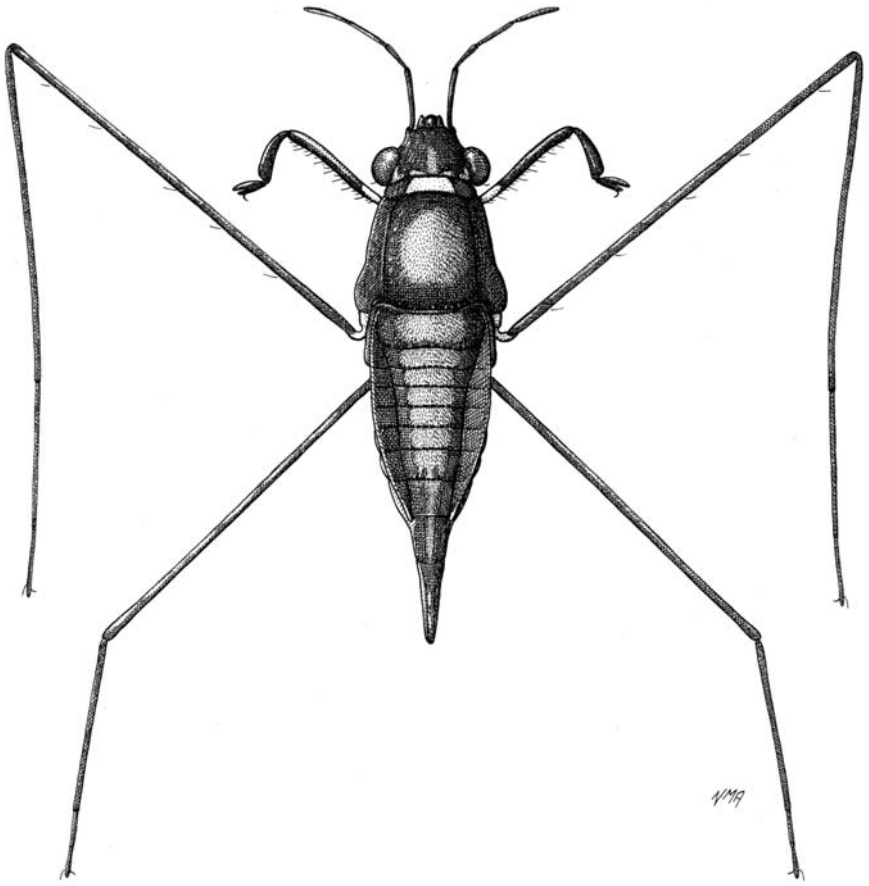


Fig. 21: *Rhagadotarsus kraepelini*, male, dorsal habitus. Reprinted with permission from ANDERSEN (1982).

among congeneric taxa is yet known for any water strider genus in the Old World where, as noted above, such local segregation instead occurs among members of differing genera and subfamilies.

In Milne Bay Province, we encountered this pattern only once, in a small estuary at the mouth of Budo Creek near Alotau. At this site, *Rhagadotarsus kraepelini* was found on mildly mixohaline waters at the inner margin of the estuary, and *Rheumatometroides browni* on the more saline waters where the creek entered Milne Bay proper.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 13♂♂, 24 ♀♀, 26 nymphs, New Guinea, Station 4, mouth of Budo Creek (USNM, BPBM, JTPC).

Subfamily Trepobatinae

The subfamily Trepobatinae, although a predominantly freshwater group, contains five endemic marine genera that have evolved in the Melanesian region, of which two, *Rheumatometroides* and *Thetibates*, occur in Milne Bay Province. Although the genus *Thetibates* is confined to the Solomons and far eastern New Guinea, the overall diversity of marine Trepobatinae is much higher at the western end of New Guinea than in the east (POLHEMUS & POLHEMUS 1996). In the Raja Ampat Islands, for instance, three genera are present (*Rheumatometroides*, *Stenobates*, and *Pseudohalobates*), with complex patterns of localized endemism prevailing among *Stenobates* in particular (POLHEMUS & POLHEMUS 2002, see Fig. 12). By contrast, the two species of marine Trepobatinae present in Milne Bay Province and adjacent archipelagoes display broad distributions and no indication of localized speciation, indicating that trepobatines may have invaded this region more recently in comparison to archipelagoes between New Guinea and the Moluccas.

Genus *Rheumatometroides* HUNGERFORD & MATSUDA 1958

Rheumatometroides browni HUNGERFORD & MATSUDA (Fig. 22, 23)

Discussion. *Rheumatometroides browni* is commonly encountered in protected mangrove estuaries throughout Milne Bay Province. It may be found in sheltered water pockets amid mangrove roots along the margins of protected bays, but is more typically encountered on the calm, mixohaline waters of mangrove-lined tidal creeks. In the latter habitats the species can tolerate a wide range of salinities, with recorded values at our collection sites ranging from 5-17 ppt.

Distribution. Originally described from Kolombangara, in the Solomon Islands, *Rheumatometroides browni* occurs throughout that archipelago, and along the northeastern coast of New Guinea, a distribution that has been hypothesized to reflect past tectonic events in the region (POLHEMUS & POLHEMUS 1998, 2002). In addition to previous records from the vicinity of Wewak and Lae (POLHEMUS & POLHEMUS 1996), the current surveys have now extended the known range of this species to Milne Bay, the islands surrounding the China Strait, and the D'Entrecasteaux, Louisiade, and Marshall Bennett island groups. It is unknown as to whether *Rheumatometroides browni* occurs on southern coast of the Papua Peninsula, although this seems likely given the presence

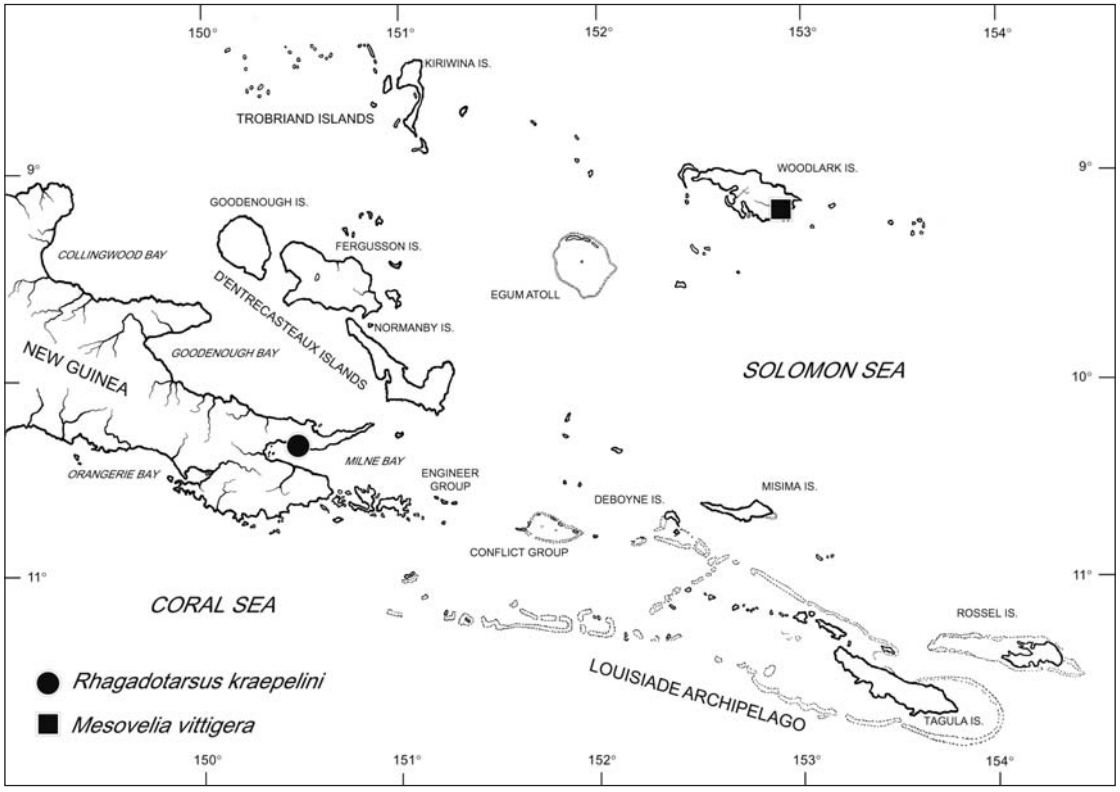


Fig. 22: Distribution of *Rhagadotarsus kraepelini* and *Mesovelia vittigera* in saline habitats on far eastern New Guinea and nearby islands.

of this species at the China Strait. There are extensive mangrove estuaries in this region between the Purari Delta and Orangerie Bay that would provide suitable habitat for *R. browni*, but no collections of *Rheumatometroides* have yet been made in these areas. Further to the west, in the Kikori River delta, *R. browni* is replaced by *R. kikori* POLHEMUS & POLHEMUS in similar habitats (POLHEMUS & POLHEMUS 1996).

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 21♂♂, 31 ♀♀, New Guinea, Station 1, Upalai River terminal reach at Haluwia; 33♂♂, 33 ♀♀, New Guinea, Station 4, mouth of Budo Creek; 18♂♂, 19 ♀♀, Fergusson Is., Station 6, Mebulibuli Creek estuary; 59♂♂, 42 ♀♀, Tagula Is., Station 8, Kalitau Creek estuary; 40♂♂, 35 ♀♀, Tagula Is., Station 10, Kolukolu Creek estuary; 14♂♂, 15 ♀♀, Rossel Is., Station 11, Woa River estuary, mangrove creek; 29♂♂, 62 ♀♀, Woodlark Is., Station 19a, middle Sinkwarai River estuary; 30♂♂, 22 ♀♀, Woodlark Is., Station 22, W side of Suloga Harbor; 7♂♂, 19 ♀♀, Normanby Is., Station 26, mouth of Apatabuia River; 15♂♂, 6 ♀♀, Sideia Is., Station 36, Kwabunamoa Bay mangrove estuary; 29♂♂, 22 ♀♀, 1 nymph, Basilaki Is., Station 39, Guiagoila River estuary (USNM, BPBM, JTPC). Extralimital material examined: PAPUA NEW GUINEA, **Morobe Prov.**: 5♂♂, 3 ♀♀, mangrove creek SW of Cape Roon, 0 m [sea level], 7°20'52.1"S, 147°08'31.6"E, water temp. 27°C, salinity 3 ppt, 3 May 2003, 10:00-11:00 hrs., CL 7240, D.A. Polhemus (USNM); 15♂♂, 2 ♀♀, intertidal creek at mouth of Aleater [= Alewiri] River, W of Sachsen Bay, 0 m [sea level], 7°19'14.7"S, 147°07'34.9"E, water temp. 27°C, 6 May 2003, 13:00-15:00 hrs., CL 7241, D.A. Polhemus (USNM); 8♂♂, 9 ♀♀, Tabare River estuary, nr. Lababia village, 0 m [sea level], 7°18'08.4"S, 147°07'22.2"E, water temp. 26°C, 5 May 2003, 09:00-09:30 hrs., CL 7244, D.A. Polhemus (USNM). **West New Britain Prov.**: 9♂♂, 5 ♀♀, Kimbe Bay, mangrove bay approx. 3 mi. S of Talasea, 0 m [sea level], 5°21'35.0"S, 150°02'43.0"E, sea temp. 29°C, salinity 13 ppt, 14 January 2005, 16 January 2005, 09:45-10:30 hrs., CL 7348, D.A. Polhemus (USNM).

Genus *Thetibates*
J. POLHEMUS & D. POLHEMUS 1996

Thetibates serena (LANSBURY) (Fig. 23, 24)

Discussion. This is an infrequently encountered species, which is usually found near shore in protected bays, often in the shade of overhanging *Callophyllum inophyllum* trees. Unlike *Rheumatometroides browni*, the other marine trepobatine species occurring in Milne Bay Province, *T. serena* is uniformly encountered on fully euhaline waters, and does not enter the mixohaline mangrove creeks.

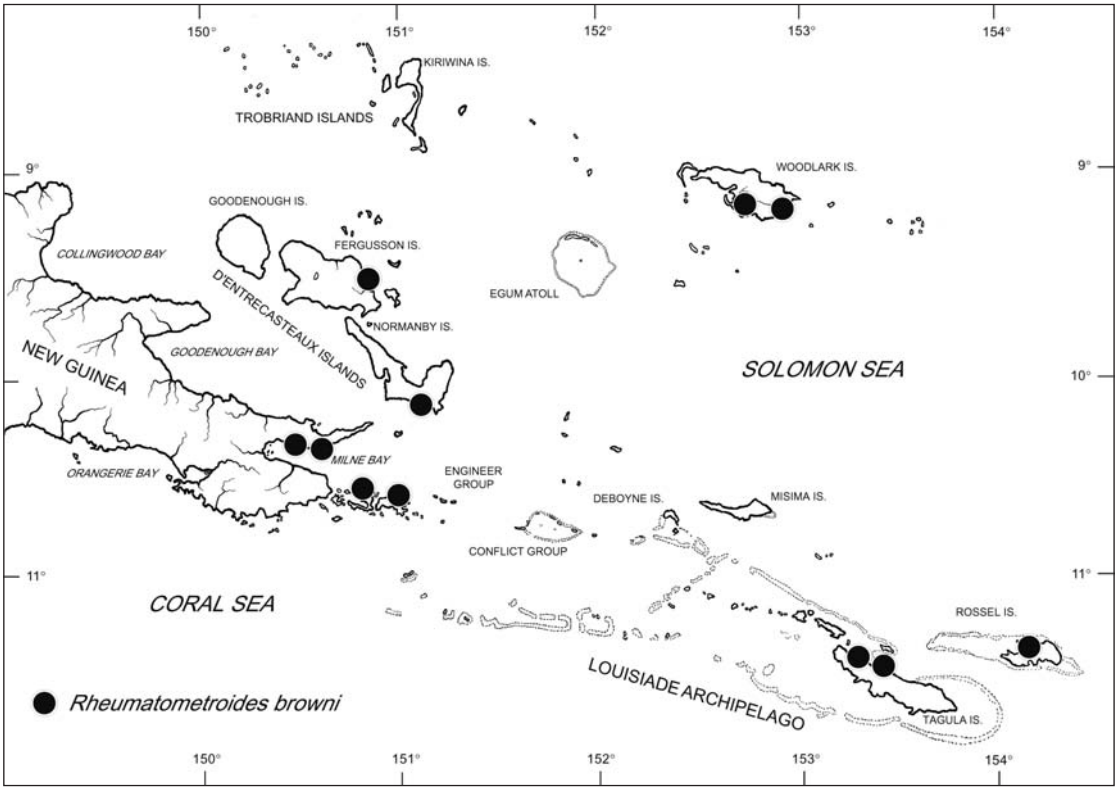


Fig. 23: Distribution of *Rheumatometroides browni* on far eastern New Guinea and nearby islands.

Distribution. *Thetibates serena* was originally described from Madang, on the northeastern coast of New Guinea (LANSBURY 1992), and recent surveys have now extended the range of this species far southeastward to New Britain, Kamiali, Milne Bay, the China Strait islands, and the Louisiade Archipelago. It has yet to be found in the D'Entrecasteaux or Marshall Bennett islands, and is similarly unknown from the southern coast of the Papuan Peninsula.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 37♂♂, 54♀♀, New Guinea, Station 1, Upalai River terminal reach at Haluwia; 1♀, New Guinea, Station 3, offshore of Lihitabu Point; 1♂, Tagula Is., Station 10, Kolukolu Creek estuary; 24♂♂, 36♀♀, 10 nymphs, Rossel Is., Station 12, head of Yonga Bay; 5♂♂, 14♀♀, 21 nymphs, Sideia Is., Station 34, Jenkin's Bay; 14♂♂, 10♀♀, Sideia Is., Station 35, Wiwiyai Bay (USNM, BPBM, JTPC).
Extralimital material examined: PAPUA NEW GUINEA, **Morobe Prov.**: 3♂♂, 1♀, Sachsen Bay, mangrove shore on S side, 0 m [sea level], 7°20'21.6"S, 147°08'41.6"E, sea temp. 30°C, salinity 23 ppt, May 2003, 11:00-12:00 hrs., CL 7238, D.A. Polhemus (USNM); 4♂♂, 1♀, Jawani Island, SW side, 0 m [sea level], 7°20'38.7"S, 147°12'16.2"E, sea temp. 33°C, salinity 27 ppt, 2 May 2003, 14:00-15:00 hrs., CL 7239, D.A. Polhemus (USNM); 61♂♂, 19♀♀, mangrove creek SW of Cape Roon, 0 m [sea level], 7°20'52.1"S, 147°08'31.6"E, water temp. 27°C, salinity 3 ppt, 3 May 2003, 10:00-11:00 hrs., CL 7240, D.A. Polhemus (USNM); 3♂♂, 2♀♀, rocky point N of Cape Dinga [= Yaraku Point], 0 m [sea level], 7°18'03.8"S, 147°08'35.3"E, sea temp. 30°C, salinity 30 ppt, 4 May 2003, 10:00-12:30 hrs., CL 7242, D.A. Polhemus (USNM). **Oro Prov.**: 1♂, Tufi Harbor, cliff-bound rocky shore near village dock, 0 m [sea level], 9°04'57.0"S, 149°19'15.0"E, 24 January 2004, 23:00-24:00 hrs., CL 4468, J.T. Polhemus (JTPC). **West New Britain Prov.**: 4♂♂, 1♀, New Britain, Kimbe Bay, Restorff Island, calm sea on W side, 5°17'35.7"S, 150°06'15.6"E, 0 m [sea level], sea temp. 29°C, salinity 35 ppt, 16 January 2005, 10:45-13:45 hrs., CL 7347, D.A. Polhemus (USNM, BPBM).

Family Hermatobatidae

The Hermatobatidae (Fig. 25) are the most enigmatic of the marine Heteroptera, and are rarely collected except by a few individual researchers who understand the specialized habits and ecology of this group. Although only three species of Hermatobatidae were found in Milne Bay Province, this represents the greatest richness within one locally circumscribed region of any place in the world. In one instance, all three species were taken together at light off Mebulibuli Point on Fergusson Island, a

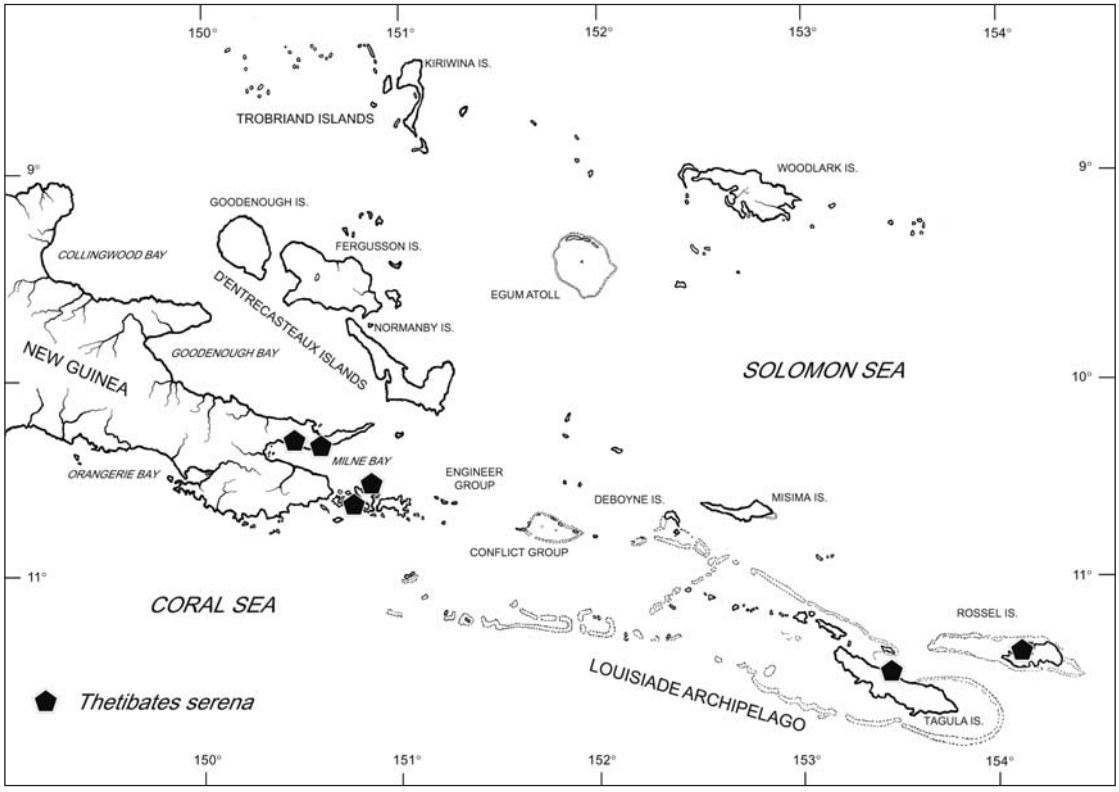


Fig. 24: Distribution of *Thetibates serena* on far eastern New Guinea and nearby islands.

nearly unprecedented pattern of localized richness for this group.

The rarity of these insects in collections was noted by HERRING (1965) in a paper where he described two new species; there he said "The genus *Hermatobates* is certainly the rarest and least known genus of Marine Hemiptera. It was founded by Carpenter in 1892 for the reception of a new species, *H. haddoni*, based on a single specimen from Mubiag Island in the Torres Straits, northern Australia. Since that time, five other species have been described. The descriptions of the six species were based on a total of nine specimens and several of the species are still known only from the type material. Females for the most part are either unknown or unassociated with the males. In 2 years of entomological work in the South Pacific, I was able to collect only three specimens; so it is not surprising that very few museums have representatives of this remarkable genus."

The authors have made a point of searching for these fascinating insects whenever possible, working both individually and together, and now possess collections from approximately 50 localities scattered across the seas of 20 countries worldwide, ranging from the coasts of Tanzania, Aldabra Atoll, Madagascar and Mauritius in the Indian Ocean, through the Malay Archipelago, the Philippines, Australia, and New Guinea, to the remote Pacific Islands including New Caledonia, the Solomons, Fiji, the Ryukyus, Palau, Micronesia, Hawaii, Tahiti and the Marquesas. Our collections now total more than 600 adult specimens plus many nymphs, approximately 1000 specimens in all, comprising most of the known species. In addition to our own collections, kind gifts from many colleagues, especially Dr. Lanna Cheng, have permitted us to assemble a mostly unreported base of material that contains adequate series of every described species plus at least three that are new to science. One of the new species is described below, and the others will be dealt with in a complete revision of the family now in progress.

Genus *Hermatobates* CARPENTER 1892 (Figs 25-46)

ANDERSEN & WEIR (2000) provided an excellent redescription of the genus, not repeated here, that the reader should consult for the general plan and morphology of the group.

The recent treatment of the *Hermatobates* of Australia and New Caledonia by

ANDERSEN & WEIR (2000) is exemplary in its presentation of the taxonomy, morphology and review of the literature. Unfortunately it contains a serious error in the incorrect synonymy of *Hermatobates weddi* CHINA 1957 with *Hermatobates marchei* COUTIÉRE & MARTIN 1902; the first author of this paper twice sent to Dr. Andersen the defining characters of the two species, with a caution not to proceed with the synonymy, but this advice was ignored. Therefore, in the following treatment of the three *Hermatobates* species found in Milne Bay Province, the defining characters are presented, the synonymy rejected, and *Hermatobates weddi* CHINA restored to valid specific status.

Females of *Hermatobates* species are difficult to separate because they are all very similar, and lack salient morphological features. The abundant material available for this study permitted the separation of the three species found in Milne Bay Province based mainly on the colouration of the anterior trochanters, other leg segments, and antennae; the most useful female character is the colouration of the anterior trochanters, which are infuscated in *H. weddi*, but bright white luteous in *H. marchei* and *H. kula* nov.sp. The key for females given below is considered valid for Milne Bay Province only, because the colouration of legs and antennae of some populations of *H. weddi* from extralimital localities deviates from the characterization given here, possibly due to character displacement in the absence of sympatric congenors.

Key to males of *Hermatobates* species of Milne Bay Province

1 Metasternum sloping posteriorly (Fig. 27); median metasternal process on a ridge at apparent posterior margin of metasternum (Figs 37, 40); fore tibia without a tubercle in basal curve, basally with a low protuberance followed by a distinct tubercle, a row of small tubercles ending with a small tooth at about two thirds of tibia length from base (Figs 26, 34) . . . . . *H. weddi* CHINA

– Metasternum tumid posteriorly (Figs 29, 31); median metasternal process distinctly removed from posterior margin of metasternum (Figs 35, 36, 38, 39); fore tibia with a distinct tubercle in basal curve, basally with either a low protuberance or denticle, followed by a distinct tubercle (Figs 28, 30, 32, 33), a row of small tubercles ending with a declevity (but no small tooth) at about two thirds of tibia length from base (Figs 28, 30, 32, 33) . . 2

2 Median metasternal process prominent, usually spatulate, rarely shorter (Figs 35, 38); fore tibia basally with a low protuberance followed by a distinct tubercle; styliform process very broad, tip bulbous . . . . . *H. marchei* COUTIÉRE & MARTIN

– Median metasternal process usually trapezoidal, rarely rounded (Figs 36, 39); fore tibia basally with a short denticle followed by a distinct tubercle; styliform process broad, tip slender . . . . . *H. kula* nov.sp.

Key to females of *Hermatobates* species of Milne Bay Province

1 Anterior trochanters slightly to heavily infuscated, never bright white luteous; anterior tibia moderately infuscated; mid and posterior trochanters moderately to heavily infuscated; basal 1/6 to 1/5 of first antennal segment light coloured, sometimes luteous, then increasingly infuscated distally . . . . . *H. weddi* CHINA

– Anterior trochanters bright white luteous; mid and posterior trochanters light coloured, at least basally; anterior tibia orange brown to luteous; basal 1/4 to 1/2 of first antennal segment luteous, then increasingly infuscated distally 2

2 Anterior coxae infuscated; anterior tibia orange brown; mid and posterior trochanters light coloured basally, darkest medially, narrowly testaceous distally; basal 1/4 of first antennal segment luteous, then increasingly infuscated distally . . . . *H. marchei* COUTIÉRE & MARTIN

– Anterior coxae margined with luteous, or largely luteous; anterior tibia yellow brown to luteous; mid and posterior trochanters mostly luteous, darkened distally dorsally and posteriorly; basal 1/2 of first antennal segment luteous, then increasingly infuscated distally . . . . . *H. kula* nov.sp.

Hermatobates weddi China (Figs 26, 27, 34, 37, 40, 43, 44)

Discussion. All species of the tight knit *Hermatobates weddi* group have very similar facies, differing primarily in the morphology of the metasternal process, anterior femora and tibia, and male genitalia. This subtlety of differentiation resulted in *H. weddi* being synonymized under *H. marchei* by Andersen & Weir (2000), presumably because these authors had no proper specimens of *H. marchei* for comparison. *Hermatobates weddi* males can be separated from both *H. marchei* and *H. kula* nov.sp. by the posteriorly sloping metasternum terminating in a short metasternal process (compare Figs 27, 37, 40), and structure of the fore tibia, which lacks a tubercle in the basal curve but does possess a small tooth at distally at about two thirds the distance to the apex (Figs 26, 34). Females are separated from those of the other two species by the characters given in the key. Because *Hermatobates weddi* has a very broad geographic range, extending from the Malay Peninsula to Tonga, with consequent infraspecific variation in morphology, there may be additional new species present within this taxon as it is currently defined.

Distribution. Australia (Northern Territory; Queensland), Papua New Guinea (south coast; D'Entrecasteaux Islands; Engineer Group), Indonesia (Irian Jaya; Sumbawa; Java; Sulawesi), East Timor, Malaysia (West Malaysia, east coast), Tonga, Fiji, Solomon Islands.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 1♂, Fergusson Is., Station 25, sea offshore of Mebulibuli Point; 11♂♂, 27 ♀♀, 112 nymphs, Normanby Is., Station 27, Bunama Bay; 3♂♂, 6 ♀♀, 15 nymphs, Normanby Is., Station 28, Kasikasi Bay; 3 ♀♀, 1 nymph, Tubetube Is., Station 40, bay on NE side; 1♂, 4 ♀♀, 2 nymphs, Nuakata Is., Station 41, Dudawali Bay (USNM, BPBM, JTPC).

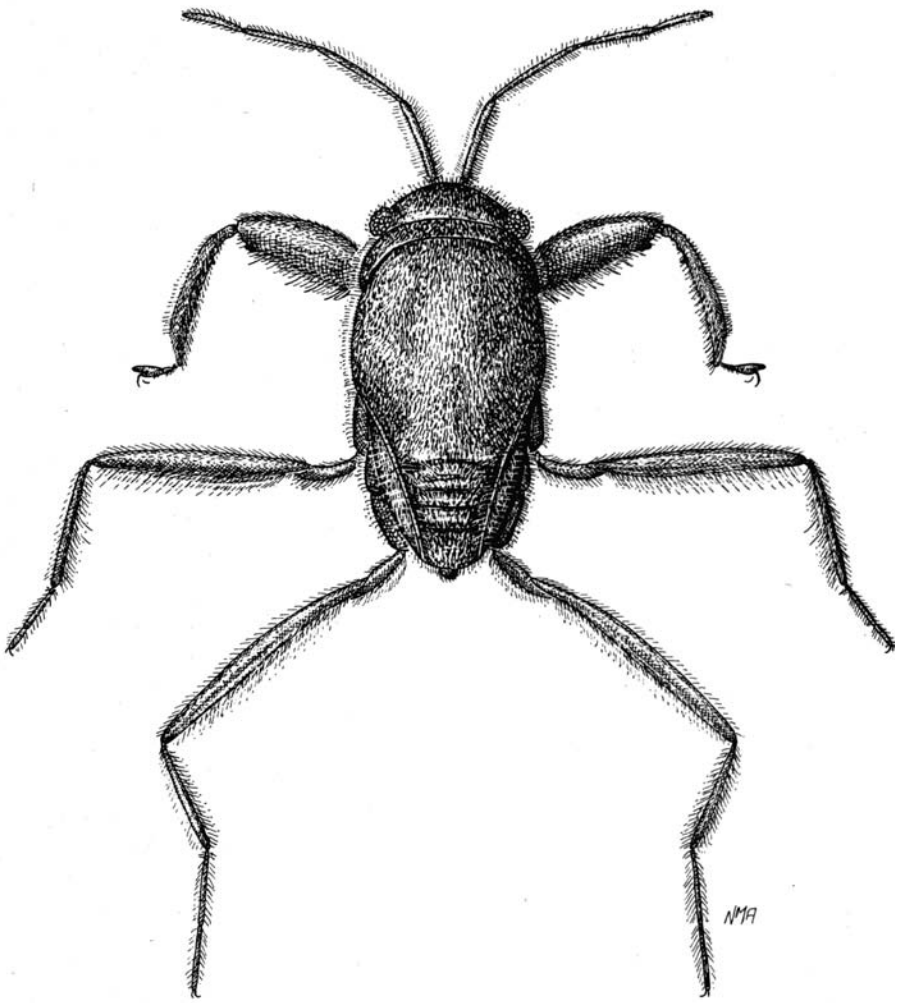


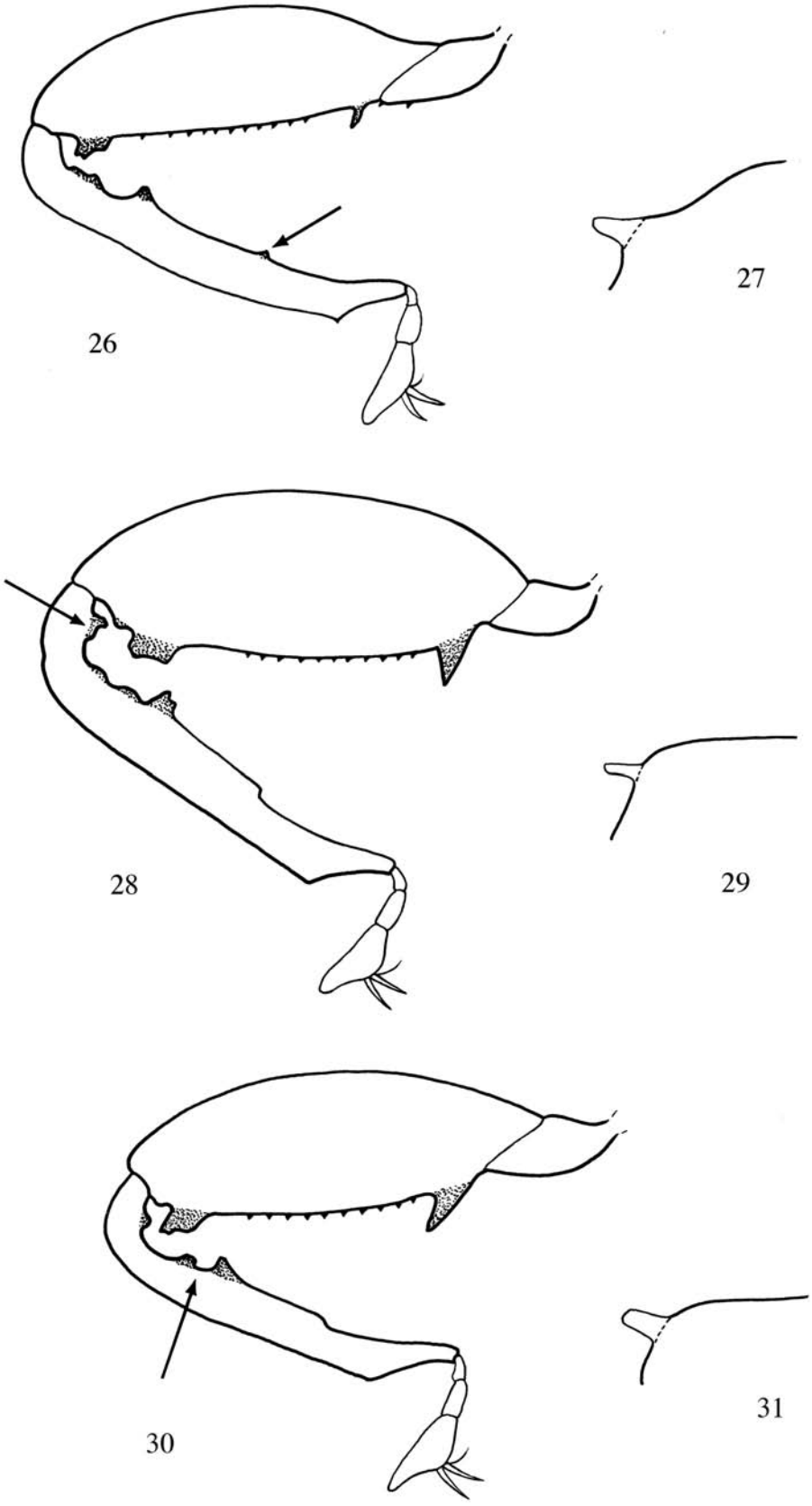
Fig. 25: *Hermatobates weddi*, male, dorsal habitus. Reprinted with permission from Andersen (1982).

Extralimital material examined: EAST TIMOR, **Dili Dist.**: 2♂♂, 1 ♀, exposed reef crest at Bekarit, Areia Branca Bay, 4.5 km E of Dili, 0 m [sea level], 8°32'20.6"S, 125°36'48.0"E, sea temp. 27 °C, 1 September 2004, 17:30-18:30 hrs., CL 7265, D.A. Polhemus (USNM).

Hermatobates marchei Coutiére & Martin (Figs 28, 29, 32, 35, 38, 41, 45)

Discussion. *Hermatobates marchei* is a quite distinct species, the males characterized by the spatulate, nearly quadrate metasternal process quite separated from the rounded posterior margin of the metasternum (Figs 29, 35, 38), and a broad styliform process with a bulbous tip (Fig. 41).

This species was originally described from Palawan in the Philippines, but the types appear to be lost. Although supposedly in the Paris Museum, several extensive searches for them in that institution have proven fruitless. Therefore, a male from Mindanao that matches the original description is hereby designated as neotype



Figs 26-31: *Hermatobates* species, structural details (**26**) *Hermatobates weddi*, male foreleg (**27**) *Hermatobates weddi*, lateral view of male metasternum (**28**) *Hermatobates marchei*, male foreleg (**29**) *Hermatobates marchei*, lateral view of male metasternum (**30**) *Hermatobates kula* nov.sp., male foreleg (**31**) *Hermatobates kula* nov.sp., lateral view of male metasternum.

(see extralimital material examined), and placed in the USNM.

Distribution. Now known from the Philippines Islands (Mindanao; Palawan), Palau, New Guinea (northeast coast in Morobe, Oro and Milne Bay provinces of Papua New Guinea), and the D'Entrecasteaux Islands (Fergusson Is.). The current surveys have extended the range of *H. marchei* approximately 4000 km southward from the original type locality, including new records from Mindanao and Palau also listed below.

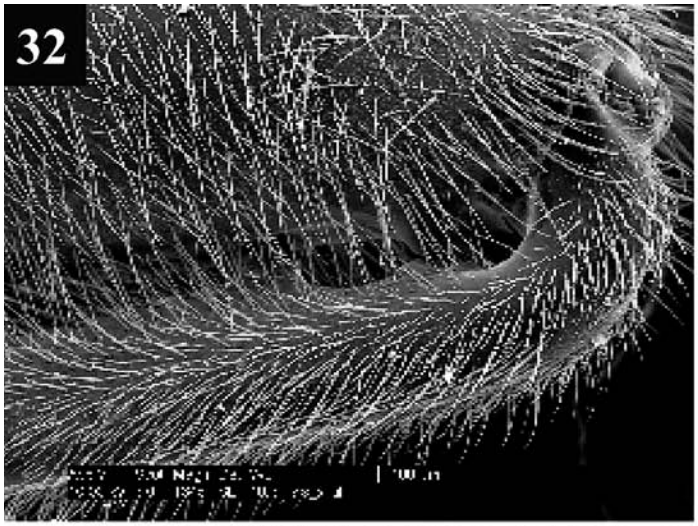
Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 1♂, 3 ♀♀, 2 nymphs, Milne Bay, Station 3, offshore of Lihitabu Point; 18♂♂, 67 ♀♀, 10 nymphs, Fergusson Is., Station 25, sea offshore of Mebulibuli Point (USNM, BPBM, JTPC).

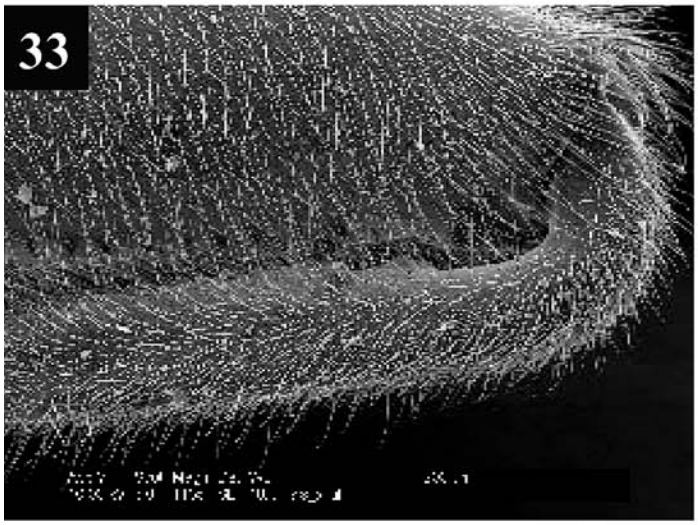
Extralimital material examined: PAPUA NEW GUINEA, **Morobe Prov.**: 1♂, 4 ♀♀, Cape Roon, 150 m offshore, 0 m [sea level], 7°20'44.8"S, 147°09'33.4"E, sea temp. 30° C, salinity 29 ppt, 2 May 2003, 10:00-10:30 hrs., CL 7237, D.A. Polhemus (USNM); 1♂, rocky point N of Cape Dinga [= Yaraku Point], 0 m [sea level], 7°18'03.8"S, 147°08'35.3"E, sea temp. 30° C, salinity 30 ppt, 4 May 2003, 10:00-12:30 hrs., CL 7242, D.A. Polhemus (USNM). **Oro Prov.**: 3♂♂, 1 ♀, 4 nymphs, Tufi Harbor, cliff-bound rocky shore near village dock, 0 m [sea level], 9°04'57.0"S, 149°19'15.0"E, 24 January 2004, 23:00-24:00 hrs., CL 4468, J.T. Polhemus (JTPC). PALAU, **Koror State**, Koror Island: 17♂♂, 11 ♀♀, 2 nymphs, T-Dock at Koror waterfront, 0 m [sea level], 7°21'07.5"N, 134°28'41.6"E, sea temp. in water pockets amid coral rubble 30° C, 8 August 1999, 11:00-12:00 hrs. (falling tide); 9 August 1999, 12:00-13:00 hrs. (falling tide); 10 August 1999, 14:00-15:30 hrs. (falling tide); 11 August 1999, 15:00-16:30 hrs. (falling tide), CL 7126, D.A. and J.T. Polhemus (USNM). PHILIPPINE ISLANDS, Mindanao, **Zamboanga del Sur Prov.**: 1♂, neotype, plus 1♂, 1 ♀, 5 nymphs, Santa Cruz Island off Zamboanga, coral reef, 0 m [sea level], CL 1997, 21 July 1985, J.T. & D.A. Polhemus (JTPC).

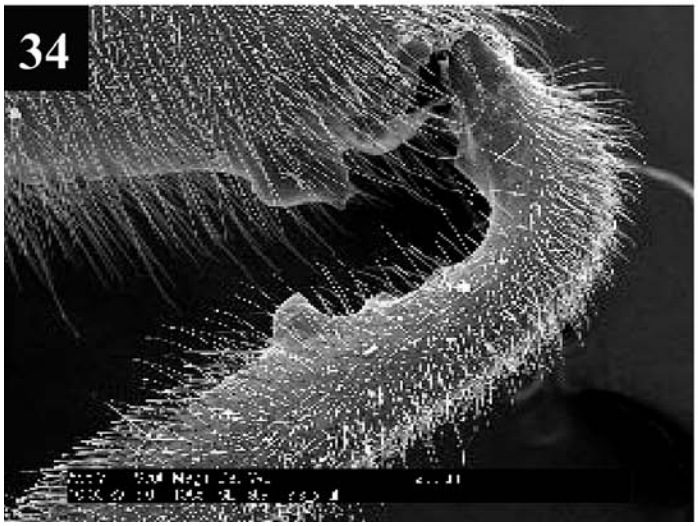
Hermatobates kula nov.sp. (Figs 30, 31, 33, 36, 39, 42, 46)

Description:

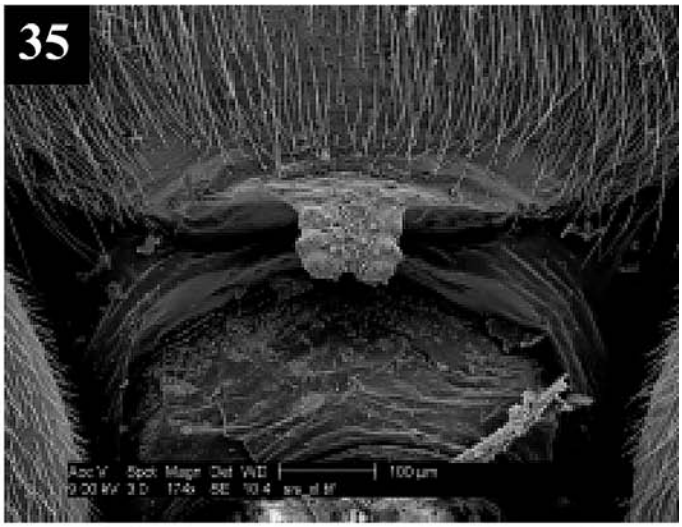
Size. Apterous male, length 3.44-4.00 ($\bar{x}$ = 3.76, n = 5); width 1.61-1.94 ($\bar{x}$ = 1.78, n = 5). Apterous female, length 3.61-3.83 ($\bar{x}$= 3.69, n = 5); width 1.89-2.11 ($\bar{x}$ = 1.99, n = 5).

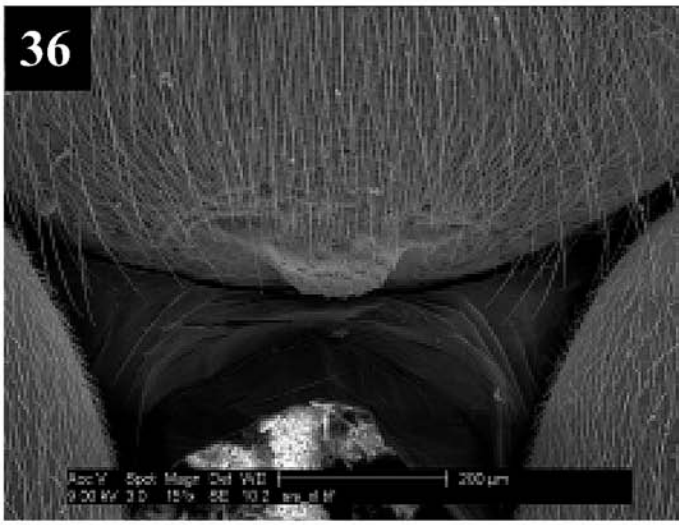


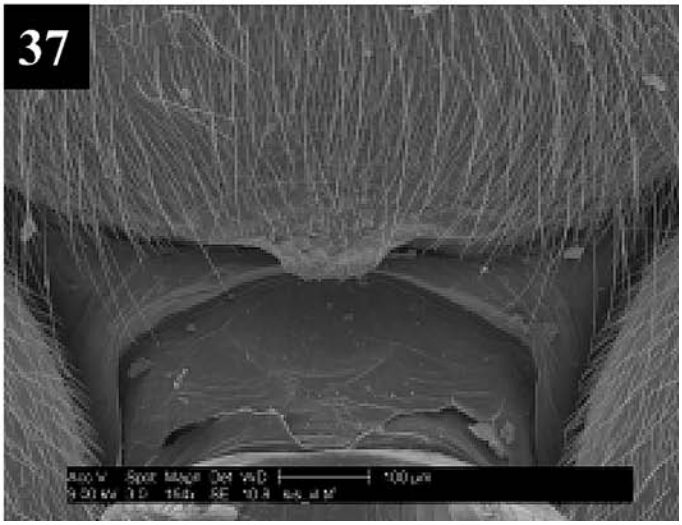




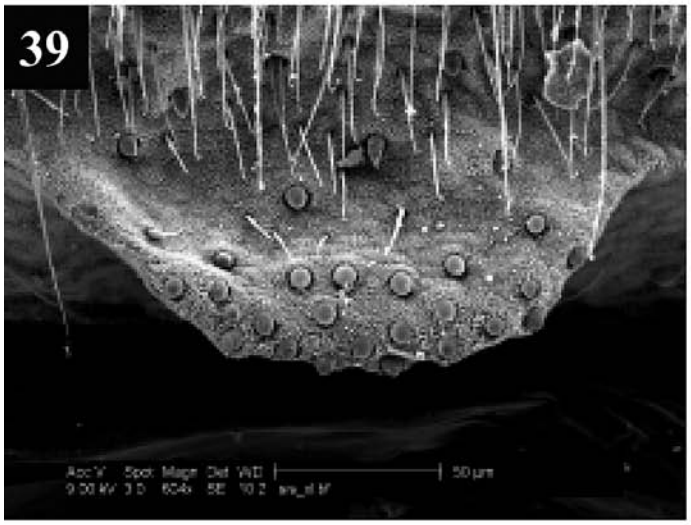
Figs 32-34: *Hermatobates* species, detail of male foreleg showing apex of femur and base of tibia (**32**) *Hermatobates marchei* (**33**) *Hermatobates kula* nov.sp. (**34**) *Hermatobates weddi*.

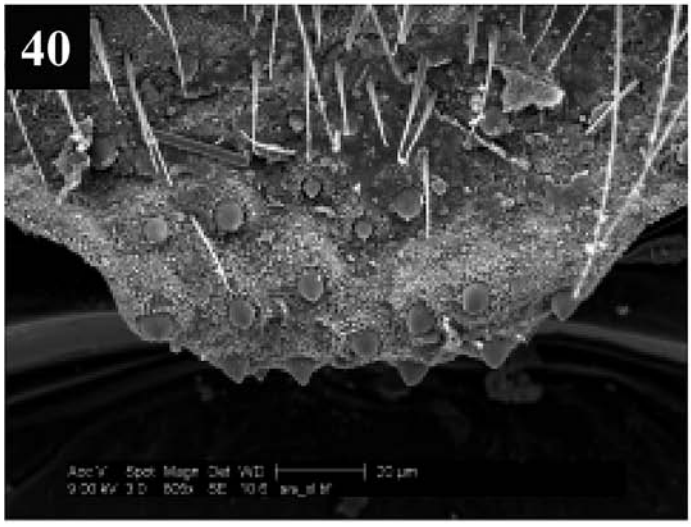


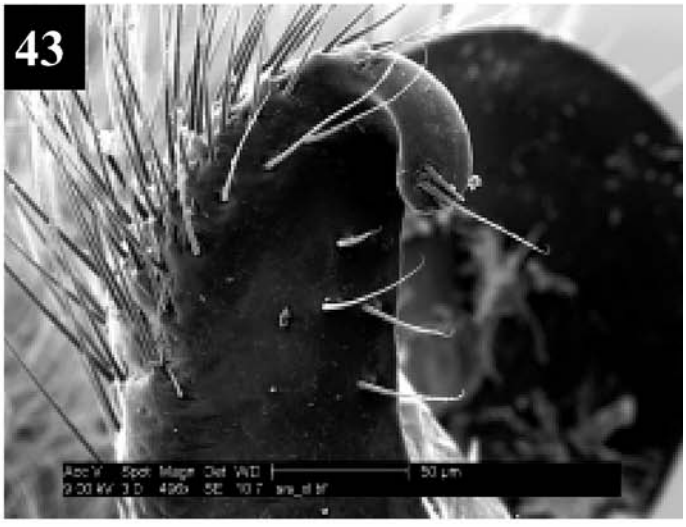




Figs 35-37: *Hermatobates* species, process on male metasternum (**35**) *Hermatobates marchei* (**36**) *Hermatobates kula* nov.sp. (**37**) *Hermatobates weddi*.







Figs 38-40: *Hermatobates* species, detail of process on male metasternum (**38**) *Hermatobates marchei* (**39**) *Hermatobates kula* nov.sp. (**40**) *Hermatobates weddi*.

Figs 41-43: *Hermatobates* species, styliform process of male ventral abdomen (**41**) *Hermatobates marchei* (**42**) *Hermatobates kula* nov.sp. (**43**) *Hermatobates weddi*.

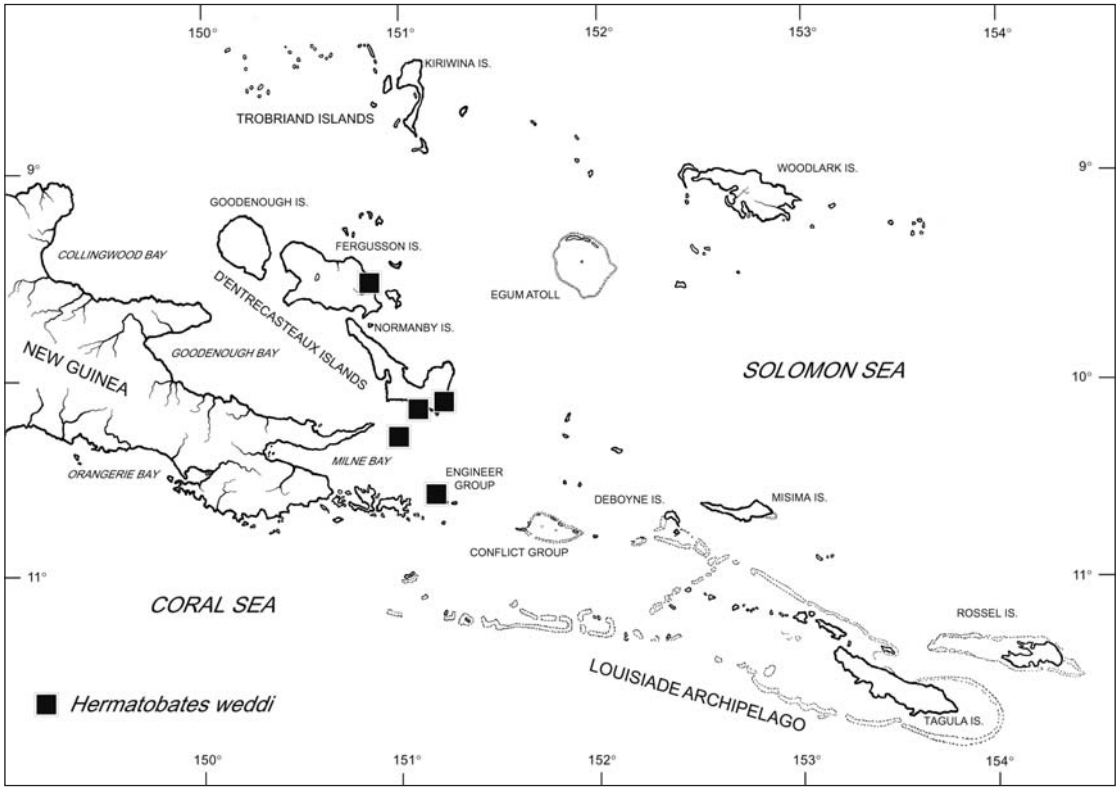


Fig. 44: Distribution of *Hermatobates weddi* on far eastern New Guinea and nearby islands.

Colour. Ground colour black with a bluish tinge, dull, body with fine silvery pubescence, and longer setae (0.14-0.18 in males; 0.05-0.11 in females). Head dark above, with a transverse line of pale spots at base. Pleural and ventral surfaces brownish, dull, genital segments blackish, shiny. Antennae blackish brown, basal third to half luteous, increasingly embrowned beyond. Legs blackish brown, fore coxae partly luteous; fore trochanters, basal part of fore femora luteous; mid- and hind trochanters partly testaceous in males, mostly luteous in females, slightly darkened dorsally and posteriorly on distal part; fore tibia yellowish brown to luteous.

Structural characters. Apterous male: body fusiform, length more than 2.0x greater than greatest width across thorax (4.00:1.83). Head length 0.27x greatest head width across eyes (0.40:1.48); eyes rather small, about 0.26x interocular width (0.26:0.97).

Antennal formula I : II : III : IV = 1.15 : 1.15 : 0.72 : 0.65; segment I almost 3x head length (1.15:0.40) and stout, slightly thicker than segment IV; antennae 0.92x total length of insect.

Pronotum very short, median length (0.11) less than half of an eye width; posterior margin almost straight in middle, curved backwards laterally. Meso- and metanotum simple. Metasternum distinctly curving toward depressed abdominal sternum, projecting process short, semi-trapezoidal, slightly but distinctly removed from posterior margin (Figs 31, 36, 39).

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2, tarsal 3 of fore leg = 1.73 : 1.73 : 0.04 : 0.07 : 0.25; of middle leg = 2.59 : 1.55 : 0.11 : 0.72 : 0.58; of hind leg = 2.63 : 1.52 : 0.11 : 0.61 : 0.61. Trochanter of fore leg with a small spine before distal end. Fore femur incrassate, with a stout pointed black tooth at base, angled distally, a broad distally bifid black tubercle before apex, between these an almost regular row of 11-14 small black teeth. Fore tibia moderately curved, inner side with a distinct tubercle in sharp basal curve, followed at some distance by a short stout tooth, then larger tooth (Figs 30, 33), a row of small tubercles ending with a declevity (but no small tooth) at about two thirds of tibia length from base, and several small tubercles on inner surface near apex; a small tooth at base of oblique comb of hairs. Trochanter of middle leg with distinct ventral spine distally. Middle femur slightly thickened in middle (0.27), ventral surface armed with 19-21 almost straight

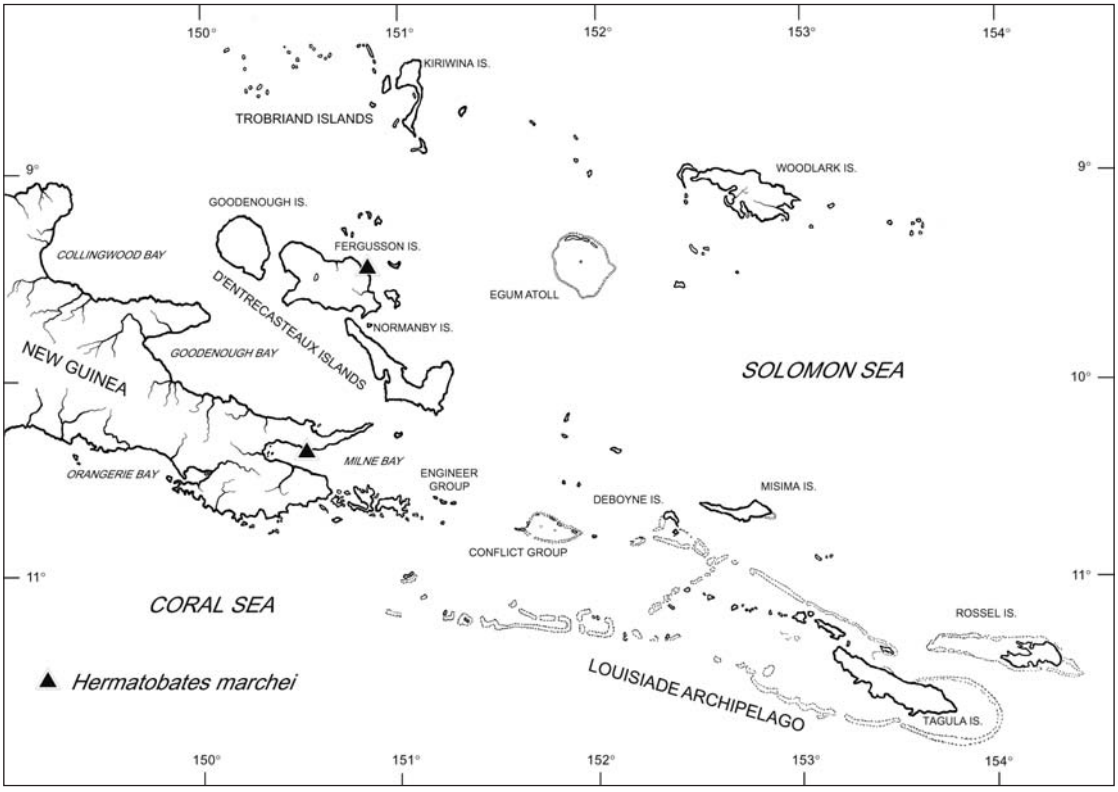


Fig. 45: Distribution of *Hermatobates marchei* on far eastern New Guinea and nearby islands.

stout spines, those near base with tips hooked, interspersed by shorter teeth. Hind femur slightly thickened on distal third, dorsoventrally compressed in large specimens; trochanter and femur unarmed. Middle and hind femora thickly set with long sivery setae (0.22).

Abdomen very short, length from abdominal scent orifice to tip 0.97; lengths of abdominal terga 4-7: 0.11, 0.18, 0.29, 0.29; genital segments large, length 0.71; styliform processes of segment 8 relatively slender with curved apices (Fig. 42).

Apterous female: body fusiform, length about 1.9x greater than greatest width across thorax (3.32:1.78). Head length 0.15x head width across eyes (0.23:1.33); eyes rather small, slightly less than 0.21x interocular width (0.20:0.94).

Antennae relatively shorter than in male, 0.7x total length of insect, antennal formula I : II : III : IV = 0.58 : 0.72 : 0.43 : 0.58; segment about 2.5x head length (0.58:0.23), subequal in thickness to segment IV.

Pronotum very short, median length (0.61) about half of an eye width; metasternum not modified.

Legs relatively shorter than in male. Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2, tarsal 3 of fore leg = 1.01 : 1.01 : 0.03 : 0.07: 0.22; of middle leg = 1.69 : 0.86 : 0.07 : 0.58: 0.47; of hind leg = 1.72 : 0.47 : 0.03 : 0.47 : 0.47. Fore femur moderately thickened, greatest width 0.20-0.22x length; trochanter and femur unarmed except for a row of about 17-20 small black teeth ventrally on femur; fore tibia moderately curved, unarmed. Middle femur slightly thickened in middle (0.18), ventrally with a row of about 18 small black spines. plus a row of long slender black setae (0.18); trochanter unarmed. Hind femur slightly thickened in middle (0.14), unarmed. Middle and hind femora thickly set with long silvery setae (0.18).

Abdomen very short, length from abdominal scent orifice to tip 0.69; lengths of abdominal terga 4-7: 0.14, 0.18, 0.22, 0.18; abdominal sterna II-VII forming a large rectangular plate, length 0.47, posterior margin slightly emarginate in middle. Genital segments, except for cone-shaped proctiger, hidden beneath sternal plate.

Diagnosis. Males of *Hermatobates kula* nov.sp. may be separated from those of *H. marchei* by the trapezoidal metasternal process (Figs 36, 39), the fore tibia which

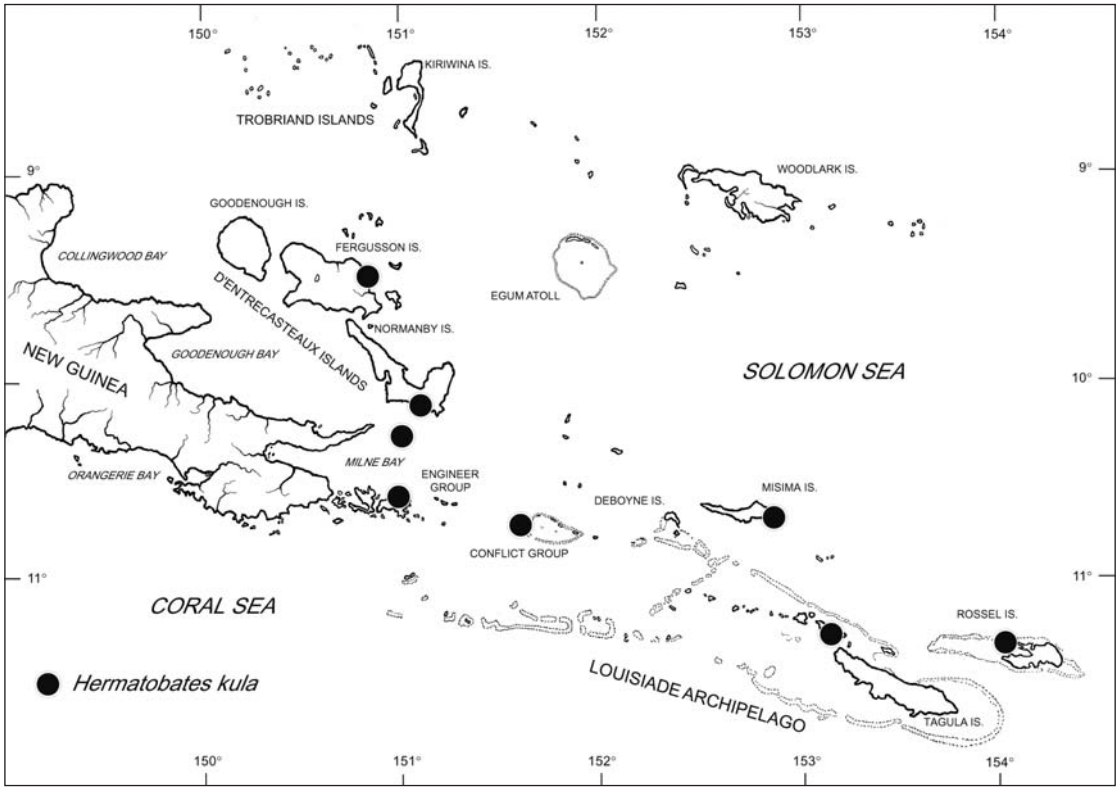


Fig. 46: Distribution of *Hermatobates kula* nov.sp. on far eastern New Guinea and nearby islands.

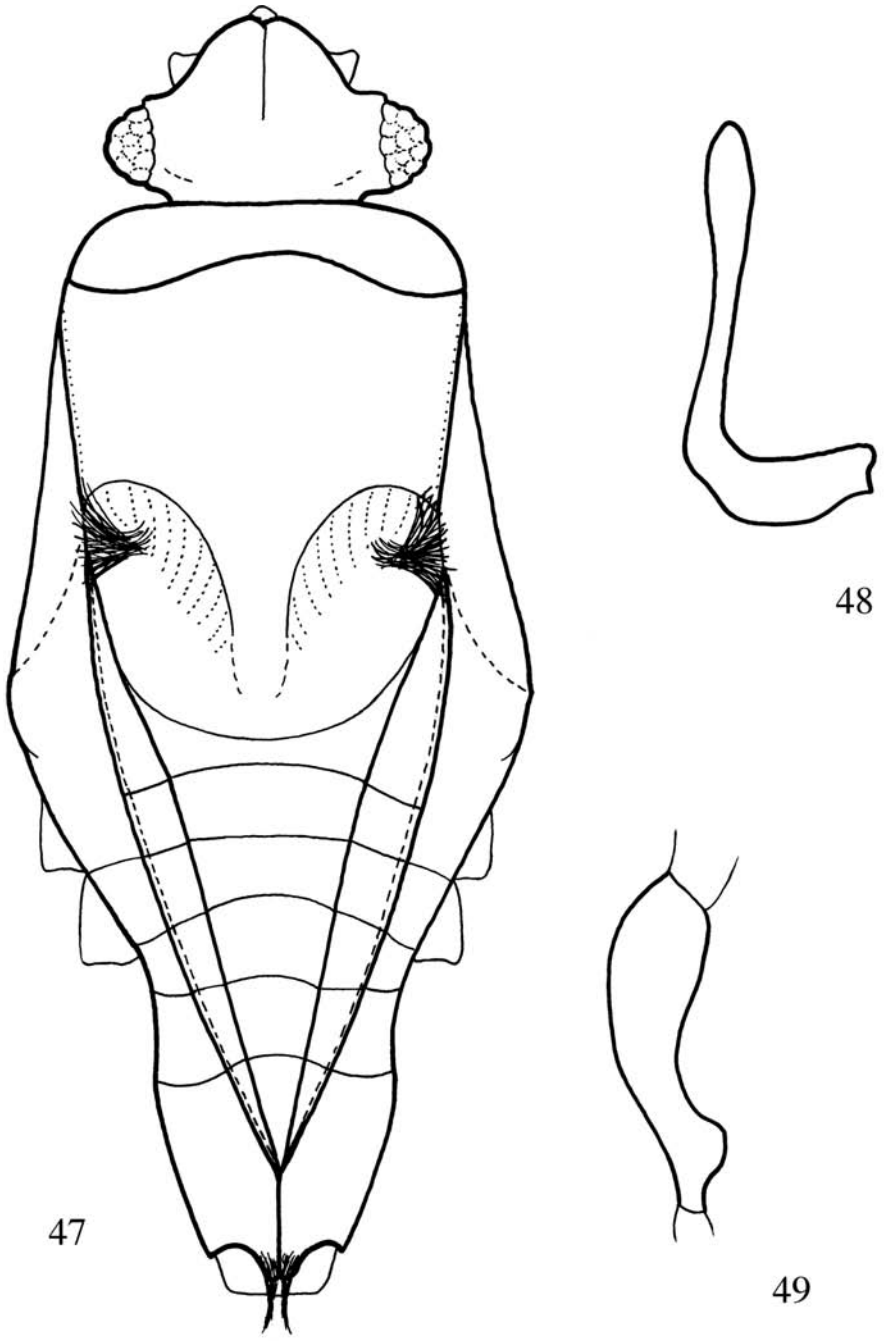
bears a short denticle basally followed by a distinct tubercle (Fig. 30), and by the broad styliform abdominal process with a slender tip (Fig. 42). Females are separated from those of *H. marchei* by the luteous basal half of the first antennal segment, and other features given in the key.

Discussion. *Hermatobates kula* nov.sp. occurs across a substantial part of Milne Bay Province (Fig. 46), but is most prevalent in the Louisiade Archipelago, where *H. weddi* and *H. marchei* are by contrast absent.

Etymology. The name "*kula*" is a noun in apposition, referring to the Kula Ring, a traditional circuit of ritual trade that circulates among the islands of the region where the species was discovered.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: Holotype, ♂, Louisiade Archipelago, Station 13, Wola Island, Rossel Lagoon, north side, 0 m [sea level], sea temp. 25.5°C, 1 September 2002, 19:00-22:30 hrs., at light, CL 7199, 11°18'05.4"S, 154°00'51.6"E (USNM).

Paratypes (nymphs not paratypes): 4♂♂, 10♀♀, 2 nymphs, Louisiade Archipelago, Calvados Chain, Panatinane Island, Huniye Bay, 0 m [sea level], 11°16'22.0"S, 153°10'49.7"E, Station 7, sea temp. 26°C, salinity 36 ppt, 28 August 2002, 19:00-20:00 hrs., night light from boat, CL 7189, D.A. & J.T. Polhemus (USNM, BPBM, JTPC); 26♂♂, 33♀♀, 11 nymphs, Louisiade Archipelago, Wola [Wula] Island, Rossel Lagoon, north side, 0 m [sea level], 11°18'05.4"S, 154°00'51.6"E, Station 13, sea temp. 25.5°C, salinity 36 ppt, 1 September 2002, 19:00-22:30 hrs., night light from boat, CL 7199, D.A. & J.T. Polhemus (USNM, BPBM, JTPC); 2♂♂, 8♀♀, 4 nymphs, Louisiade Archipelago, Misima Island, Bwagoia harbor, 0 m [sea level], 10°41'15.7"S, 152°50'45.6"E, Station 14, sea temp. 26°C, salinity 36 ppt, 2 September 2002, 19:00-20:00 hrs., night light from boat, CL 7200, D.A. & J.T. Polhemus (USNM, BPBM, JTPC); 9♂♂, 6♀♀, 2 nymphs, Conflict Group, Irai Island, north side, 0 m [sea level], 10°45'57.5"S, 151°42'29.0"E, Station 18, sea temp. 26°C, salinity 36 ppt, 4 September 2002, 15:00-20:00 hrs., night light from boat, CL 7213, D.A. & J.T. Polhemus (USNM, BPBM, JTPC); 1♂, 1♀, D'Entrecasteaux Islands, Normanby Island, Bunama Bay, sea 60 m offshore, 0 m [sea level], 10°08'37.9"S, 151°09'12.4"E, Station 27, salinity 36 ppt, sea temp. 29°C, 28 January 2003, 18:30-23:00 hrs., night light from boat, CL 7227, D.A. & J.T. Polhemus (USNM, BPBM, JTPC); 1♂, 3 nymphs, Nuakata Island, north



Figs 47-50: *Ocheovelia heissi* nov.sp., structural details (**47**) Female, dorsal habitus, appendages omitted (**48**) Male paramere (**49**) Female middle trochanter (**50**) Female adominal apex, lateral view.

coast, Haliwa Una Bay, sea 150 m offshore, 0 m [sea level], 10°16'20.4"S, 151°00'34.9"E, Station 29, sea temp. 28°C, salinity 36 ppt, 30 January 2003, 19:00-00:00 hrs, night light from boat, CL 7233, D.A. & J.T. Polhemus (USNM); 1 ♀, Basilaki Is., Hemoe Bay, 0 m [sea level], 10°35'41.5"S, 150°59'57.5"E, Station 38, sea temp. 29.5°C, salinity 36 ppt, 17 January 2004, 20:30-23:00 hrs., night light from boat, CL 7295, D.A. & J.T. Polhemus (USNM, BPBM, JTPC);

Additional material (not paratypes): 2♂♂, 4♀♀, Louisiade Archipelago, Tagula [Sudest] Island, sea offshore of Mohuwo Point [Nepenthes Point], 0 m [sea level], 11°21'58.7"S, 153°16'29.3"E, Station 9, sea temp. 25.5°C, salinity 36 ppt, 29 August 2002, 19:00-20:00 hrs., night light from boat, CL 7193, D.A. & J.T. Polhemus (USNM, BPBM, JTPC); 2♂♂, D'Entrecasteaux Islands, Fergusson Island, east coast, sea 100 m offshore of N side of Mebulibuli Point, 0 m [sea level], 9°30'18.5"S, 150°52'52.8"E, Station 25, sea temp. 29°C, salinity 36 ppt, 26-27 January 2003, 18:30-00:30 hrs. each night (low tide near midnight), night light from boat, CL 7223, D.A. & J.T. Polhemus (USNM).

Distribution. Occurs in the island groups immediately north and east of the eastern tip of New Guinea, primarily in the Louisiades, but also the Conflict Group, the D'Entrecasteaux Islands, Basilaki and Nuakata (Fig. 46).

Family Mesoveliidae

Genus *Mesovelia* Mulsant & Rey 1852

Mesovelia vittigera Horvath (Figs 21, 22)

Discussion. Although generally a freshwater species that is widespread in pond and marsh habitats throughout the western Pacific, *Mesovelia vittigera* is also able to tolerate a certain degree of salinity, and occasionally occurs in estuarine habitats with salinities of up to 5 ppt. This was demonstrated by its presence among an otherwise marine set of taxa in the middle Sinkwarai River estuary on Woodlark Island, where it co-occurred with *Rheumatometroides browni*, *Halobates murphyi*, and *Xenobates seminulum*. We have also found M. *vittigera* on mixohaline interior pools in the limestone islands of

Palau (the so-called "marine lakes" of that archipelago), where it occurred syntopically with the typically marine veliid *Halovelia bergrothi*. The water salinity at this Palau locality was vertically stratified, with a thin lens of cold, nearly limnetic water approximately 15 cm in thickness and with a salinity of 0-5 ppt overlying a deeper, warmer layer of mixohaline water with a salinity of 25 ppt. This vertical stratification of salinity was similar to that seen in many estuaries in the Melanesian region, but was more stable due to the absence of directional flow.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 2 winged ♂♂, 3 wingless ♂♂, 5 wingless ♀♀, Woodlark Is., Station 19a, middle Sinkwarai River estuary (USNM, JTPC).
Extralimital material examined: PALAU, **Koror State**: 6♂♂, 5 ♀♀, Koror Island, "Goby Lake", Ngermeuangel massif, 0 m [sea level], water temp. 28°C, 11 August 1999, 07:00-08:00 hrs., 7°18'48.0" N, 134°30'01.0"E, CL 7131, J.T. and D.A. Polhemus (USNM).

Family Veliidae
Subfamily Haloveliinae
Ocheovelia nov.gen. (Figs 47-52)
Halovelia Lansbury 1996 (in part).

Type-species: *Ocheovelia heissi* Polhemus & Polhemus nov.sp.

Description:

Size. Length of males 1.91-2.20, females 2.16-2.41; general body characteristics and size sexually dimorphic, females strongly modified, males elongate and more robust than females, not modified except for abdominal venter.

Colour. Ground colour blackish, without silvery setae; head weakly marked with orange brown on base of vertex; pronotum posteriorly narrowly orange brown; legs and venter tinged with orange brown.

Structural characters. Always apterous, as are all truly marine water striders; male elongate oval, female widest across thorax, narrowing posteriorly (Figs 47-51). Eyes globose, exserted, small, separated by about four times the width of an eye, appressed to anterior pronotal margin, with two long ocular setae. Head moderately declivant anteriorly, more so in females, posterior margin sloping caudo-dorsally, without obvious facial trichobothria, but with numerous setae; vertex with indistinct median sulcus; gular region short, plainly visible, rostral cavity closed posteriorly, weakly carinate. Rostrum reaching onto mesosternum, segment I short, enclosed in rostral cavity, segment IV about the length of I, almost four times longer than II, segment III about twice as long as I. Antennae long, slender in female, segment I stout in male, segment I longest, III and IV subequal in length, II shortest, total length less than body length (Fig. 51).

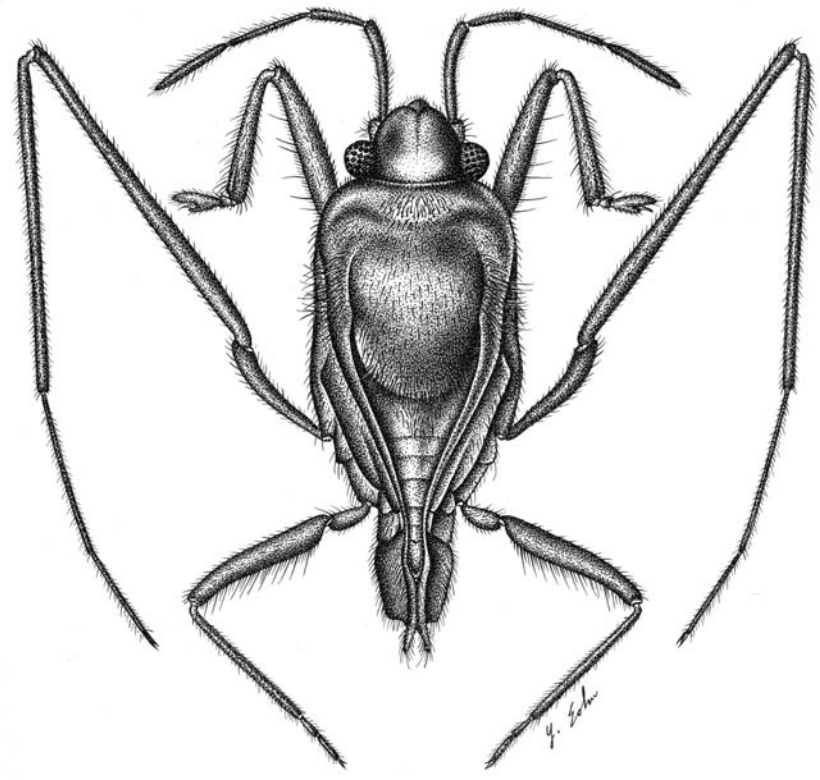


Fig. 51: *Ocheovelia solomon*, female, dorsal habitus (illustration Young Sohn).

Male pronotum slightly raised medially, short, about 1/3 head length, without evident collar; dorsal suture between pro- and mesonotum sinuate, obliterated laterally; sutures between pro- and mesopleura lost; sutures between mesonotum and metanotum, and between metanotum and abdominal terga (T I-III) lost, only marked by pairs of lateral pits; entire dorsum sparsely set with decumbent setae, longer posteriorly. Female pronotum length as in male, but strongly raised posteriorly, broad anterolaterally, much wider than head through eyes; mesonotum, metanotum, basal abdominal segments fused, strongly raised, strongly modified, sculptured, depressed anterolaterally, weakly to strongly depressed laterally (Figs 47, 51). Metasternal scent gland opening (omphalium) barely visible in female,

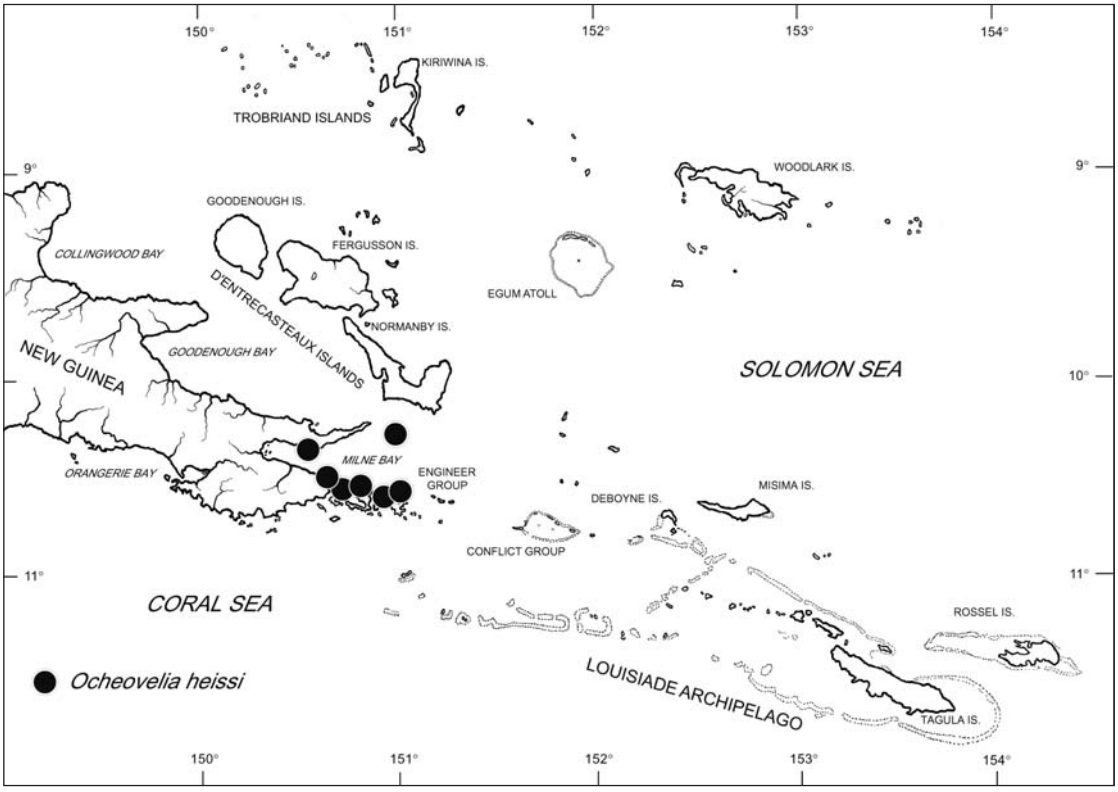


Fig. 52: Distribution of *Ocheovelia heissi* nov.sp. on far eastern New Guinea and nearby islands.

not evident in male (covered with dense setae), scent channels curving laterally to base of metacetabulae. Male abdomen slightly tapering posteriorly, connexiva not raised; tergites IV-VII subequal in length, VII longer, genital segments deflected ventrally; basal abdominal sternites with broad tumescence, IV-VI abruptly depressed medially, VII directed ventrally; parameres of moderate length, slender, truncate distally (Fig. 48), tips touching in repose. Female abdomen modified, narrowed posteriorly to segment VI, segment VII broadened, pleural margins of seventh sternite produced dorsally into long triangular projections (Fig. 50); tergum VIII large, deflected ventrad, concealing proctiger.

Legs slender except fore and hind femora swollen in males and females; middle legs much longer than others, middle femur 3/4 (female) to 9/10 (male) as long as body, middle tibia slightly shorter, middle tarsi shorter than tibia, distal segment shortest; middle trochanter long, curved, in female with a basal tumescence dorsally (Fig. 49); all femora set ventrally with short slender setae, unmodified; anterior tibia of male with a comb of minute black setae occupying about 1/2 of tibial length; fore claws falcate, somewhat thickened, other claws very small; arolia not evident.

Diagnosis. This genus is most similar to *Halovelia* BERGROTH, but differs from any other in the Haloveliinae in exhibiting unique modifications for phoresy, the females being strongly modified to carry the males on their back. The males are elongate, in contrast to the subovate shape seen in males of *Halovelia*; the basal abdominal sternites have a broad tumescence; and the third antennal segment is relatively long. The males of the three known species are very similar, and have similar male genitalic features, whereas the female dorsum of each species is strikingly and distinctively modified to accommodate the male (Figs 47 and 51, and see Figures 3 and 4 in LANSBURY 1996).

The generic description of *Ocheovelia* above does not repeat some redundant information given for the closely related genus *Halovelia* by ANDERSEN (1989a), but instead stresses the differences between the two genera. The synapomorphies establishing *Ocheovelia* as a clade distinct from *Halovelia* are: female mesonotum, metanotum, and basal abdominal segments fused, strongly raised and modified, being sculptured and depressed anterolaterally; female abdomen modified, narrowing posteriorly to segment VI, with segment VII then broadened; female with pleural margins of seventh stern-

ite produced dorsally into long triangular projections; male with the base of the abdominal venter bearing a broad tumescence.

Discussion. The genus *Ocheovelia* as defined herein contains three species, *O. solomon* (ANDERSEN), *O. anderseni* (LANSBURY), and the newly described *O. heissi* nov.sp. Two of these species were previously held in *Halovelia*.

ANDERSEN (1989b) described *Halovelia solomon* from several males, but did not know the female of this species, thus he was unable to appreciate its startling differences in comparison to other Haloveliinae. He did note, however, that the males were very different in comparison to any other *Halovelia*, with an elongate body shape, a relatively long antennal segment III, and the base of the abdominal venter bearing a broad tumescence. In his cladistic analysis of *Halovelia* he notes "the taxonomical relationships of *H. solomon* ... are problematical" (1989b: 216). We have recently collected males and females of this species at several localities in the Solomon Islands (see below), and are now able to correctly place it in its proper taxonomic context.

LANSBURY (1996) described *Halovelia anderseni* from Nagada Harbor near Madang, Morobe Province, Papua New Guinea, and illustrated the greatly modified female, but did not associate the modifications with phoresy. This species has now been taken much farther southeast, along the coast of the Cape Nelson Peninsula near Tufi.

Etymology. The generic name "*Ocheovelia*" is derived from *ocheo* (Gr.), to bear or carry, and *Velia*, the nominate genus of the family. Gender feminine.

Distribution. Northeastern New Guinea and the Solomon Islands.

Ocheovelia heissi nov.sp. (Figs 47-50, 52)

Description:

Size. Apterous male, length 2.05-2.20 ($\bar{x}$ = 2.14, n = 5); width 1.00-1.04 ($\bar{x}$ = 1.01, n = 5). Apterous female, length 2.30-2.41 ($\bar{x}$ = 2.35, n = 5); width 0.97-1.04 ($\bar{x}$ = 1.00, n = 5).

Colour. Male (see generic description): ground colour black; male with greyish pubescence which is longer on abdominal dorsum; female with pubescence and tufts of setae on thoracic dorsum, abdominal dorsum and depressed areas almost hair free. Vertex of head with large irregular orange brown spot at base. Antennae and legs blackish brown, first antennal segment and all femora shining.

Structural characters (see generic description). Apterous male: elongate oval, length more than 2.0x greater than greatest width across thorax (2.20:1.04). Head length 0.69x head width across eyes (0.40:0.58); eyes rather small, slightly less than 0.2x interocular width (0.09:0.47).

Antennal formula I : II : III : IV = 0.50 : 0.25 : 0.29 : 0.43; segment I distinctly longer than head (0.50:0.40) and stout, much thicker than segment IV.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg = 0.76 : 0.61 : 0.07 : 0.18; of middle leg = 1.91 : 1.73 : 0.79 : 0.54; of hind leg = 0.90 : 0.72 : 0.11 : 0.14. Grasping comb slightly more than 1/2 of fore tibial length; middle femur about 0.9x total body length; hind femur distinctly thicker than middle femur (0.14:0.11).

Base of abdominal venter with a broad tumescence furnished with long hairs, terminating abruptly beyond sternite III, sternites IV-VII deeply depressed medially. Parameres (claspers) relatively short, barely crossing each other dorsal to genital segment; blade of each paramere slender (Fig. 48), slightly curved dorsad, tip straight and dorso-ventrally flattened with rounded apex; vesica with two slender elongate sclerites crossing in an "X" pattern, these sclerites simple, lacking projections or bifurcations.

Apterous female: elongate, length about 2.3x greater than greatest width across thorax (2.34:1.01). Head length 0.59x head width across eyes (0.32:0.54); eyes rather small, slightly less than 0.18x interocular width (0.07:0.40).

Antennal formula I : II : III : IV = 0.45 : 0.25 : 0.29 : 0.40; segment I distinctly longer than head (0.45:0.32) and stout, thicker than segment IV.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg = 0.72 : 0.54 : 0.07 : 0.18; of middle leg = 1.62 : 1.55 : 0.68 : 0.46; of hind leg = 0.83 : 0.65 : 0.11 : 0.18. Middle femur about 0.7x total body length; hind femur distinctly thicker than middle femur (0.11:0.07).

Thorax broad, modified, heavily sculptured (Fig. 47); mesonotum, metanotum and basal abdominal segment fused, raised anteriorly (Fig. 47), slightly depressed anterolaterally, compressed laterally on pleura, deeply and broadly depressed on either side of large median tumescence.

Abdomen tapering from base to segment VI; segment VII swollen basally, modified (Fig. 47), pleural plates forming large paired triangular protuberances extending dorsad above abdomen. Tergum VIII large, deflected ventrad, concealing proctiger.

Diagnosis. *Ocheovelia heissi* nov.sp., *O. anderseni* (LANSBURY) and *O. solomon* (ANDERSEN) are sibling species with geographically allopatric ranges: *O. anderseni* is known only from the northeast coast of Papua New Guinea, *O. solomon* only from the Solomon Islands, and *O. heissi* nov.sp. only from far eastern New Guinea and immediately adjacent islands. In *Ocheovelia heissi* nov.sp. the male fore femur is densely pilose beneath, and not flattened on the basal half as it is in *O. anderseni*, and the grasping comb is longer (~ 1/2 the length of fore tibia) than it is in either *O. anderseni* (2/5) or *O. solomon* (1/3). The modifications of the fused female meso-metanotum and basal abdominal tergites of the three species are different in shape, with *O. heissi* nov.sp. dorsally much more deeply and broadly sculptured on either side of the median tumescence than the other two species, *O. solomon* narrowly incised (Fig. 51), and *O. anderseni* not deeply incised at all. In addition, the dorsal tufts of stout setae are different among the species, being located in *O. anderseni* primarily on the anterior part of the pronotum, while in *O. heissi* nov.sp. and *O. solomon* they lie at the apparent base of the connexiva, with the setae in *O. solomon* straight and projecting in every direction (Fig. 51), rather than being distinctly curved and primarily directed medially as in *O. heissi* nov.sp. (Fig. 47). In contrast to the distinctive females, the males of *Ocheovelia heissi* nov.sp. are very similar to those of the other two species in the genus.

Discussion. This species is found on the open waters of sheltered bays, and has not been encountered near the shore or amid coral blocks. All of our captures came via night lighting from the stern of the research vessel.

Etymology. The name "*heissi*" is a patronymic, honoring the many contributions of our esteemed colleague Ernst Heiss to the study of Heteroptera, and his collection of many fascinating species, often new to science, from all over the world, which he magnanimously shared with his colleagues.

Biological notes. The type series was taken at night after being attracted to a light at the stern of the research vessel Marlin 1 as it lay anchored at Kana Kopi Bay, a sheltered embayment with mangrove shores on the south side of Milne Bay, not far to the west of the China Strait.

Type material: **Holotype**, ♀: PAPUA NEW GUINEA, **Milne Bay Prov.**: Kana Kopi Bay, ESE of Alotau, 0 m [sea level], 10°28'54.3"S, 150°39'10.2"E, Station 31, sea temp. 29°C, 13 Jan. 2004, 19:30-2200 hrs., night light from boat, CL 7283, D.A. & J.T. Polhemus (USNM). **Paratypes**: PAPUA NEW GUINEA, **Milne Bay Prov.**: 70♂♂, 43♀♀, New Guinea, Station 31, Kana Kopi Bay, same data as holotype. D.A. & J.T. Polhemus (USNM, BPBM, JTPC); 2♂♂, New Guinea, sea offshore of W side of Lihitabu Point, N side of Milne Bay, E of Alotau, 0 m [sea level], 10°21'13"S, 150°35'05"E, Station 3, sea temp. 29°C, salinity 33 ppt, 8 April 2002, 16:00-16:30 hrs., CL 7168, D.A. & J.T. Polhemus (USNM); 23♂♂, 5♀♀, Nuakata Island, north coast, Haliwa Una Bay, sea 150 m offshore, 0 m [sea level], 10°16'20.4"S, 151°00'34.9"E, Station 29, sea temp. 28°C, salinity 36 ppt, 30 January 2003, 19:00-00:00 hrs, night light from boat, CL 7233, D.A. & J.T. Polhemus (USNM, BPBM, JTPC); 3♀♀, Lesimano Is., N of Sariba Is., south shore, 0 m [sea level], 10°34'36.1"S, 150°42'49.4"E, Station 33, sea temp. 29°C, salinity 36 ppt, 14 January 2004, 21:00-22:00 hrs., night light from boat, CL 7286, D.A. & J.T. Polhemus (USNM); 25♀♀, Sideia Is., Wiwiyai Bay, 0 m [sea level], 10°32'50"S, 150°49'28.5"E, Station 35, sea temp. 30°C, salinity 36 ppt, 15 January 2004, 20:00-21:30 hrs., night light from boat, CL 7290, D.A. & J.T. Polhemus (USNM, BPBM, JTPC); 1♂, Sideia Is., mangrove estuary at head of Kwabunamoa Bay, 0 m [sea level], 10°34'19.7"S,

150°50'41.8"E, Station 36, water temp. 31°C, salinity 6 ppt (head of estuary)-34 ppt (mouth of estuary), 16 January 2004, 10:45-11:00 hrs. and 13:30-13:45 hrs., CL 7291, D.A. & J.T. Polhemus (USNM); 1 ♀, Basilaki Is., Babana Bay, E. of North Point, 0 m [sea level], 10°35'58.0"S, 151°02'01.4"E, Station 37, sea temp. 30°C, salinity 36 ppt, 16 January 2004, 20:30-23:00 hrs., night light from boat, CL 7293, D.A. & J.T. Polhemus (USNM); 8♂♂, 5 ♀♀, Basilaki Is., Hemoe Bay, 0 m [sea level], 10°35'41.5"S, 150°59'57.5"E, Station 38, sea temp. 29.5°C, salinity 36 ppt, 17 January 2004, 20:30-23:00 hrs., night light from boat, CL 7295, D.A. & J.T. Polhemus (USNM, BPBM, JTPC).

Distribution. Far eastern New Guinea and immediately adjacent islands (Nuakata, Lesimano, Sideia, Basilaki) (Fig. 52).

Ocheovelia anderseni (Lansbury) comb.nov.

Halovelia anderseni Lansbury 1996

Discussion. *Ocheovelia anderseni* is known only from Papua New Guinea, and had until recently been collected only from Nagada Harbor, in Madang Province, where Lansbury captured a large number of specimens and provided notes on their habitat and ecology. Our recently collected specimen from Tufi represents a significant range extension to the southeast.

Extralimital material examined: PAPUA NEW GUINEA, **Madang Prov.**: 3♂♂, 2 ♀♀, Nagada Harbor at Christensen Research Station, NW of Madang, 0 m [sea level], 5°09'S, 145°41'E, sea temp. 33°C, 26 March 1994, 12:00-14:00 hrs., CL 7033, D.A Polhemus (BPBM, JTPC). **Oro Prov.**: 1 ♀, Kofure River Estuary, W of Tufi, 0 m [sea level], 9°04'49.4"S, 149°17'00.0"E, sea temp. 32°C, CL 4465, 24 Jan. 2004, D.A. & J.T. Polhemus (USNM).

Ocheovelia solomon (Andersen), comb.nov. (Fig. 51)

Halovelia solomon Andersen 1989

Discussion. *Ocheovelia solomon* is known only from the Solomon Islands, and the distinctive female (Fig. 49) was unknown until our recent expeditions in that archipelago during late 2004 and early 2005. This species is clearly a member of the genus *Ocheovelia*, and very distinct from the other two included species.

Extralimital material examined: SOLOMON ISLANDS, **Western Province.**: 23♂♂,4 ♀♀, Lola Is., Vonavona Lagoon, SW of Munda, north coast, 0 m [sea level], 8°18'30.0"S, 157°09'53.9"E, sea temp. 31°C, salinity 35 ppt, at light on dock at night, 16 November 2004, 20:00-21:00 hrs., CL 7331, D.A. Polhemus (USNM, JTPC, BPBM); 1♂, 2 ♀♀, Gizo Is., mangrove-lined bay on north coast, W of Gizo, 0 m [sea level], 8°02'41.1"S, 156°48'31.9"E, sea temp. 31°C, salinity 36 ppt, 13 March 2005, 20:00-22:00 hrs., night light from boat, CL 7380, D.A. and J.T. Polhemus (USNM); 2♂♂, 1 ♀, Kolombangara Is., Ringgi harbor, 0 m [sea level], 8°07'14.2"S, 157°06'43.2"E, sea temp. 29°C, salinity 14 ppt, 19 March 2005, 19:30-22:00 hrs., night light from boat, CL 7395, D.A. and J.T. Polhemus (USNM); 3♂♂, 1 ♀, Mbanga Is., western shore near Goldie College, 0 m [sea level], 8°16'27.4"S, 157°12'36.1"E, sea temp. 31°C, salinity 36 ppt, 20 March 2005, 19:30-22:00 hrs., night light from boat, CL 7398, D.A. and J.T. Polhemus (USNM).

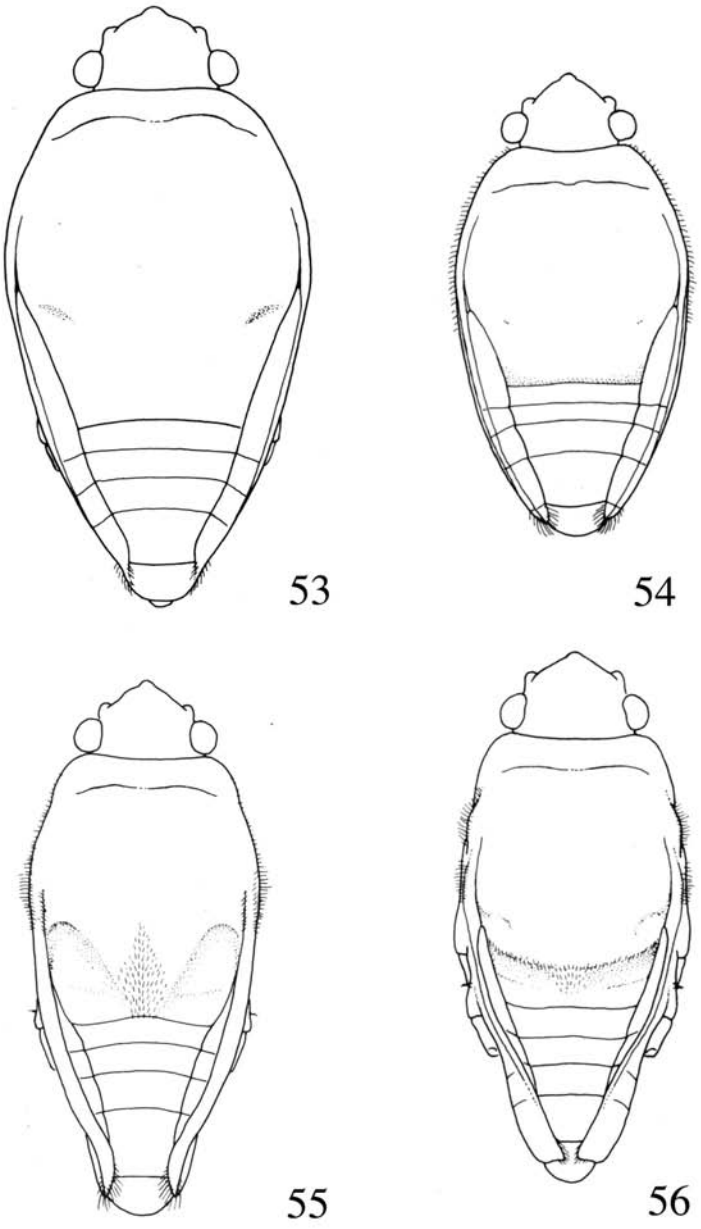
Genus *Halovelia* Bergroth 1893 (Figs 53-75)

The genus *Halovelia* now contains 38 species, including the two new species described below, distributed from the Red Sea and East African coast to the western Pacific, as far as the Caroline Islands, the Marshall Islands, and Samoa. The species of this genus utilize a wide variety of habitats, including mangrove coasts, rocky shores, and coral reefs, and exhibit extensive localized endemism amid the islands of the Southwest Pacific.

Halovelia annemariae Andersen (Figs 55, 59, 63)

Discussion. *Halovelia annemariae* was described from the Solomon Islands, where it is relatively common in the Western Province. It was previously known from Papua New Guinea based on a single collection at Dregerhafen on the north coast, made by Biro in 1898 (Andersen 1989a). This species was also mentioned by Lansbury (1996) in his paper on the marine water striders of Nagada Harbor, Papua New Guinea, but no specific specimen records were provided.

The paucity of New Guinea specimens of *H. annemariae* in our collections, in contrast to the abundant material of other species, suggests that the habitat preferences of this species in eastern New Guinea are not well understood. By contrast, we collected many *H. annemariae* in the protected



Figs 53-56: *Halovelia* species occurring on far eastern New Guinea and nearby islands, females, dorsal habitus (**53**) *Halovelia bergrothi* Esaki (**54**) *Halovelia corallia* Andersen (**55**) *Halovelia annemariae* Andersen (**56**) *Halovelia novoguinensis* Andersen. Reprinted with permission from Andersen (1989).

bays of the western Solomon Islands, where it seems to be the dominant *Halovelia* species, and is without significant competition from other congenors.

Distribution. This species was previously known from the Solomon Islands and northeastern Papua New Guinea (Madang Province). Our new records from New Britain are the first from the Bismarck Archipelago, and the additional new records from Oro and Milne Bay provinces of Papua New Guinea extend the range of this species well to the southeast along the New Guinea coast and into the islands surrounding the China Strait.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 2♂♂, 1 ♀, Milne Bay, Station 3, offshore of Lihitabu Point; 1♂, 1 ♀, Normanby Is., Station 27, Bunama Bay; 1 ♀, Lesimano Is., Station 33, south shore (USNM, JTPC).
Extralimital material examined: PAPUA NEW GUINEA, **Oro Prov.**: 1♂, Tufi Harbor, cliff-bound rocky shore near village dock, 0 m [sea level], 9°04'57.0"S, 149°19'15.0"E, 24 January 2004, 23:00-24:00 hrs., CL 4468, J.T. Polhemus (JTPC). **West New Britain Prov.**: 46♂♂, 9 ♀♀, New Britain, Wilaumez Peninsula, nearshore sea at Walindi Plantation, N of Kimbe, 0 m [sea level], sea temp. 28°C, 11 January 2005, 20:00-21:00 hrs., at light from stern of boat at night, CL 7342, D.A. Polhemus (USNM); 17♂♂, 27 ♀♀, New Britain, Kimbe Bay, Restorff Island, calm sea on W side, 0 m [sea level], 5°17'35.7"S, 150°06'15.6"E, sea temp. 29°C, salinity 35 ppt, 16 January 2005, 10:45-13:45 hrs., CL 7347, D.A. Polhemus (USNM, BPBM).

Halovelia bergrothi Esaki (Figs 53, 57, 61, 66)

Discussion. *Halovelia bergrothi* is perhaps the most widespread and adaptable marine haloveliine in the southwest Pacific region. It may be found in a wide variety of habitats, ranging from the shelter of scattered coral rubble blocks on tidally exposed nearshore reef flats or offshore reef crests to open waters up to 200 m offshore in protected bays or in the lee of small islets. This species does not appear to be associated with mangroves; its occurrence is instead correlated with suitable coral reef or rocky shore habitat.

Although, as noted above, *H. bergrothi* does not typically occur in estuaries, we have found this species skating on nearly fresh water at the surface of interior mixohaline lakes in Palau (see discussion under *Mesovelia vittigera*). This indicates that *H. bergrothi* has a potentially wide salinity tolerance, which may further explain its broad distribution in the southwest Pacific.

Distribution. The type of *H. bergrothi* came from the Madang area of northeastern New Guinea, and the species is widely distributed on the continental shores and archipelagoes of the western Pacific, including Vietnam, the Philippines, the Solomons, the Carolines, the Marianas, the Marshalls, Nauru, Samoa and New Caledonia. Our current surveys have now extended the range of this species to include Milne Bay,

the D'Entrecasteaux Islands, the Louisiade Archipelago, Egum Atoll and the Engineer Group.

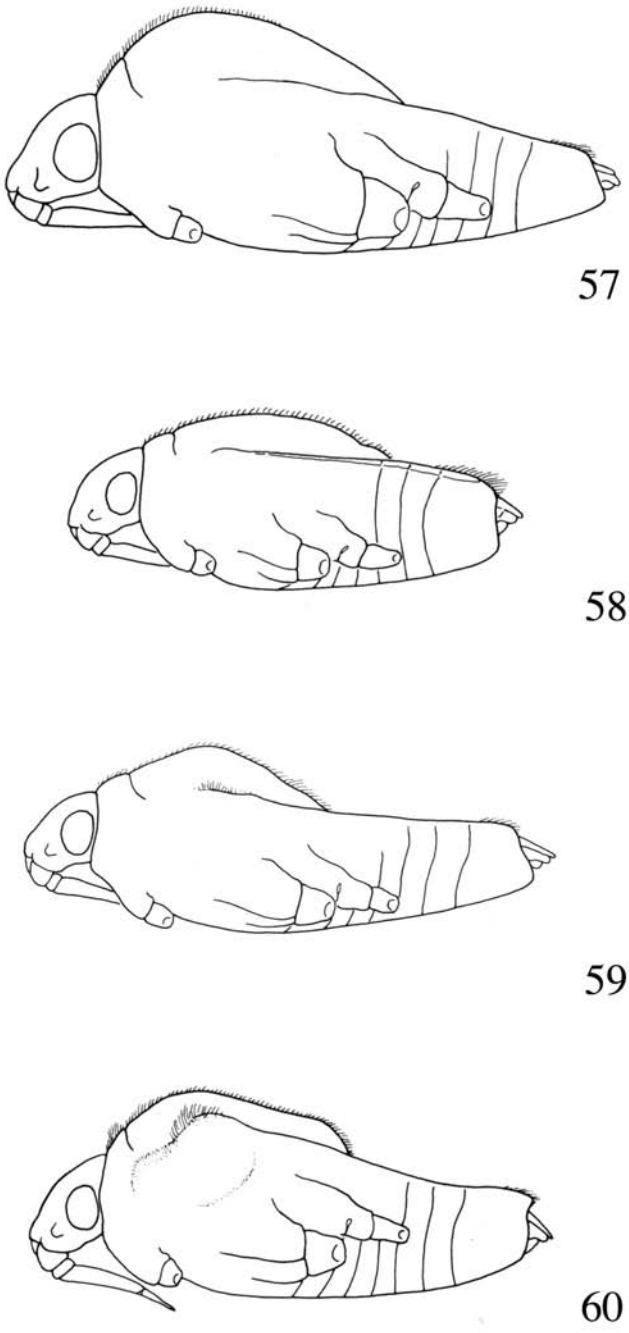
Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 5♂♂, 4 ♀♀, New Guinea, Station 2, Killerton Islands; 12♂♂, 26 ♀♀, New Guinea, Station 3, offshore of Lihitabu Point; 25♂♂, 30 ♀♀, Fergusson Is., Station 5, reef flat at Mebulibuli Point; 4♂♂, 3 ♀♀, Wola Island (Rossel Lagoon), Station 13, north side; 4♂♂, 6 ♀♀, Yanaba Is. (Egum Atoll), Station 24, sea, offshore of S side; 3♂♂, 4 ♀♀, Fergusson Is., Station 25, offshore of Mebulibuli Point; 42♂♂, 33 ♀♀, Normanby Is., Station 27, Bunama Bay; 2♂♂, 3 ♀♀, Normanby Is., Station 28, Kasikasi Bay; 17♂♂, 19 ♀♀, Nuakata Is., Station 29, Haliwa Una Bay; 13♂♂, 20 ♀♀, New Guinea, Station 31, Kana Kopi Bay; 2 ♀♀, Lesimano Is., Station 33, south shore; 1 ♂, Basilaki Is., Hemoe Bay, CL 7295, Station 38; 3♂♂, 1 ♀, Tubetube Is., Station 40, bay on NE side (USNM, BPBM, JTPC).
Extralimital material examined: PAPUA NEW GUINEA, **Morobe Prov.**: 26♂♂, 13 ♀♀, Cape Roon, 150 m offshore, 0 m [sea level], 7°20'44.8"S, 147°09'33.4"E, sea temp. 30°C, salinity 29 ppt, 2 May 2003, 10:00-10:30 hrs., CL 7237, D.A. Polhemus (USNM); 1 ♀, rocky point N of Cape Dinga [= Yaraku Point], 0 m [sea level], 7°18'03.8"S, 147°08'35.3"E, sea temp. 30°C, salinity 30 ppt, 4 May 2003, 10:00-12:30 hrs., CL 7242, D.A. Polhemus (USNM). PALAU, **Koror State**: 8♂♂, 9 ♀♀, Koror Island, "Goby Lake", Ngermeuangel massif, 0 m [sea level], water temp. 28°C, 11 August 1999, 07:00-08:00 hrs., 7°18'48.0" N, 134°30'01.0"E, CL 7131, J.T. and D.A. Polhemus (USNM).

Halovelia corallia Andersen (Fig. 54, 58, 62, 66)

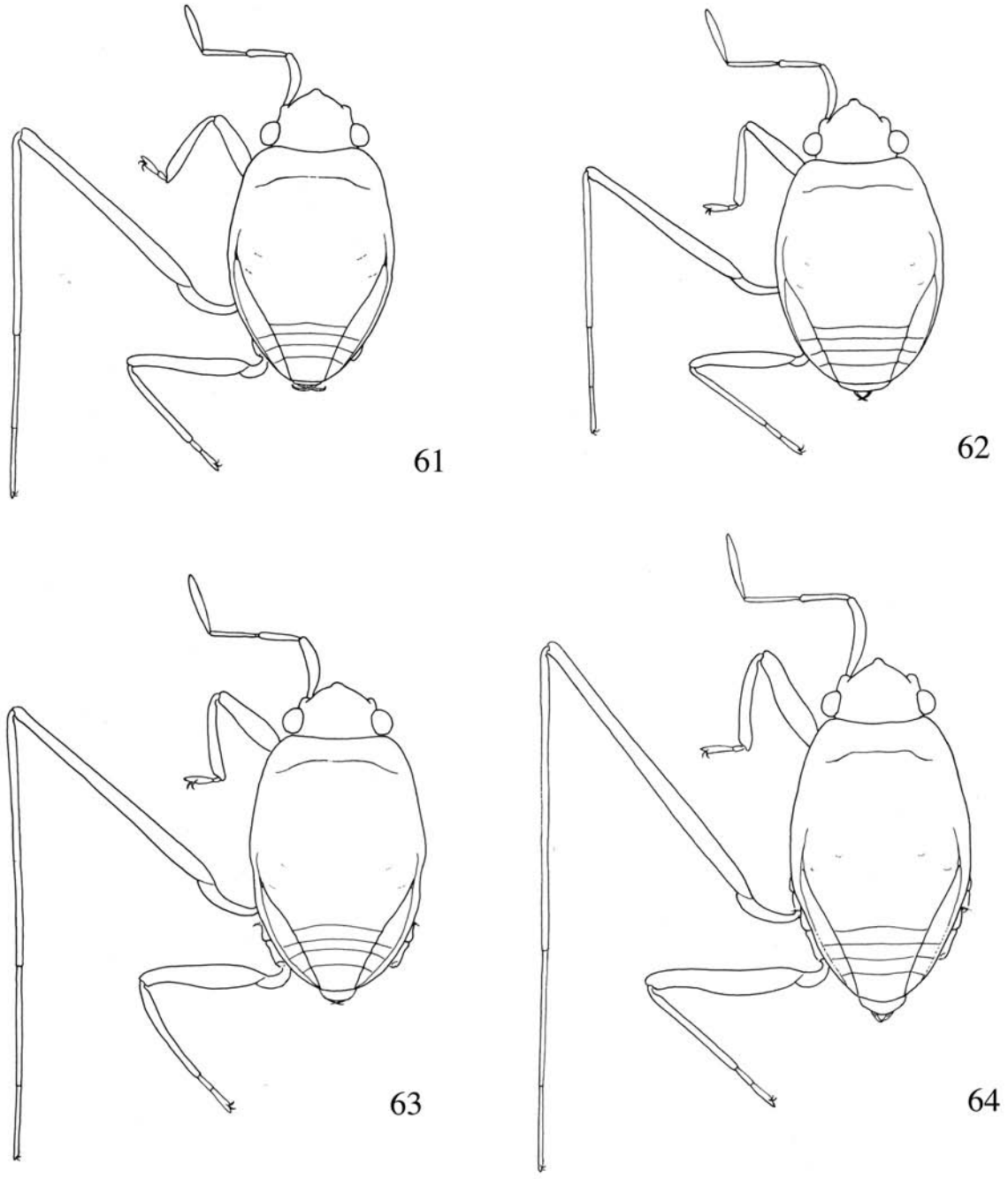
Discussion. *Halovelia corallia* is an uncommon species in Milne Bay Province, and was taken by our survey teams only twice, on the open offshore waters of Bwagoia Harbor at Misima island during a windy night with moderately choppy sea conditions, and at light in Huniye Bay on Panatinanae Island. As a result, little can be concluded regarding its ecological preferences. Although both of our recent localities lie in the Louisiade Archipelago, the known range of this species (see below) indicates that it should occur elsewhere along the southern coast of the Papuan Peninsula between Port Moresby and the China Strait.

Distribution. This species was orignally described from Motupore Island, near Port Moresby on the southeast coast of New Guinea, with additional specimens recorded from Daru Island and the coast of Queensland. Our surveys have extended the range of *H. corallia* 800 km to the east, into the Louisiade Archipelago, demonstrating that it occurs along the entire northern and western margins of the Coral Sea.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 1♂, 1 ♀, Panatinane Island, Station 7, Huniye Bay; 1 ♀, Misima Island, Station 14, Bwagoia harbor (USNM).



Figs 57-60: *Halovelia* species occurring on far eastern New Guinea and nearby islands, females, lateral habitus (**57**) *Halovelia bergrothi* Esaki (**58**) *Halovelia corallia* Andersen (**59**) *Halovelia annemariae* Andersen (**60**) *Halovelia novoguinensis* Andersen. Reprinted with permission from Andersen (1989).



Figs 61-64: *Halovelia* species occurring on far eastern New Guinea and nearby islands, females, dorsal habitus (**61**) *Halovelia bergrothi* ESAKI (**62**) *Halovelia corallia* ANDERSEN (**63**) *Halovelia annemariae* ANDERSEN (64) *Halovelia novoguinensis* ANDERSEN. Reprinted with permission from ANDERSEN (1989).

Halovelia novoguinensis ANDERSEN (Fig. 56, 60, 64, 65)

Discussion. *Halovelia novoguinensis* is usually encountered on the open waters of protected bays, skating 100-400 m offshore. This habit may explain why the species had not been previously re-collected in the 20 years since the original type series was taken by the authors near Port Moresby in 1983.

Distribution. Originally described from Motupore Island in Bootless Inlet, near Port Moresby, and until now known only from the type locality. Our surveys have demonstrated that this species occurs in the China Strait area and the Louisiade Archipelago, extending its range eastward by 800 km along the northern margin of the Coral Sea.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 25♂♂, 36♀♀, Panatinane Island, Station 7, Huniye Bay; 2♀♀, Tagula Is., Station 9, Mohuwo Point; 80♂♂, 30♀♀, Tagula Is., Station 10, Kolukolu Creek estuary; 1♀, Rossel Is., Station 12, head of Yonga Bay; 2♀♀, Misima Island, Station 15, bay NW of Tabula Point; 2♀♀, Misima Island, Station 17, bay at Bwagabwaga village (USNM, BPBM, JTPC).

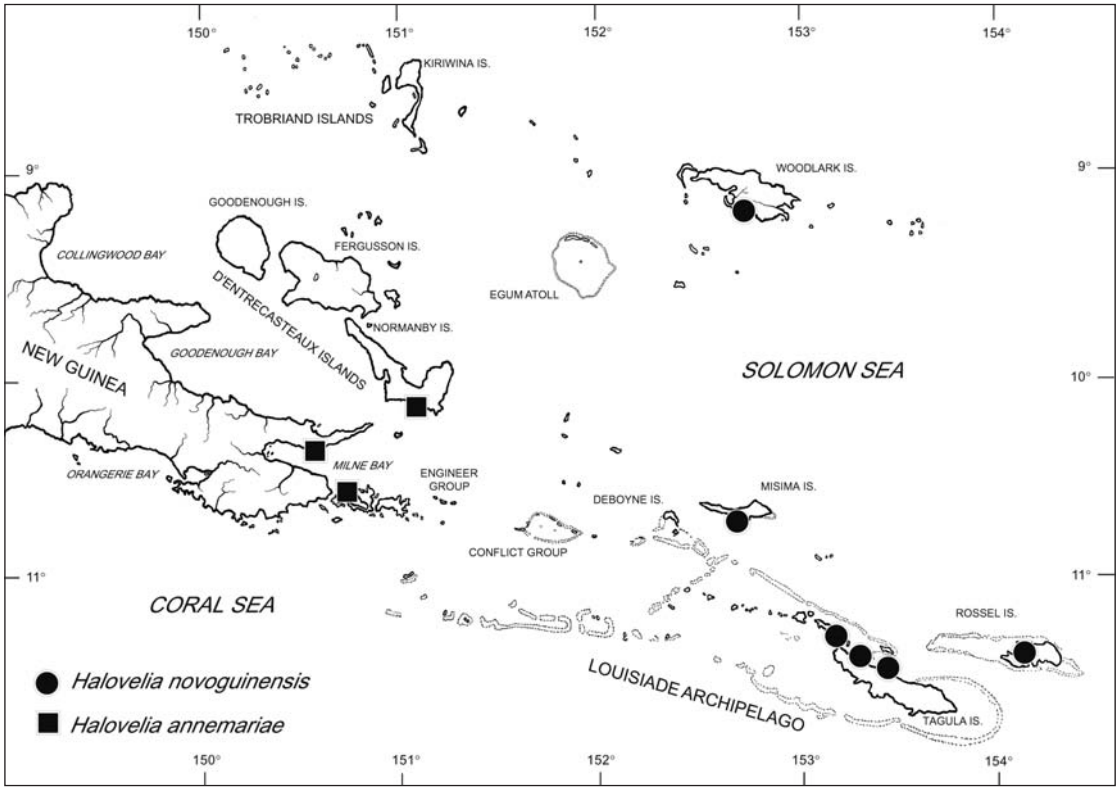


Fig. 65: Distribution of *Halovelia novoguinensis* and *Halovelia annemariae* on far eastern New Guinea and nearby islands.

Halovelia huniye nov.sp. (Figs 67-70)

Description:

Size. Apterous male, length 1.75-1.84 ($\bar{x}$ = 1.80, n = 3); width 0.94-1.01 ($\bar{x}$ = 0.97, n = 3). Apterous female, length 2.34-2.56 ($\bar{x}$ = 2.41, n = 5); width 0.97-1.04 ($\bar{x}$ = 1.01, n = 5).

Colour. Ground colour black; male with greyish pubescence which is longer on abdominal dorsum, especially caudally; female with pubescence on thoracic and abdominal dorsum, triangular patch of silvery setae on metanotum and basal abdominal terga, longer setae on connexiva especially distally. Vertex of head with large irregular orange brown spot at base. Antennae and legs blackish brown, first antennal segment and all femora shining.

Structural characters. Apterous male: body shape elongate oval, length more than 2.0x greater than greatest width across thorax (1.83:0.89). Head length 0.67x head width across eyes (0.36:0.54); eyes rather small, about 0.35x interocular width (0.12:0.34).

Antennal formula I : II : III : IV = 0.35 : 0.21 : 0.25 : 0.30; segment I subequal to head length (0.35:0.36) and stout, slightly thicker than segment IV.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg = 0.63 : 0.53 : 0.05 : 0.16; of middle leg = 1.62 : 1.51 : 0.65 : 0.47; of hind leg = 0.79 : 0.59 : 0.07 : 0.14. Grasping comb slightly more than 1/4 of fore tibial length (0.16/0.53); middle femur about 0.9x total body length; hind femur distinctly thicker than middle femur (0.11:0.07).

Abdominal venter not modified, with moderately long hairs. Parameres (claspers) relatively short, barely crossing each other dorsal to genital segment; blade of each paramere (Fig. 68) slender, slightly curved dorsad, not twisted, tip straight, spatulate, dorso-ventrally flattened with rounded apex; vesical sclerites as in Fig. 69.

Apterous female: elongate, almost parallel-sided (Fig. 67), length about 2.4x greater than greatest width across thorax (2.27:0.94). Head length 0.60x head width across eyes (0.32:0.58); eyes rather small, slightly less than 0.18x interocular width (0.08:0.43).

Antennal formula I : II : III : IV = 0.33 : 0.21 : 0.23 : 0.30; segment I subequal to head length (0.33:0.332), subequal in thickness to segment IV.

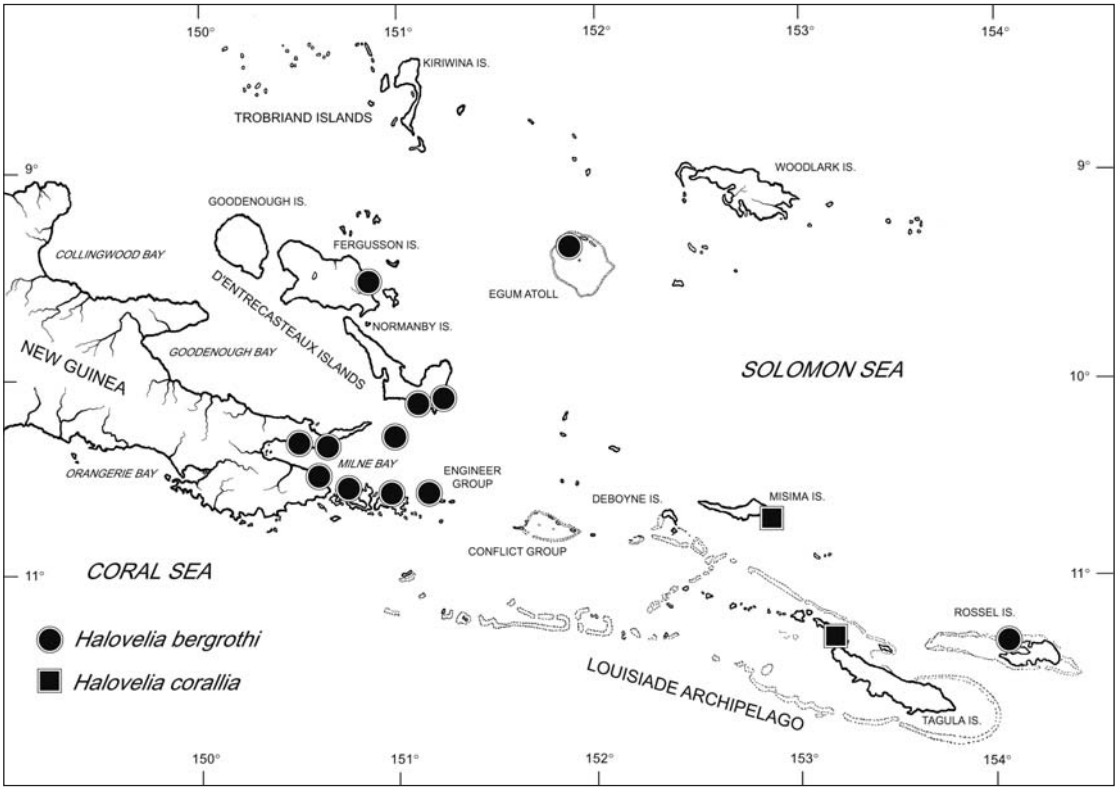


Fig. 66: Distribution of *Halovelia bergrothi* and *Halovelia corallia* on far eastern New Guinea and nearby islands.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg = 0.62 : 0.53 : 0.05 : 0.19; of middle leg = 1.58 : 1.44 : 0.63 : 0.44; of hind leg = 0.77 : 0.60 : 0.09 : 0.16. Middle femur about 0.7x total body length; hind femur distinctly thicker than middle femur (0.12:0.08).

Thoracic dorsum distinctly raised, greatest height at about middle of mesonotum, without long dorsal pubescence; metanotum and basal abdominal segments fused, sloping rather evenly to abdominal tergite IV; meso- and metapleura distinctly impressed.

Abdomen tapering very slightly from base to segment VI; connexiva of segment VII angled inward, set with long setae directed medially. Tergum VIII large, deflected ventrad, concealing proctiger.

Diagnosis. This species keys to *H. lannae* ANDERSEN, and the male is similar, however there are several significant differences. The more slender male vesical sclerite is club shaped, not as in *H. lannae* (Fig. 69). The female is very different, much more parallel sided than any other species (Fig. 67), with a large brush of medially directed setae distally on the connexiva of segment VII, which are abruptly infolded distally (Fig. 67); the metanotum and basal abdominal segments are not raised medially, nor depressed laterally as in *H. lannae*, but slope rather evenly, without tufts of long setae. The meso- and metapleura are also distinctly impressed.

Etymology. The name "*huniye*" is a noun in apposition, named for Huniye Bay on Panitinane Island where this species was discovered.

Type material: **Holotype**, apterous ♀: PAPUA NEW GUINEA, **Milne Bay Prov.**: Louisiade Archipelago, Calvados Chain, Panatinane Island, Huniye Bay, 0 m [sea level], 11°16'22.0"S, 153°10'49.7"E, Station 7, sea temp. 26°C, salinity 36 ppt, 28 August 2002, 19:00-20:00 hrs., night light from boat, CL 7189, J.T. and D.A. Polhemus (USNM). **Paratypes**: PAPUA NEW GUINEA, **Milne Bay Prov.**: 3 apterous ♂♂, 11 apterous ♀♀, Panatinanae Island, Station 7, same data as holotype, J.T. and D.A. Polhemus (USNM, BPBM); 1♂, Basilaki Is., Babana Bay, E of North Point, 0 m [sea level], 10°35'58.0"S, 151°02'01.4"E, Station 37, sea temp. 30°C, salinity 36 ppt, 16 January 2004, 20:30-23:00 hrs., night light from boat, CL 7293, D.A. & J.T. Polhemus (USNM).

Distribution. Known only from Panatinane and Basilaki islands (Fig. 70).

Halovelia misima nov.sp. (Figs 70-75)

Description:

Male length 1.55, width 0.86. Female length 1.87, width 0.94.

Colour. Ground colour black; male with greyish pubescence which is longer on abdominal dorsum; female with pubescence and stout setae on thoracic dorsum, long dark setae on metanotum, longer medially directed setae on connexiva especially along segments IV-V. Vertex of head with an irregular orange brown spot at base, with median furrow. Antennae and legs blackish brown, first antennal segment and all femora shining.

Structural characters. Apterous male: elongate oval, length more than 1.75x greater than greatest width across thorax (1.58:0.90). Head length 0.65x head width across eyes (0.35:0.54); eyes rather small, about 0.14x interocular width (0.06:0.43).

Antennal formula I : II : III : IV = 0.37 : 0.19 : 0.21 : 0.33; segment I subequal to head length (0.37:0.35) and stout, subequal to thickness of IV.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg = 0.53 : 0.47 : 0.03 : 0.13; of middle leg = 1.23 : 1.12 : 0.51 : 0.37; of hind leg = 0.60 : 0.53 : 0.06 : 0.14. Grasping comb about 1/4 of fore tibial length (0.12/0.47); middle femur about 0.8x total body length; hind femur distinctly thicker than middle femur (0.10:0.07).

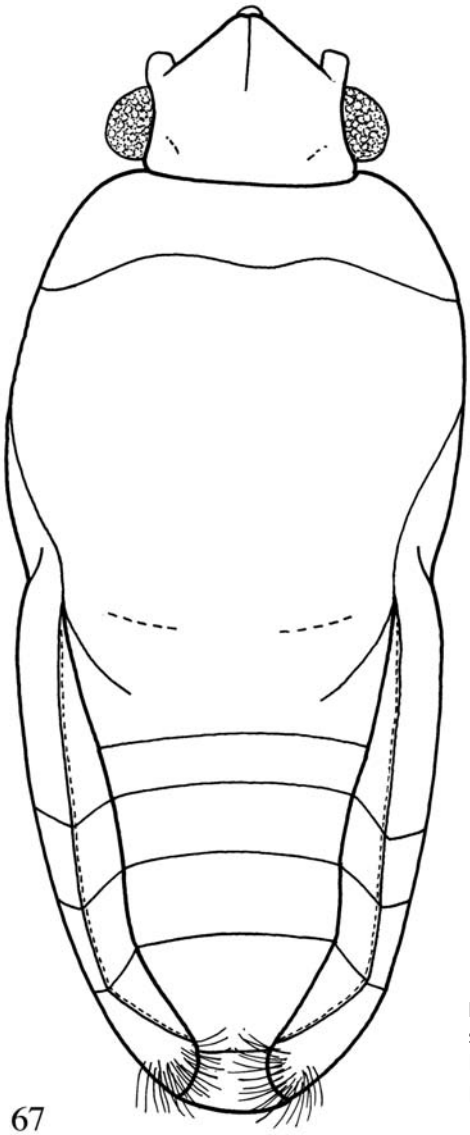
Abdominal venter not modified, with moderately long hairs. Parameres (claspers) relatively short, barely crossing each other dorsal to genital segment; blade of each paramere (Fig. 72) broad, slightly curved dorsad, not twisted, tip straight, dorso-ventrally flattened with acuminate apex; vesical sclerites as in Fig. 73.

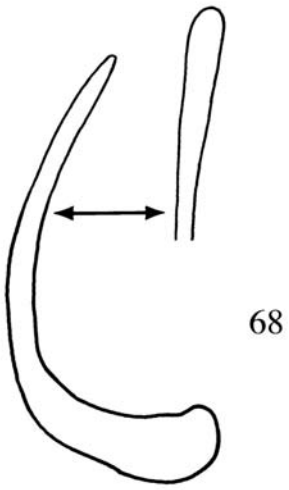
Apterous female: elongate, abdomen constricted behind mesonotum, length about 2.0x greater than greatest width across thorax (1.91:0.97). Head length 0.50x head width across eyes (0.29:0.58); eyes rather small, slightly less than 0.23x interocular width (0.09:0.40).

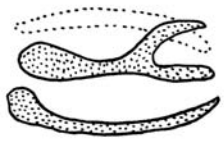
Antennal formula I : II : III : IV = 0.43 : 0.23 : 0.29 : 0.34; segment I about 1.5x head length (0.43:0.29), subequal in thickness to segment IV.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg = 0.61 : 0.50 : 0.04 : 0.19; of middle leg = 1.30 : 1.33 : 0.58 : 0.43; of hind leg = 0.54 : 0.54 : 0.07 : 0.18. Middle femur about 0.7x total body length; hind femur subequal in thickness to middle femur (0.12:0.11).

Thoracic dorsum moderately raised, greatest height at about middle of mesonotum, with long dorsal pubescence (Fig. 71); metanotum and basal abdominal segments fused, basal abdominal segments hidden under produced metanotum thickly set with long setae projecting caudad (Fig. 71); meso- and metapleura distinctly impressed behind mesonotum.







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Figs 67-69: *Halovelia huniye* nov.sp., structural details (**67**) Female, dorsal habitus, appendages omitted (**68**) Male paramere, with alternate view of apex (**69**) Male endosomal sclerites.

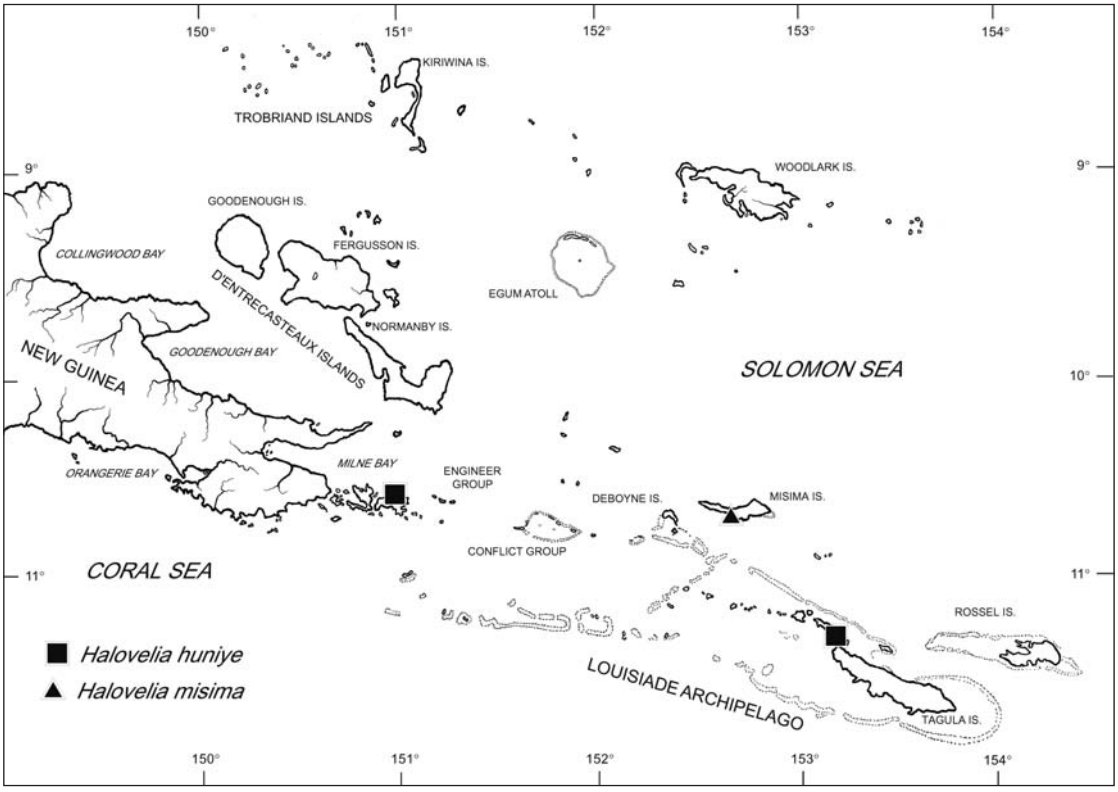


Fig. 70: Distribution of *Halovelia huniye* and *Halovelia misima* on far eastern New Guinea and nearby islands.

Abdomen narrowed behind mesonotum, tapering from base to segment VII; connexiva almost vertical, basal three segments thickened and set with long setae directed medially (Figs 71, 74). Tergum VIII large, deflected ventrad (Figs 74, 75), concealing proctiger.

Diagnosis. This species drops at couplet 14-15 for males, and at couplet 15 for females in ANDERSEN (1989a). The male grasping comb is 1/3 of the fore tibial length or slightly less, and the male clasper is short and broad, with the apex sharp (Fig. 72). The female upper meso- and metapleura are deeply depressed from mid mesopleura caudad, forming a sulcus extending along the base of the connexiva; the female abdominal tergites are deeply depressed medially and modified, and the connexiva are thickened basally, and densely set with dark setae directed medially and slightly caudad (Fig. 71).

Discussion. The type series was collected in a small, deepwater bay mostly enclosed by steep mountain cliffs, northwest of Tabula Point on the south shore of Misima Island. This area possessed rocky shores, and lacked significant development of mangroves or fringing reefs.

Etymology. The name "misima" is a noun in apposition, named for Misima Island where this species was discovered.

Type material: Holotype, apterous ♂: PAPUA NEW GUINEA, **Milne Bay Prov.**: Misima Island, south coast, small bay 0.5 km NW of Tabula Point, 0 m [sea level], 10°40'34.7"S, 152°37'14.8"E, Station 15, sea temp. 26°C, salinity 36 ppt, 4 Sept. 2002, night light from boat, CL 7207, J.T. and D.A. Polhemus (USNM). Paratypes: PAPUA NEW GUINEA, **Milne Bay Prov.**: 3♂♂, 2 ♀♀, Misima Island, Station 15, same data as holotype, J.T. and D.A. Polhemus (USNM, JTPC).

Distribution. Known only from the type locality, a small bay on the south coast of Misima Island (Fig. 70).

Genus *Haloveloides* ANDERSEN 1992 (Figs 76-82)

Members of the genus *Haloveloides* are small, dark, angulate marine veliids that are found from the Malay Peninsula eastward through the Malay Archipelago to the Philippines, New Guinea, and the Solomon Islands; two species are known from Melanesia, and both were taken during our surveys in Milne Bay Province. *Haloveloides* species are often found in relatively open and unsheltered marine settings, such as pools on exposed reef flats, in embayments

at the mouths of rivers, or on the open sea. Unlike *Halovelia* species, individuals of *Haloveloides* are sometimes collected at considerable distances from land; for example, near the island of Bacan, in the northern Moluccas, the authors took a good series of *Haloveloides brevicornis* ANDERSEN while net trolling from a small boat over a kilometer offshore. Species can also form large aggregations on more sheltered inshore waters, as reported by LANSBURY (1996) for *H. papuensis* in northeastern New Guinea, and as similarly observed by one of us (DAP) for an undescribed species on Waigeo Island in the Raja Ampat group, lying immediately west of New Guinea.

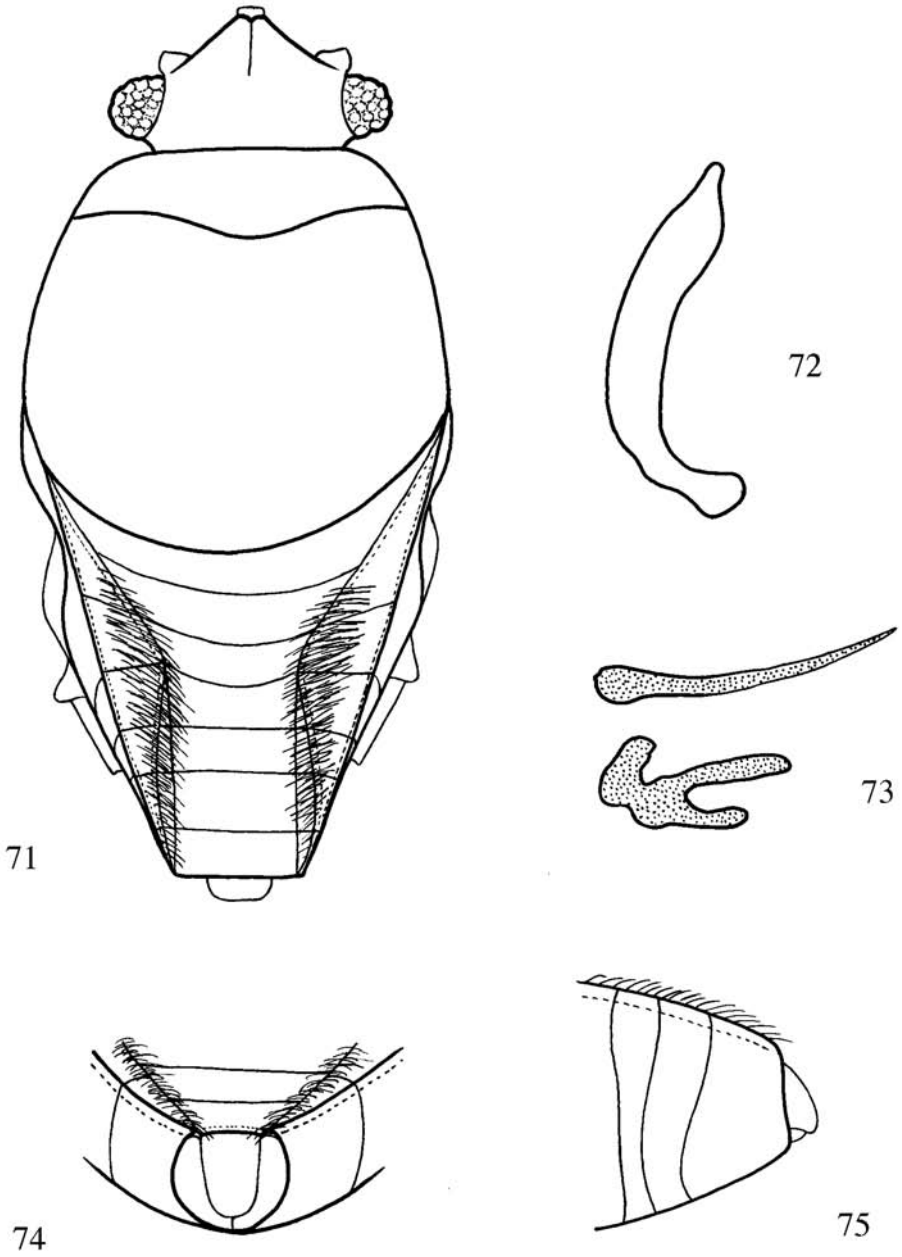
Haloveloides browni (LANSBURY) (Figs 79-82)

Discussion. *Haloveloides browni* is an extremely adaptable species that occurs across a wide range of marine and estuarine habitats, including mangrove shorelines, rocky shores, tidally exposed reef crests, and open waters up to 200 m offshore. Although taken during our current surveys only in the D'Entrecasteaux Islands, *H. browni* is common along the northern coast of the Papuan Peninsula in the Kamiali area, and as such appears to be a northern New Guinea faunal element that reaches the limit of its range at or near the eastern tip of New Guinea.

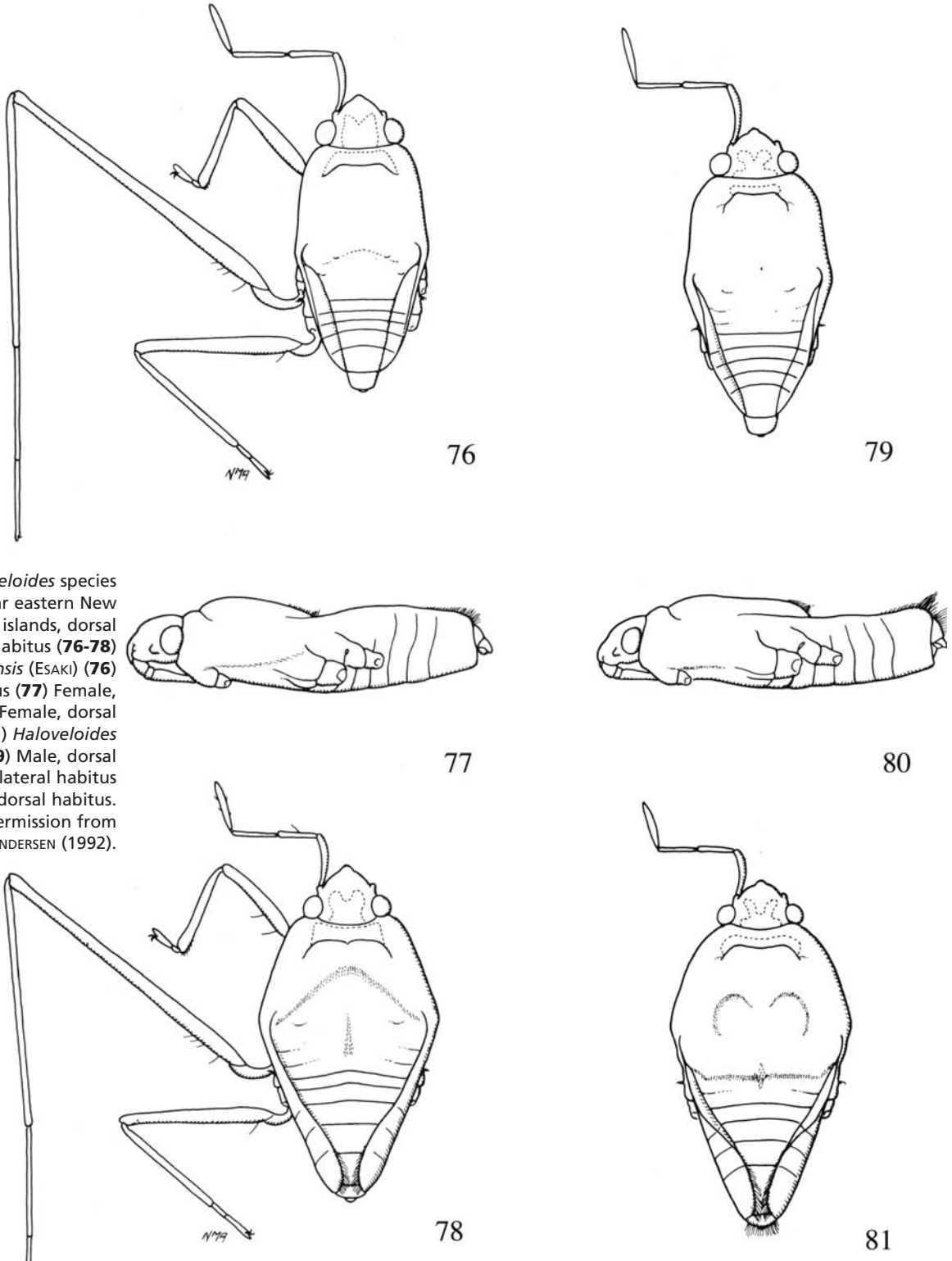
Distribution. Originally described from the Kokorana Islands, near Rendova in the Solomon Islands, *H. browni* has been previously recorded from the Solomons (Rendova, Ulawa), the Bismarcks (New Ireland), and the Madang area of northeastern New Guinea (ANDERSEN 1992). Our current surveys now extend the range to the D'Entrecasteaux Islands (Fergusson, Normanby).

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 3♂♂, 9 ♀♀, New Guinea, Station 3, offshore of Lihitabu Point; 62♂♂, Fergusson Is., Station 5, reef flat at Mebulibuli Point; 10♂♂, 16 ♀♀, Fergusson Is., Station 25, sea offshore of Mebulibuli Point; 8♂♂, 9 ♀♀, 1 nymph, Normanby Is., Station 27, Bunama Bay; 3♂♂, 6 ♀♀, Normanby Is., Station 28, Kasikasi Bay; 1♂, 4 ♀♀, New Guinea, Station 31, Kana Kopi Bay (USNM, BPBM, JTPC).

Extralimital material examined: PAPUA NEW GUINEA, **Morobe Prov.**: 26♂♂, 4 ♀♀, Cape Roon, 150 m offshore, 0 m [sea level], 7°20'44.8"S, 147°09'33.4"E, sea temp. 30°C, salinity 29 ppt, 2 May 2003, 10:00-10:30 hrs., CL 7237, D.A. Polhemus (USNM); 31♂♂, Sachsen Bay, mangrove shore on S. side, 0 m [sea level], 7°20'21.6"S, 147°08'41.6"E, sea temp. 30°C, salinity 23 ppt, May 2003, 11:00-12:00 hrs., CL 7238, D.A. Polhemus (USNM); 66♂♂, 42 ♀♀, Jawani Island, SW side, 0 m [sea level], 7°20'38.7"S, 147°12'16.2"E, sea temp. 33°C, salinity 27 ppt, 2 May 2003, 14:00-15:00 hrs., CL 7239, D.A. Polhemus (USNM); 68♂♂, 5 ♀♀, rocky point N of Cape Dinga [= Yaraku Point], 0 m [sea level], 7°18'03.8"S, 147°08'35.3"E, sea temp. 30°C, salinity 30 ppt, 4 May 2003, 10:00-12:30 hrs., CL 7242, D.A. Polhemus (USNM).



Figs 71-75: *Halovelia misima* nov.sp., structural details (**71**) Female, dorsal habitus, appendages omitted (**72**) Male paramere (**73**) Male endosomal sclerites (**74**) Female abdominal apex, posterior view (**75**) Female abdominal apex, lateral view.



Figs 76-81: *Haloveloides* species occurring on far eastern New Guinea and nearby islands, dorsal and lateral habitus (**76-78**) *Haloveloides papuensis* (ESAKI) (**76**) Male, dorsal habitus (**77**) Female, lateral habitus (**78**) Female, dorsal habitus (**79-81**) *Haloveloides browni* (LANSBURY) (**79**) Male, dorsal habitus (**80**) Female, lateral habitus (**81**) Female, dorsal habitus. Reprinted with permission from ANDERSEN (1992).

Haloveloides papuensis (ESAKI) (Figs 76-78, 82)

Discussion. Although abundant further to the northeast in the area surrounding Madang (LANSBURY 1996), *Haloveloides papuensis* was taken in Milne Bay Province at only a few widely scattered localities in the Louisiades, Woodlark, and in the islands east of China Strait. The collection habitats ranged from shallow inshore waters to open waters up to 100 m offshore. LANSBURY (1996) describes observing "large flotillas" of this species on shaded inshore waters at Nagada Harbor, near Madang, but we en-

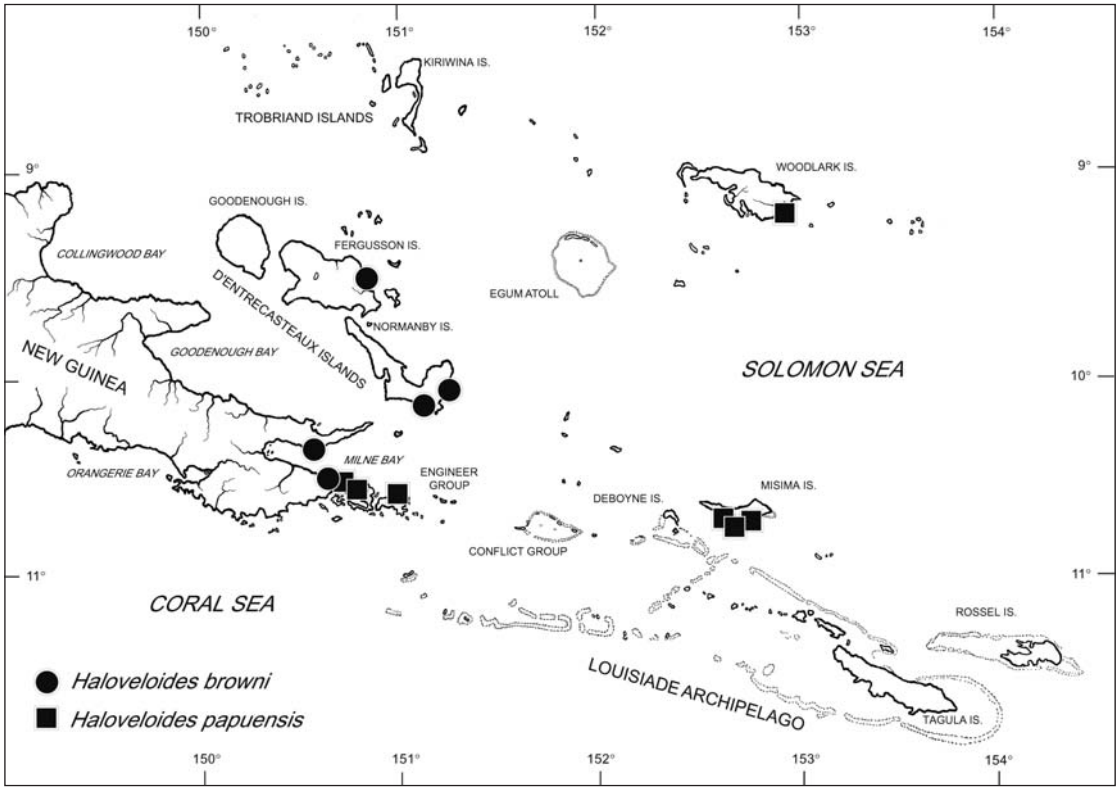


Fig. 82: Distribution of *Haloveloides browni* and *Haloveloides papuensis* on far eastern New Guinea and nearby islands.

countered no such aggregations during our surveys.

Distribution. Papua New Guinea (northeast coast from Madang to Milne Bay), Woodlark, the Bismarck Archipelago (New Britain), and the Solomon Islands (Malaita, New Georgia, Russell, Ulawa).

Distribution. The holotype of *H. papuensis* came from Dregerhafen, near Madang in northeastern New Guinea. Many additional collections have come from this area, and the species has also been recorded from the Bismarcks (Mussau) and the Solomons (Malaita, New Georgia, Ulawa, Russell Islands) (ANDERSEN 1992). Our new records from the Louisiade Archipelago and the China Strait area extend the distribution of this species well to the south.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 9♂♂, 6 ♀♀, Misima Is., Station 15, bay NW of Tabula Point; 3♂♂, 5 ♀♀, Misima Is., Station 16, Lowaga Bay; 46♂♂, 5 ♀♀, Misima Is., Station 17, bay at Bwagabwaga village; 3♂♂, 2 ♀♀, Woodlark Is., Station 19b, lower Sinkwarai River estuary; 37♂♂, 69 ♀♀, 1 nymph, Lesimano Is., Station 33, south shore; 2♂♂, 2 ♀♀, New Guinea, Station 31, Kana Kopi Bay; 1♂, 1 ♀, Basilaki Is., Station 38, Hemoe Bay (USNM, BPBM, JTPC).

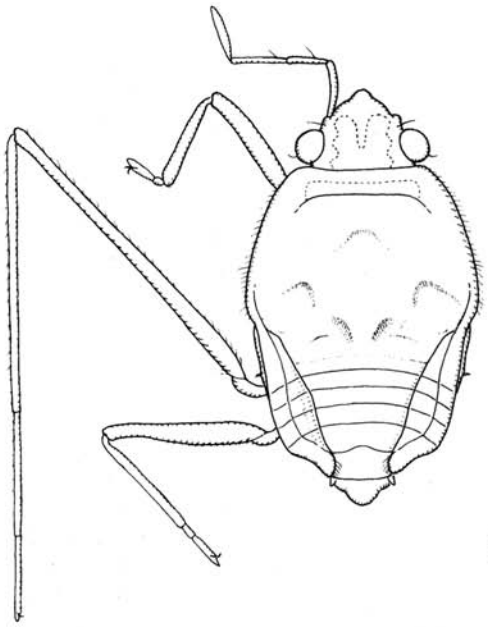
Extralimital material examined: PAPUA NEW GUINEA, **West New Britain Prov.**: 2 ♀♀, New Britain, Kimbe Bay, Restorff Island, calm sea on W. side, 0 m [sea level], 5°17'35.7"S, 150°06'15.6"E, sea temp. 29° C, salinity 35 ppt, 16 January 2005, 10:45-13:45 hrs., CL 7347, D.A. Polhemus (USNM, BPBM).

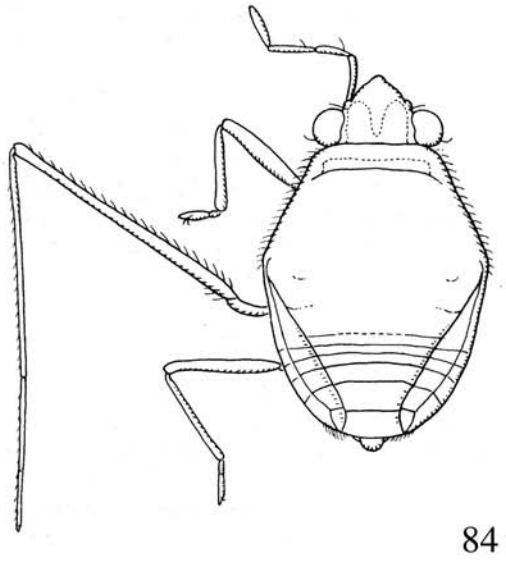
Genus *Xenobates* ESAKI 1927 (Figs 83-92)

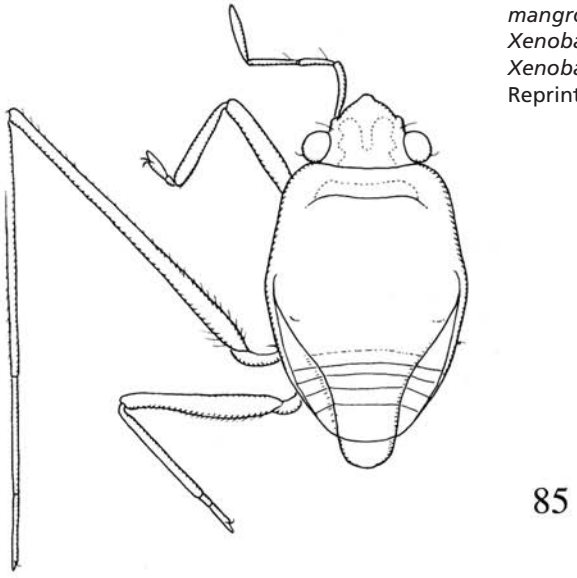
Members of the genus *Xenobates* are tiny, ovate water striders that typically inhabit the margins of mangrove estuaries, often near the interface of haline and limnetic waters (LANSBURY 1996). They are frequently overlooked by collectors due to both their small size, and to the generally muddy, uncomfortable, and crocodile-infested nature of the mangrove swamps they inhabit. Five species were collected from Milne Bay Province, one of them new, and it seems likely that further new species will be found in other parts of New Guinea once the extensive mangrove estuaries bordering the island are more thoroughly investigated.

Xenobates caudatus ANDERSEN & WEIR (Fig. 86)

Discussion. Among the set of *Xenobates* species occurring in Milne Bay Province, *X. caudatus* is most typically encountered in the lower estuarine zones and along adja-







Figs 83-85: *Xenobates* species occurring on far eastern New Guinea and nearby islands, dorsal habitus (**83**) *Xenobates mangrove* Andersen & Weir, female, dorsal habitus (**84**) *Xenobates ovatus* Andersen & Weir, female, dorsal habitus (**85**) *Xenobates mangrove* Andersen & Weir, male, dorsal habitus. Reprinted with permission from Andersen & Weir (1999).

cent open shorelines, with one stray even having been taken 400 m offshore. This species may also occasionally range into the deep mangrove habitats of the upper estuaries, where it co-occurs with *X. ovatus* and *X. mangrove*, as seen in the Kolukolu Creek estuary of Tagula Island.

The dorsal habitus of this species has never been figured, in contrast to most other species in the genus.

Distribution. *Xenobates caudatus* was described from Motupore Island, near Port Moresby, and to date has been known only from that locality. Our new records from Milne Bay, the Louisiade Archipelago, and the Marshall Bennett Islands extend the range of this species eastward by approximately 800 km.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 7♂♂, 2 ♀♀, New Guinea, Station 1, Upalai River terminal reach at Haluwia; 10♂♂, 71 ♀♀, Tagula Is., Station 10, Kolukolu Creek estuary; 31♂♂, 29 ♀♀, 1 nymph, Rossel Is., Station 12, head of Yonga Bay; 1 ♀, Woodlark Is., Station 23, rocky creek on NW side of Suloga harbor; 1♂, 6 ♀♀, Lesimano Is., Station 33, south shore; 1♂, Basilaki Is., Hemoe Bay, CL 7295, Station 38 (USNM, BPBM, JTPC).
Extralimital material examined: PAPUA NEW GUINEA, **Morobe Prov.**: 4♂♂, 2 ♀♀, Sachsen Bay, mangrove shore on S. side, 0 m [sea level], 7°20'21.6"S, 147°08'41.6"E, sea temp. 30°C, salinity 23 ppt, May 2003, 11:00-12:00 hrs., CL 7238, D.A. Polhemus (USNM).

Xenobates mangrove Andersen & Weir (Figs 83, 85, 87)

Discussion. *Xenobates mangrove* is found amid mangrove roots and along muddy banks in the uppermost reaches of mangrove creeks, and unlike *X. caudatus* never ranges downstream into the lower estuaries or onto the margins of the adjacent bays. Individuals may occur all the way up to the interface between limnetic and mixohaline regimes at the upper limit of tidal influence, on waters with surface salinities as low as 3 ppt.

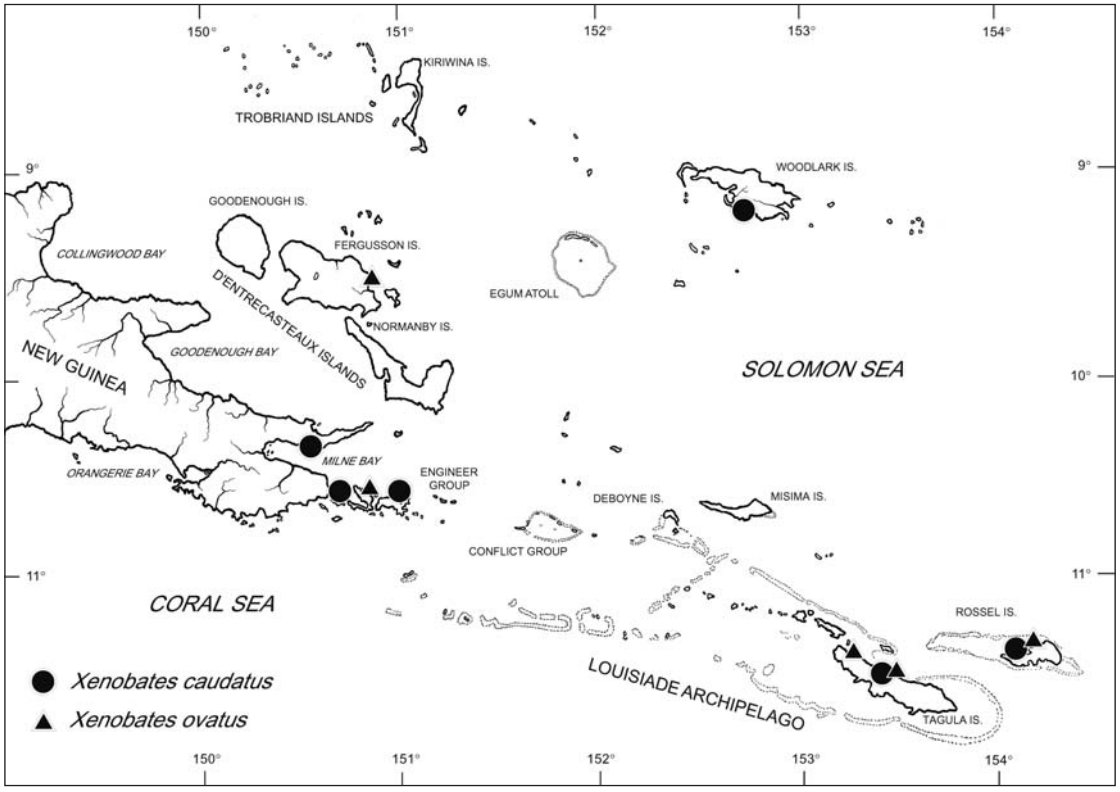


Fig. 86: Distribution of *Xenobates caudatus* and *Xenobates ovatus* on far eastern New Guinea and nearby islands.

Distribution. *Xenobates mangrove* was originally described from specimens taken at Townsville, Australia, and previously known only from the coast of Queensland. Our surveys have revealed that this species also occurs in New Guinea from Milne Bay northeast to Kamiali, and in the Louisiade Archipelago, extending the documented range northeastward by over 800 km.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 7♂♂, 21 ♀♀, New Guinea, Station 1, Upalai River terminal reach at Haluwia; 13♂♂, 18 ♀♀, Tagula Is., Station 8, Kalitau Creek estuary; 3 ♀♀, Tagula Is., Station 10, Kolukolu Creek estuary (USNM, BPBM, JTPC). Extralimital material examined: PAPUA NEW GUINEA, **Morobe Prov.**: 4♂♂, 7 ♀♀, mangrove creek SW of Cape Roon, 0 m [sea level], 7°20'52.1"S, 147°08'31.6"E, water temp. 27° C, salinity 3 ppt, 3 May 2003, 10:00-11:00 hrs., CL 7240, D.A. Polhemus (USNM); 35♂♂, 51 ♀♀, intertidal creek at mouth of Aleater [= Alewiri] River, W of Sachsen Bay, 0 m [sea level], 7°19'14.7"S, 147°07'34.9"E, water temp. 27° C, 6 May 2003, 13:00-15:00 hrs., CL 7241, D.A. Polhemus (USNM).

Xenobates ovatus Andersen & Weir (Figs 84, 86)

Discussion. The ecological preferences of X. *ovatus* are similar to those of X. *mangrove*, with both species being confined to the upper reaches of mixohaline tidal creeks, where they sometimes co-occur. As with the latter species, X. *ovatus* has a tolerance for low salinity waters of 5-10 ppt typical of such habitats.

At the estuary of Mebulibuli Creek on Fergusson Island this species was found schooling in large numbers on shaded waters and in dark recesses near the overhanging root boles of scattered large *Callophyllum* trees along the channel margin, in company with a few individuals of *Rheumatometroides browni*. The estuary here was broad (approximately 30 m), shallow (1 m or less), and nearly fresh, with a salinity of only 5 ppt, and lacked the mangrove fringe of *Rhizophora* or *Avicennia* typical of more haline reaches.

Our specimens of X. *ovatus* from the D'Entrecasteaux Islands have a greater degree of orange colouration on the dorsum than those taken in the Louisiades, but appear to be otherwise identical.

Distribution. *Xenobates ovatus* was described from Lakefield National Park on the coast of the Cape York Peninsula in northern Australia, and was known until now only from that area. Our records from the D'Entrecasteaux Islands and the Louisiade

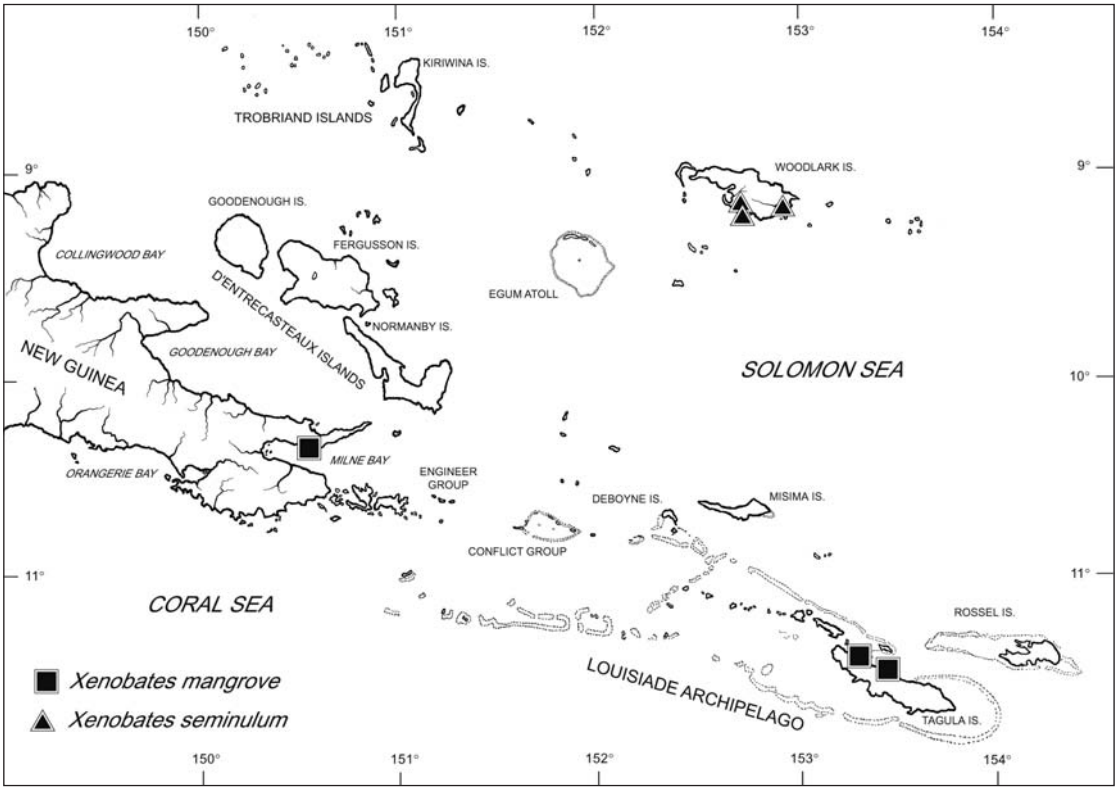


Fig. 87: Distribution of *Xenobates mangrove* and *Xenobates seminulum* on far eastern New Guinea and nearby islands.

Archipelago now extend the range of this species far to the north and east, by approximately 1000 km.

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 30♂♂, 3 ♀♀, Fergusson Is., Station 6, Mebulibuli Creek estuary; 8♂♂, 15 ♀♀, Tagula Is., Station 8, Kalitau Creek estuary; 20♂♂, 70 ♀♀, Tagula Is., Station 10, Kolukolu Creek estuary; 4♂♂, 3 ♀♀, Rossel Is., Station 11, Woa River estuary; 3♂♂, 5 ♀♀, 3 nymphs, Sideia Is., Station 36, Kwabunama Bay (USNM, BPBM, JTPC).

Xenobates seminulum (Esaki) (Fig. 87)

Discussion. *Xenobates seminulum* was described from Friedrich-Wilhelmshafen (now called Madang) at Astrolabe Bay, in northern Papua New Guinea. It has subsequently been taken at several localities on the north coast of Papua New Guinea, and has now been found at Woodlark Island in the Marshall Bennett group. Lansbury (1989) also reported one female (not examined) from Kolombangara in the Solomon Islands. This species is sometimes taken on open offshore waters at considerable distances from the edge of the mangrove front, in contrast to most other species in the genus which generally remain within the shelter of the mangroves.

Distribution. New Guinea (northeast coast), Woodlark Island, and the Solomon Islands (Kolombangara).

Material examined: PAPUA NEW GUINEA, **Milne Bay Prov.**: 13♂♂, 17 ♀♀, Woodlark Is., Station 19a, middle Sinkwarai River estuary; 2♂♂, 3 ♀♀, Woodlark Is., Station 20, sea offshore of Reu Island; 5♂♂, 9 ♀♀, Woodlark Is., Station 21, mangrove estuary, W side of Suloga Harbor; 4♂♂, 14 ♀♀, Woodlark Is., Station 22, sea 400 m offshore of W side of Suloga Harbor (USNM, JTPC).

Xenobates kanakopi nov.sp. (Figs 88-92)

Description:

Size. Apterous male, length 1.48-1.54 ($\bar{x}$ = 1.50, n = 5); width 0.68-0.76 ($\bar{x}$ = 0.70, n = 5). Apterous female, length 1.69-1.80 ($\bar{x}$ = 1.73, n = 5); width 0.90-0.94 ($\bar{x}$ = 0.92, n = 5).

Colour. Ground colour dark brown or black above; a large U-shaped spot on head and posterior half of pronotum in middle, yellowish brown; thoracic and abdominal dorsum with fine silvery pubescence, scattered on mesonotum, dense laterally on abdominal tergites II and III, all of tergite VII. Antennae and legs brown; basal part of first antennal segment, most of fore femur be-

neath, all coxae and trochanters, yellowish. Ventral surface chiefly brownish; head, prosternum, and acetabulae yellowish; genital segments of both male and female usually brown.

Structural characters. Apterous male: broad fusiform, length less than 2.2x greater than greatest width across thorax (1.48:0.68). Head length 0.57x head width across eyes (0.28:0.50); eyes rather large, exserted, about 0.44 interocular width (0.12:0.27).

Antennae about 0.83x total length of insect; antennal formula I : II : III : IV = 0.42 : 0.21 : 0.30 : 0.30; total = 1.23; segment I longer than head length (0.42:0.28) and stout, subequal to width of segment IV; antennal segments with short pilosity and a few longer hairs.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg = 0.41 : 0.37 : 0.02 : 0.12; of middle leg = 1.09 : 0.88 : 0.35 : 0.28; of hind leg = 0.58 : 0.44 : 0.07 : 0.14; fore femur with a row of spinous hairs on inner margin before apex; middle femur about 0.74x total body length, proximally thickened and with a row of long bristle-like setae along anterior margin, each hair being slightly shorter than the greatest width of femur; hind femur subequal to width of middle femur (0.09:0.09).

Abdominal venter modified, ventrites III-VI raised medially, depressed laterally, forming a broad longitudinal carina abruptly terminating at ventrite VI posteriorly, tergite VII depressed medially, with moderately long hairs. Genital segments large, segment VII not raised; parameres (claspers) relatively short, barely crossing each other dorsal to genital segment; blade of each paramere (Fig. 89) slender, slightly curved dorsad, not twisted, tip straight, narrow, dorso-ventrally flattened with acuminate apex.

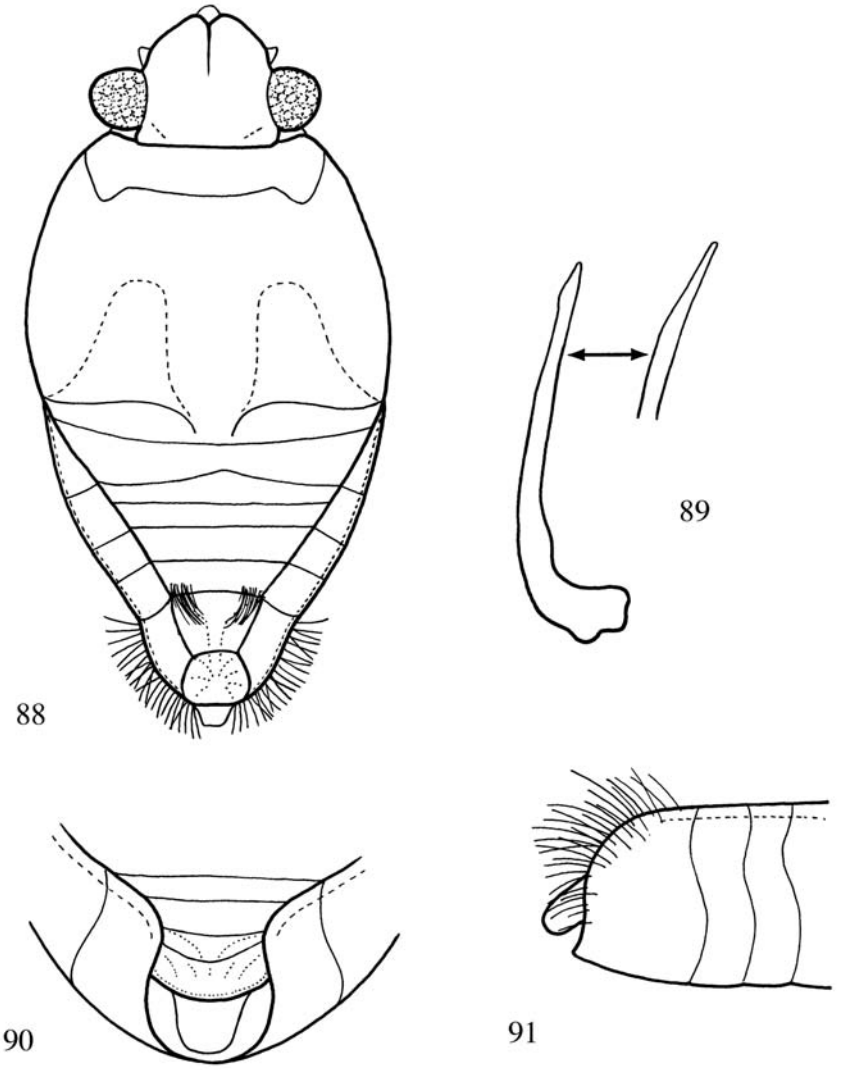
Apterous female: body shape ovate (Fig. 88), length about 3.2x greater than greatest width across thorax (1.71:0.54). Head length 0.60x head width across eyes (0.32:0.53); eyes rather large, about 0.41x interocular width (0.12:0.29).

Antennal formula I : II : III : IV = 0.28 : 0.21 : 0.26 : 0.26; segment I less than head length (0.28:0.32), subequal in thickness to segment IV.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg = 0.46 : 0.37 : 0.05 : 0.12; of middle leg = 1.23 : 0.77 : 0.42 : 0.30; of hind leg = 0.60 : 0.49 : 0.06 : 0.12. Middle femur about 0.72x total body length; hind femur subequal to width of middle femur (0.07:0.07).

Thorax convex above, with short dorsal pubescence; mesonotum slightly depressed on either side of midline (Fig. 88); metanotum slightly depressed; abdominal tergites IV and V slightly depressed.

Abdomen tapering from base to segment VII, tergites VI and VII depressed, shining; connexiva semivertical, almost vertical along segment VII, set with long setae along segments VI and VII directed outward and caudad (Figs 88, 91). Tergum VIII cup-



Figs 88-91: *Xenobates kanakopi* nov.sp., structural details (**88**) Female, dorsal habitus, appendages omitted (**89**) Male paramere, with alternate view of apex (**90**) Female abdominal apex, posterior view (**91**) Female abdominal apex, lateral view.

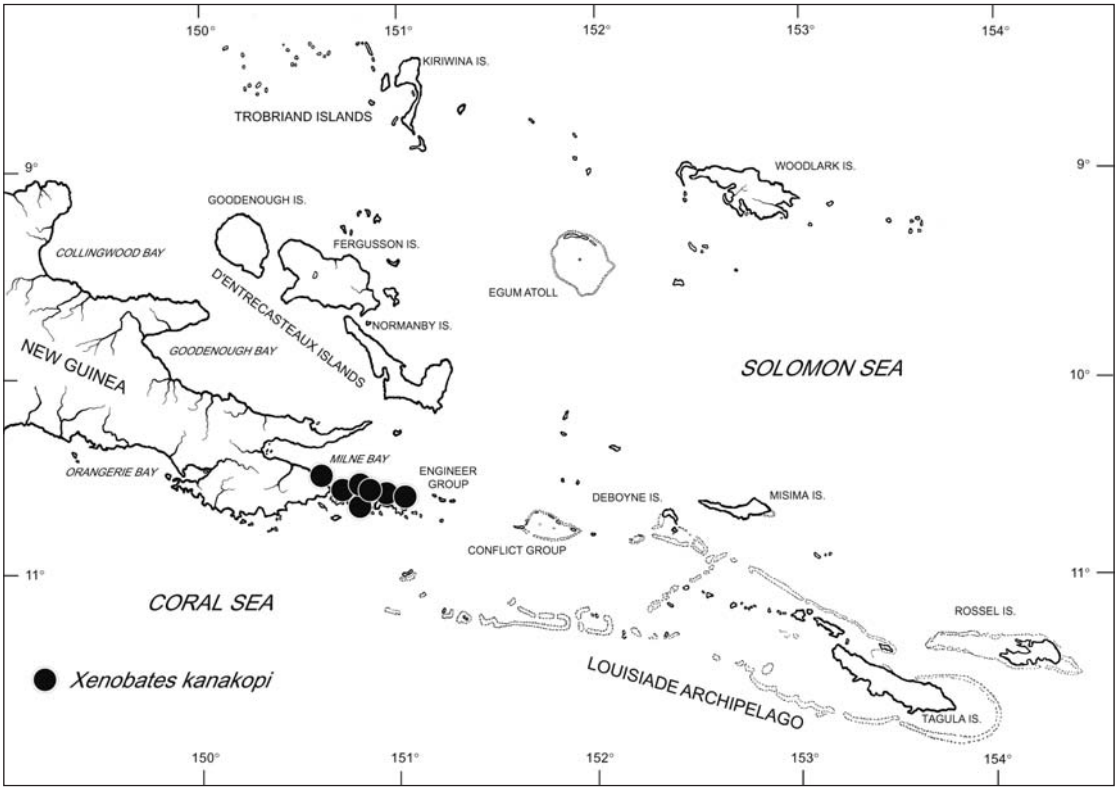


Fig. 92: Distribution of *Xenobates kanakopi* nov.sp. on far eastern New Guinea and nearby islands.

shaped, raised posteriorly, shining; proctiger deflected about 45°, almost concealing gonocoxae (Figs 90, 91).

Diagnosis. *Xenobates kanakopi* nov.sp. most closely resembles *Xenobates caudatus* ANDERSEN & WEIR and *Xenobates pilosellus* LANSBURY; the latter has orange brown regions laterally on the mesonotum and yellowish brown connexiva, and is set with coarse silvery pubescence over much of the dorsal surface, especially on tergites II, II and VII. *Xenobates kanakopi* nov.sp. is uniformly blackish brown dorsally except for the pronotum and head, with scattered fine silvery pubescence on the mesonotum, and dense silvery pubescence laterally on tergites II and III, and all of tergite VII. Female abdominal tergite VII is depressed, and tergite VIII is cup-shaped (Figs 88, 90), raised posteriorly and shining. The male abdominal venter of *X. pilosellus* is tumid basally, abruptly terminating at ventrite V, with ventrites VI and VII depressed medially, whereas in *X. kanakopi* nov.sp. the ventral abdomen is similar but with the ventral tumescence abruptly terminating at ventrite VI, and with ventrite VII depressed medially and shining.

Xenobates caudatus females have a similar pattern of silvey pubescence as in *X. kanakopi* nov.sp., but the mesonotum is not depressed on either side as it is in *X. pilosellus* and *X. kanakopi* nov.sp., and the proctiger protrudes posteriorly, rather than being distinctly deflected downward as in *X. kanakopi* nov.sp. The male basal abdominal tumescence of *X. caudatus* also has an abrupt termination past tergite V, with sternite VII broadly depressed, and sternite VIII partly depressed, whereas in *X. kanakopi* nov.sp. the abdominal tumescence terminates past sternite VI, sternite VII is depressed medially, and sternite VIII is not depressed.

Etymology. The name "*kanakopi*" is a noun in apposition, named for Kana Kopi Bay where this species was discovered.

Type material: **Holotype**, apterous ♂: PAPUA NEW GUINEA, **Milne Bay Prov.**: Kana Kopi Bay, ESE of Alotau, 0 m [sea level], 10°28'54.3"S, 150°39'10.2"E, Station 31, sea temp. 29° C, 13 Jan. 2004, 19:30-2200 hrs., night light from boat, CL 7283, D.A. & J.T. Polhemus (USNM). **Paratypes** (nymphs not paratypes): PAPUA NEW GUINEA, **Milne Bay Prov.**: 6♂♂, 70 ♀♀, New Guinea, Station 31, Kana Kopi Bay, same data as holotype, D.A. & J.T. Polhemus (USNM, BPBM, JTPC); 2 ♀♀, Lesimano Is., N of Sariba Is., south shore, 0 m [sea level], 10°34'36.1"S, 150°42'49.4"E, Station 33, sea temp. 29° C, salinity 36 ppt, 14 January 2004, 21:00-22:00 hrs.,

night light from boat, CL 7286, D.A. & J.T. Polhemus (USNM); 21♂♂, 21♀♀, 12 nymphs, Sideia Is., Jenkin's Bay, 0 m [sea level], 10°36'45"S, 150°45'35"E, Station 34, sea temp. 31°C, salinity 36 ppt, 15 January 2004, 10:00-14:00 hrs., CL 7289, D.A. & J.T. Polhemus (USNM, BPBM, JTPC); 16♂♂, 105♀♀, Sideia Is., Wiwiyai Bay, 0 m [sea level], 10°32'50"S, 150°49'28.5"E, Station 35, sea temp. 30°C, salinity 36 ppt, 15 January 2004, 20:00-21:30 hrs., night light from boat, CL 7290, D.A. & J.T. Polhemus (USNM, BPBM, JTPC); 3♀♀, Sideia Is., mangrove estuary at head of Kwabunamoa Bay, 0 m [sea level], 10°34'19.7"S, 150°50'41.8"E, Station 36, water temp. 31°C, salinity 6 ppt (head of estuary)-34 ppt (mouth of estuary), 16 January 2004, 10:45-11:00 hrs. and 13:30-13:45 hrs., CL 7291, D.A. & J.T. Polhemus (USNM); 17♂♂, 89♀♀, Basilaki Is., Babana Bay, E of North Point, 0 m [sea level], 10°35'58.0"S, 151°02'01.4"E, Station 37, sea temp. 30°C, salinity 36 ppt, 16 January 2004, 20:30-23:00 hrs., night light from boat, CL 7293, D.A. & J.T. Polhemus (USNM, BPBM, JTPC); 1♂, Basilaki Is., Hemoe Bay, 0 m [sea level], 10°35'41.5"S, 150°59'57.5"E, Station 38, sea temp. 29.5°C, salinity 36 ppt, 17 January 2004, 20:30-23:00 hrs., night light from boat, CL 7295, D.A. & J.T. Polhemus (USNM).

Distribution. Known only from extreme eastern New Guinea and immediately adjacent islands (Lesimano, Sideia, Basilaki) (Fig. 92).

Discussion

The current survey of marine Heteroptera on far eastern New Guinea and nearby islands was intended to provide an initial biodiversity profile of the species occurring in this fascinating region, in conjunction with ongoing marine conservation and land use planning initiatives in Milne Bay Province supported by the provincial government and Conservation International. The marine Heteroptera provide a particularly informative group for such activities, due to their consistency of representation across a wide range of salinities and habitat types, variation of species assemblages on local scales between sampling sites (i.e., high beta diversity), and relatively well investigated taxonomy. The latter factor in particular allowed confidence that identifications could be made to at least the genus level in the field for all specimens collected, allowed unequivocal identification of taxa once in the laboratory, and reduced the overall number of undescribed species to be dealt with, a frequently limiting factor in studies utilizing tropical insects. It is to be expected that certain groups of marine Heteroptera, particularly shore bugs in the infraorder Leptopodomorpha, will also exhibit high species richness in this region, but assessment of this must await future intensive surveys of rocky shores and emergent coral platforms. For instance, results of recent collections from such habitats in the Solomons and Fiji strongly suggest that members of the genera *Salduncula* (Saldidae) and *Corallocoris* (Omaniidae) will also be found in Milne Bay Province, thus the currently documented assemblage of marine Heteroptera from this area almost certainly represents an underestimate of the true species richness.

Even so, the assemblage of marine Heteroptera now recorded from Milne Bay Province is the most diverse known from any single area on earth. With an area of 265,000 km^2, Milne Bay Province occupies only 0.037 % of the planet's area (and only 0.052 % of planet's water area), yet it supports 16.5 % of the world's known marine Gerromorpha (Table 1). In terms of local species richness, Milne Bay proper (Stations 1, 2, 3, 4 and 31), the islands east of China Strait (Stations 32-39), Fergusson and Normanby islands in the D'Entrecasteaux group (Stations 5, 6, and 25-28), and Rossel Island in the Louisiades (Stations 11-13) supported the highest number of species, having 16, 16, 12 and 11 respectively, apparently due to their habitat complexity resulting from a combination of large, reef-bound lagoons or platform reefs (Figs 4-6) coupled with rocky island shores bearing fringing mangrove estuaries (Figs 11 and 12). By contrast, richness was lowest at Egum Atoll (Station 24) and Conflict Atoll (Station 18), which supported 3 and 4 species respectively; these atolls have large lagoons and fringing reefs, but lack estuarine and mangrove habitats or steep rocky shores. Species richness was intermediate at Tagula (Stations 8-10), Misima (Stations 14-17), Nuakata (Stations 29 and 41) and Woodlark (Stations 19-23) islands, which supported 9, 9, 8 and 7 species respectively; all these latter sites except Nuakata (which is a relatively small island) are more isolated from New Guinea proper,

Table 1: Summary of marine Heteroptera taxa collected across all marine sampling stations combined in Milne Bay Province.

HETEROPTERA
- **Gerridae**
  - *Halobates calyptus* HERRING
  - *Halobates germanus* WHITE
  - *Halobates hayanus* WHITE
  - *Halobates maculatus* SCHADOW
  - *Halobates murphyi* POLHEMUS & POLHEMUS
  - *Halobates princeps* WHITE
  - *Halobates proavus* WHITE
  - *Halobates sericeus* ESCHSCHOLTZ
  - *Rhagadotarsus kraepelini* BREDDIN
  - *Rheumatometroides browni* HUNGERFORD & MATSUDA
  - *Thetibates serena* (LANSBURY)
- **Hermatobatidae**
  - *Hermatobates marchei* COUTIERE & MARTIN
  - *Hermatobates weddi* CHINA
  - *Hermatobates kula* nov.sp.
- **Mesoveliidae**
  - *Mesovelia vittigera* HORVÁTH
- **Veliidae**
  - *Halovelia annemariae* ANDERSEN
  - *Halovelia bergrothi* ESAKI
  - *Halovelia corallia* ANDERSEN
  - *Halovelia novoguinensis* ANDERSEN
  - *Halovelia huniye* nov.sp.
  - *Halovelia misima* nov.sp.
  - *Haloveloides browni* (LANSBURY)
  - *Haloveloides papuensis* (ESAKI)
  - *Ocheovelia heissi* nov.gen. et nov.sp.
  - *Xenobates caudatus* ANDERSEN & WEIR
  - *Xenobates mangrove* ANDERSEN & WEIR
  - *Xenobates ovatus* ANDERSEN & WEIR
  - *Xenobates seminulum* (ESAKI)
  - *Xenobates kanakopi* nov.sp.

have varying degrees of fringing reef and lagoon development, and uniformly support mangrove estuaries (Figs 7-10). These patterns of species richness are summarized in Table 2.

In addition to the new species described in this report, significant range extensions are recorded here for many species. Our collections of *Halobates proavus* WHITE apparently represent a new island record for New Guinea. Within Papua New Guinea, the ranges of *Halobates calyptus* HERRING, *Halobates hayanus* WHITE, *Halobates maculatus* SCHADOW, *Halobates princeps* WHITE, *Thetibates serena* (LANSBURY), *Halovelia annemariae* ANDERSEN, *Halovelia bergrothi* ESAKI, and *Haloveloides papuensis* (ESAKI) are extended far to the southeast, by approximately 800-1000 km. The ranges of *Halovelia corallia* ANDERSEN, *Halovelia novoguinensis* ANDERSEN, and *Xenobates caudatus* ANDERSEN & WEIR, all of which were previously known only from Motupore Island near Port Moresby, are extended approximately 800 km eastward. The ranges of *Xenobates mangrove* ANDERSEN & WEIR and *Xenobates ovatus* ANDERSEN & WEIR, known until now only from coastal Queensland, are extended approximately 800-1000 km northeastward. The documented range of *Hermatobates marchei* COUTIÉRE & MARTIN, previously reported only from the type locality at Palawan in the Philippines, is extended to the southeast by more than 4000 km.

This refined understanding of species distributions has allowed us to assess certain broader scale biogeographic patterns prevailing at the eastern end of New Guinea and in proximal archipelagoes. Several patterns clearly emerge:

1.) Taxa typical of the southern coast of New Guinea (and in some cases northeastern Australia) that extend eastward along the northern margin of the Coral Sea to the Louisiade Archipelago. Species conforming to this pattern include *Hermatobates weddi* CHINA, *Halovelia corallia* ANDERSEN, *Halovelia novoguinensis* ANDERSEN, *Xenobates caudatus* ANDERSEN & WEIR, *Xenobates mangrove* ANDERSEN & WEIR, and *Xenobates ovatus* ANDERSEN & WEIR.

2.) Taxa typical of the northern coast of New Guinea (and in some cases the Philippines and Palau) that extend eastward as far as the D'Entrecasteaux Islands or the Louisiade Archipelago, and sometimes to Woodlark Island or the Solomons. Species conforming to this pattern include *Halobates calyptus* ESCHSCHOLTZ, *Halobates maculatus* SCHADOW, *Halobates murphyi* POLHEMUS & POLHEMUS, *Hermatobates marchei* COUTIÉRE & MARTIN, and *Halovelia annemariae* ANDERSEN.

3.) Taxa that occupy a limited regional range, possibly tectonically influenced, that includes the Solomons, the Bismarcks, and the coasts of northeastern New Guinea corresponding to the geologically defined Adelbert-Finisterre Terrane and East Papua Composite Terrane (the Huon and Papuan peninsulas respectively). Species conforming to this pattern include *Rheumatometroides browni* HUNGERFORD & MATSUDA, *Thetibates serena* (LANSBURY), *Haloveloides browni* (LANSBURY), *Haloveloides papuensis* (ESAKI) and *Xenobates seminulum* (ESAKI).

4.) Locally endemic species confined to the Milne Bay region of far eastern New Guinea, and island groups immediately to the east. Species conforming to this pattern include *Hermatobates kula* nov.sp., *Ocheovelia heissi* nov.sp., *Halovelia huniye* nov.sp., *Halovelia misima* nov.sp., and *Xenobates kanakopi* nov.sp.

It is worth noting that most of the species involved in the first and fourth patterns are members of the Haloveliinae, that many species involved in the second pattern are members of the Halobatinae, and that all of the species involved in the third pattern are members of either the Haloveliinae or Trepobatinae. This indicates that different lineages of marine Gerromorpha have had different biogeographic histories in the region, and have followed differing dispersal corridors or been influenced by differing tectonic events. It also illustrates the fact that the presence of a land barrier in the Torres Strait during the height of the Pleistocene, only 20,000 years ago, effectively prevented dispersal of many species, particularly *Halobates*, along the south coast of New Guinea and into the

Table 2: Distribution of marine Heteroptera species across major islands or island groups sampled in Milne Bay Province. Locality codes as follows: MIB = Milne Bay, FER = Fergusson Island, NOR = Normanby Island, TAG = Tagula [Sudest] Island, ROS = Rossel [Yela] Island (including Wola Island), MIS = Misima Island, CON = Conflict Group (Irai Island), WOD = Woodlark Island, EGM = Egum Atoll (Yanaba Island), NUA = Nuakata Island (plus Iabama Island), CHS = Islands east of the China Strait (Sariba, Lesimano, Sideia, Basilaki); ENG = Engineer Group (Tubetube Island), PAN = Panatinanae.

Taxon	MIB	FER	NOR	TAG	ROS	MIS	CON	WOD	EGM	NUA	CHS	ENG	PAN
HETEROPTERA													
Gerridae													
Halobates calyptus	X	-	X	-	X	X	-	X	-	X	X	-	X
Halobates germanus	-	-	-	-	-	X	-	-	-	-	-	-	-
Halobates hyanus	-	X	X	X	X	-	-	-	-	X	-	X	-
Halobates maculatus	X	X	X	-	-	X	X	-	X	X	X	X	-
Halobates murphyi	X	-	-	X	X	-	-	X	-	-	X	-	-
Halobates princeps	-	X	X	-	X	-	X	-	X	X	X	X	-
Halobates proavus	X	X	X	-	-	-	-	-	-	-	-	-	-
Halobates sericeus	-	X	-	X	-	X	X	-	-	-	-	-	-
Rhagadotarsus kraepelini	X	-	-	-	-	-	-	-	-	-	-	-	-
Rheumatometroides browni	X	X	X	X	X	-	-	X	-	-	X	-	-
Thetibates serena	X	-	-	X	X	-	-	-	-	-	X	-	-
Hermatobatidae													
Hermatobates marchei	X	X	-	-	-	-	-	-	-	-	-	-	-
Hermatobates weddi	-	X	X	-	-	-	-	-	-	X	-	X	X
Hermatobates kula nov.sp.	-	X	X	-	X	X	X	-	-	X	X	-	X
Mesoveliidae													
Mesovelia vittigera	-	-	-	-	-	-	-	X	-	-	-	-	-
Veliidae													
Halovelia annemariae	X	-	X	-	-	-	-	-	-	-	X	-	-
Halovelia bergrothi	X	X	X	-	X	-	-	-	X	X	X	X	-
Halovelia corallia	-	-	-	-	-	X	-	-	-	-	-	-	X
Halovelia novoguinensis	-	-	-	X	X	X	-	-	-	-	-	-	X
Halovelia huniye nov.sp.	-	-	-	-	-	-	-	-	-	-	X	-	X
Halovelia misima nov.sp.	-	-	-	-	-	X	-	-	-	-	-	-	-
Haloveloides browni	X	X	X	-	-	-	-	-	-	-	X	-	-
Haloveloides papuensis	X	-	-	-	-	X	-	X	-	-	X	-	-
Ocheovelia heissi nov.sp.	X	-	X	-	-	-	-	-	-	X	X	-	-
Xenobates caudatus	X	-	-	X	X	-	-	X	-	-	X	-	-
Xenobates mangrove	X	-	-	X	-	-	-	-	-	-	-	-	-
Xenobates ovatus	-	X	-	X	X	-	-	-	-	-	X	-	-
Xenobates seminulum	-	-	-	-	-	-	-	X	-	-	-	-	-
Xenobates kanakopi nov.sp.	X	-	-	-	-	-	-	-	-	-	X	-	-
Total	**16**	**12**	**12**	**9**	**11**	**9**	**4**	**7**	**3**	**8**	**16**	**5**	**6**

Coral Sea. Instead, these species have moved around the northern margin of New Guinea, arriving in the Milne Bay area via the Solomon Sea, and in many cases also spreading eastward into the Solomon Islands.

As our recent surveys have amply demonstrated, the true distributions of many marine Heteroptera are still far from completely known, and it is not unexpected that other taxa will eventually be discovered thousands of kilometers outside of their currently understood ranges. At the same time, it seems likely that few other areas of the world will prove to be as rich in these insects as Milne Bay Province, which due to its fortuitous geographic position represents a major faunal intersection zone at the outer limit of many species ranges. This further emphasizes the importance of this area to marine conservation, both for Papua New Guinea and the world as a whole.

The marine ecosystems of the Milne Bay Province are some of the most intact on the planet, and currently remain in excellent condition; it has been a remarkable pleasure and privilege to work in them over the last

five years. Even so, care must be taken with land use practices in watersheds on New Guinea and nearby islands to mitigate the impacts of siltation from logging and agricultural development, as well as other forms of land-based pollution, which could easily degrade the region's remarkable freshwater and marine insect communities. The current study also highlights the importance of intact mangrove estuaries in conserving many components of marine Heteroptera biodiversity; the clearing or disturbance of mangroves should therefore be discouraged, since it is likely that the patterns of faunal richness and endemism indicated by marine Heteroptera are reflective of those prevailing for other marine and estuarine organisms in the region.

Acknowledgements

We wish to thank all of the participants on the Kula Ring 1, Kula Ring 2, and Kula Ring 3 expeditions that formed the backbone of the marine insect survey program in Milne Bay Province. Foremost among those we wish to acknowledge are Wayne Thompson, skipper of the research vessel Marlin 1, his wife Lee, and the various Melanesian crew members who kept the vessel in top condition so that we could collect or get underway at any hour of the day or night; their willingness to push Marlin 1 into many difficult and remote bays, some uncharted, and to make overnight transits between islands greatly enhanced the scope and quality of our collections. Deepest thanks are also due to the staff of Conservation International's Melanesia Program, specifically Bruce Beehler and Todd Stevenson in Washington, DC; Gai Kula in Port Moresby; and David Mitchell, Bena Seta and Neal Lima in Alotau, who provided invaluable local logistics and community liaison, and allowed us to integrate our research with their larger program of marine conservation in Milne Bay Province. Additionally, we wish to thank the other collaborating scientists who shared both the work and the excitement of the cruises, specifically Dr. Gerald Allen of Perth, Australia, and Dr. Ron Englund of the Bishop Museum, Honolulu, Hawaii. Finally, we wish to thank Chris Abel of Alotau, a descendent of the first missionary family in the China Strait region, for his constant cheer, innovative thinking, and commitment to the betterment of his community and its surrounding ecosystems; he helped us out of many logistical tangles both large and small, and the final scope and design of the project owed much to his assistance. We are indebted to Dr. Herbert Zettel for his critical review of the manuscript, and for allowing us access to unpublished distributional records for certain taxa. We also give special thanks to three editors who have kindly permitted the reprinting of splendid figures from their publications, mainly prepared by the late N.M. Andersen: Dr. L.B. Vilhelmsen, Entomologica Scandinavica, Copenhagen, Denmark; Jan van der Linde, Brill Academic Publishers, Leiden; and Dr. Camilla Myers and Carla Flores, Invertebrate Taxonomy, (papers by N.M. Andersen & T.A. Weir), CSIRO Publishing, Collingwood, Victoria, Australia, journal website http://www.publish.csiro.au/journals/ls. This research was supported in part by grant DEB-0103794 from the National Science Foundation, Washington, DC; by the Melanesian Freshwater Ecosystems grant from Conservation International; and by the Smithsonian Institution's Drake Fund. In addition, JTP completed this research as an adjunct faculty member in the Bioagricultural Sciences Department at Colorado State University. We thank all the above parties for their continued support of research into the systematics and biogeography of aquatic Heteroptera.

Zusammenfassung

Marine Heteroptera, oder Wanzen, sind weit verbreitete aber selten wahrgenommene Elemente tropischer, mariner Ökosysteme der Erde, die ihren höchsten Grad an Vielfalt im südwestlichen Pazifik erreichen. Im Rahmen der vorliegenden Studie wurden zwischen April 2002 und Jänner 2004 Aufsammlungen mariner Heteroptera an 41 Standorten in der Milne Bay Province des östlichsten Papua Neuguinea durchgeführt. Die Standorte umfassen Lokalitäten in und um Milne Bay sowie den unmittelbar angrenzenden Inseln Killerton, Iabama, Nuakata, Sariba, Lesimano, Sideia, und Basilaki, den D'Entrecasteaux Inseln (Fergusson,

Normanby), den Louisiade Archipel (Panatinane, Tagula, Rossel, Wola, Misima), der Engineer Gruppe (Tubetube), der Conflict Gruppe (Irai), der Marshall Bennet Inselgruppe (Woodlark) und dem Egum Atoll (Yanaba). Insgesamt wurden 29 Arten in 10 Gattungen gesammelt, darunter die im Folgenden neu beschriebenen Taxa: *Ocheovelia* nov.gen., mit der Typusart *Ocheovelia heissi* nov.sp.; *Hermatobates kula* nov.sp.; *Halovelia huniye* nov.sp.; *Halovelia misima* nov.sp.; und *Xenobates kanakopi* nov.sp.; Weiters wird ein männlicher Neotypus von *Hermatobates marchei* COUTIÉRE & MARTIN von der Zamboanga Halbinsel (Mindanao, Philippinen) festgelegt. Die folgenden neuen Kombinationen werden vorgeschlagen: *Ocheovelia anderseni* (LANSBURY) und *Ocheovelia solomon* (ANDERSEN); beide Arten wurden bisher in die Gattung *Halovelia* gestellt. Auf Grundlage der Erhebungen, beherbergt die Milne Bay Province eine der artenreichsten marinen Wanzenzönosen der Welt. Mit einer Fläche von 265.000 km^2 macht die Provinz nur 0,037 % der Weltfläche (und nur 0,052 % der globalen Wasserfläche) aus, dennoch beherbergt sie 16,5 % der bekannten marinen Gerromorpha der Welt. Die höchsten Artenzahlen wurden in der Milne Bay, den Inseln östlich der China Strait, auf Fergusson und Normanby in der D'Entrecasteaux Gruppe und Rossel Island im Louisiade Archipel (16, 16, 12, und 11), vermutlich wegen der hohen Komplexität der Habitate erreicht, die sowohl große, riff-gebundene Lagunen oder Platformriffe als auch steinige Küsten mit Mangrovensäumen an den Ästuaren beherbergen. Im Unterschied dazu war der Artenreichtum am geringsten auf Egum und der Conflict Gruppe (3 und 4 Arten), die große Lagunen und Saumriffe, aber keine Ästuare und Mangrovenhabitate oder steile Felsküsten beherbergen. Dazwischen liegende Artenzahlen wurden an den Standorten auf Tagula (9 Arten), Misima (9 Arten) und Woodlark (7 Arten) festgestellt, die alle einheitliche Mangrovenästuare und in unterschiedlichem Ausmaß Saumriffe und Lagunen beherbergen, aber weiter von der Hauptinsel Neu Guinea isoliert sind. Die Beta-Diversität war mäßig hoch in der Milne Bay Province; an keinem Standort wurden mehr als 16 der 29 Arten festgestellt. Die Aufsammlungen erweitern das bekannte Areal für mehrere Arten: *Halobates proavus* WHITE wird anscheinend erstmals für Neu Guinea gemeldet. Innerhalb Papua Neu Guineas wird das bekannte Areal von *Halobates calyptus* HERRING, *Halobates hayanus* WHITE, *Halobates maculatus* SCHADOW, *Halobates princeps* WHITE, *Thetibates serena* (LANSBURY), *Halovelia annemariae* ANDERSEN, *Halovelia bergrothi* ESAKI und *Haloveloides papuensis* (ESAKI) um ca. 800-1000 km nach Südosten erweitert. Das Areal von *Halovelia corallia* ANDERSEN, *Halovelia novoguinensis* ANDERSEN und *Xenobates caudatus* ANDERSEN & WEIR, die bisher nur von den Motupore Inseln nahe Port Moresby bekannt waren, erweitert sich um ca. 800 km ostwärts. Das Areal von *Xenobates mangrove* ANDERSEN & WEIR und *Xenobates ovatus* ANDERSEN & WEIR, die bisher nur von der Küste vor Queensland bekannt waren, erweitert sich um ca. 800-1000 km nordostwärts. Das bekannte Areal von *Hermatobates marchei* COUTIÉRE & MARTIN, bisher nur von der Typenlokalität Palawan auf den Philippinen gemeldet, erweitert sich um mehr als 4000 km nach Südosten; in früheren Aufsammlungen der Autoren wurde diese Art auch in Mindanao und Palau festgestellt. Die biogeographische Diskussion zeigt vier Hauptverbreitungsmuster der marinen Wanzen des östlichen Neu Guineas: Südküsten-Taxa die östlich entlang des Nordrandes der Coral Sea vorkommen; Nordküsten-Taxa die südöstlich von der Huon Halbinsel bis zu den D'Entrecasteaux Inseln, dem Louisiade Archipel und manchmal bis zum Bismarck Archipel und den Salomonen vorkommen; Regional-endemische Taxa des Bismarck Archipel, der Salomonen und der Nordostküste von Neu Guinea; Lokal-endemische Taxa die auf die Region zwischen Milne Bay und dem Louisiade Archipel beschränkt sind. In einer Tabelle werden alle Taxa und deren Vorkommen auf den untersuchten Inseln dieser Studie aufgelistet.

References

Andersen N.M. (1982): The Semiaquatic Bugs (Hemiptera, Gerromorpha). Phylogeny, Adaptations, Biogeography and Classification. — Entomonograph 3, Scandinavian Science Press, Klampenborg: 1-455.

Andersen N.M. (1989a): The coral bugs, genus *Halovelia* Bergroth (Hemiptera, Veliidae). I. History, classification and taxonomy of species except the *H. malaya*-group. — Entomol. Scand. **20**: 75-120.

Andersen N.M. (1989b): The coral bugs, genus *Halovelia* Bergroth (Hemiptera, Veliidae). II. Taxonomy of the *H. malaya*-group, cladistics, ecology, biology and biogeography. — Entomol. Scand. **20**: 179-227.

Andersen N.M. (1992): A new genus of marine water striders (Hemiptera, Veliidae) with five new species from Malesia. — Entomol. Scand. **22**: 389-404.

Andersen N.M. & L. Cheng (2004): The marine insect *Halobates* (Heteroptera: Gerridae): biology, adaptations, distribution, and phylogeny. — Oceanography and Marine Biology: An Annual Review **42**: 119-180.

Andersen N.M. & T.A. Weir (1994): The sea skaters, genus *Halobates* Eschscholtz (Hemiptera: Gerridae) of Australia: taxonomy, phylogeny, and zoogeography. — Invertebrate Taxonomy **8**: 861-909.

Andersen N.M. & T.A. Weir (1999): The marine Haloveliinae (Hemiptera: Veliidae) of Australia, New Caledonia and southern New Guinea. — Invertebrate Taxonomy **13**: 309-350.

Andersen N.M. & T.A. Weir (2000): The coral treaders, *Hermatobates* Carpenter (Hemiptera: Hermatobatidae) of Australia and New Caledonia, with notes on biology and ecology. — Invertebrate Taxonomy **14**: 327-345.

Herring J.L. (1961): The genus *Halobates* (Hemiptera: Gerridae). — Pacific Insects **3** (2-3): 223-305.

Herring J.L. (1965): *Hermatobates*, a new generic record for the Atlantic Ocean, with description of new species (Hemiptera: Gerridae). — Proc. US Nat. Mus. **117**, No. 3510: 123-129.

Lansbury I. (1989): Notes on the Haloveliinae of Australia and the Solomon Islands (Insecta, Hemiptera, Heteroptera: Veliidae). — Reichenbachia **26**: 93-109.

Lansbury I. (1992): Notes on the marine-freshwater gerrid genus *Rheumatometroides* (Hemiptera, Gerridae) of Papua New Guinea. — Tijdschr. Entomol. **135**: 1-10.

Lansbury I. (1996): Notes on the marine veliid genera *Haloveloides*, *Halovelia* and *Xenobates* (Hemiptera-Heteroptera, Veliidae) of Papua New Guinea. — Tijdschr. Entomol. **139**: 17-28.

Polhemus D.A. & J.T. Polhemus (1998): Assembling New Guinea – 40 million years of island arc accretion as indicated by the distribution of aquatic Heteroptera (Insecta). — In: Hall R. & J. Holloway (Eds), Biogeographical and Geological Evolution of SE Asia. Backhuys Publishers, Leiden: 327-340.

Polhemus J.T. & D.A. Polhemus (1991): Three new species of marine water striders from the Australasian region, with notes on other species (Gerridae: Halobatinae, Trepobatinae). — Raffles Bull. Zool. **39** (1): 1-13.

Polhemus J.T. & D.A. Polhemus (1996): The Trepobatinae (Heteroptera: Gerridae) of New Guinea and surrounding regions, with a review of the world fauna. Part 4. The marine tribe Stenobatini. — Entomol. Scand. **27**: 279-346.

Polhemus J.T. & D.A. Polhemus (2002): The Trepobatinae (Gerridae) of New Guinea and surrounding regions, with a review of the world fauna. Part 6. Phylogeny, biogeography, world checklist, bibliography, and final taxonomic addenda. — Insect Syst. Evol. **33**: 253-290.

Zettel H. (2005): A new sea skater from the southern Philippines, with a key to the Philippine species of *Halobates* (Heteroptera: Gerridae). — Entomofauna **26**: 409-420.

Address of the Authors:

John T. Polhemus
Colorado Entomological Institute
3115 South York St.
Englewood, CO, 80113
U.S.A.
E-Mail: jtpolhemus@msn.com

Dan A. Polhemus*
Dept. of Systematic Biology
MRC 105
Smithsonian Institution
Washington, DC, 20560
U.S.A.
*Current research address:
Dept. of Natural Sciences
Bishop Museum
1525 Bernice St.
Honolulu, HI 96817
U.S.A.
E-Mail: bugman@bishopmuseum.org