

**A NEW SPECIES OF THE FRESHWATER CRAB, PREVIOUSLY ASSIGNED TO  
*GEOTHELPHUSA MIYAZAKII* (MIYAKE & CHIU, 1965)  
(CRUSTACEA: DECAPODA: POTAMIDAE),  
FROM YAEMAMA GROUP, SOUTHERN RYUKYUS, JAPAN**

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**ABSTRACT.** – A new species of the freshwater crab, heretofore assigned to *Geothelphusa miyazakii*, is described. The new species is distinguished from *G. miyazakii* sensu stricto by characters of the first gonopod and carapace. *Geothelphusa marginata*, new species is restricted to Ishigaki and Iriomote Islands, Yaeyama Group, Southern Ryukyus, Japan. Populations of *G. marginata* on each island have minor differences in carapace shape and colouration, and subspecific status is recognized here for populations on different islands. The populations on Ishigaki Island are referred to *G. m. marginata*, and the populations on Iriomote Island are referred to *G. m. fulva*, new subspecies. The present work brings the number of *Geothelphusa* species to 43.

**KEY WORDS.** – *Geothelphusa marginata marginata*, *G. m. fulva*, new species, Potamidae, Southern Ryukyus, taxonomy.

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## INTRODUCTION

The Yaeyama Group in the Southern Ryukyus is located 110 km east of Taiwan and consists of about 20 islands (Fig. 1), some of which have held permanent freshwater that support species of freshwater crabs. *Geothelphusa miyazakii* (Miyake & Chiu, 1965) has been recorded from Ishigaki and Iriomote Islands of the Yaeyama Group by Minei (1973, 1974). However, no taxonomic work has discussed the morphological differences between populations within the Yaeyama Group and between Taiwan and Yaeyama. The aim of this study is to review their taxonomic status by morphological comparison. The present paper consists of new species description, followed by two separate subspecies diagnosis, and brings the number of *Geothelphusa* species to 43.

## MATERIALS AND METHODS

Specimens examined are deposited in the Hiwa Museum for Natural History, Hiroshima, Japan (HMNH), the National

Museum of Natural Science, Taichung, Taiwan (NMNS), National Science Museum, Tokyo, Japan (NSMT), the Graduate School of Fishery Science, National Taiwan Ocean University, Keelung, Taiwan (NTOU), the Natural History Museum and Institute, Chiba, Japan (CBM), the Ryukyu University Museum, Fujukan, Okinawa, Japan (RUMF) Zoological Laboratory, Kyushu University, Fukuoka, Japan (ZLKU) (ZLKU specimens have been transferred to the Kitakyushu Museum of Natural History and Human History, Fukuoka, Japan), and in the Zoological Reference Collection of the Raffles Museum of Biodiversity Research, National University of Singapore, Singapore (ZRC).

The terminology and measurements follow Ng (1988), Dai (1999), and Shy & Yu (1999). Abbreviations are as follows: CL, carapace length; CW, carapace width; CH, carapace height; FW, frontal region width; EXW, width between external orbital angles; G1, gonopod 1; G2, gonopod 2.

Only adult specimens were used to calculate morphometric proportions (Table 1). In the present study, the minimum adult

Table 1. Comparison of ratio characters among three taxa of *Geothelphusa marginata* and *Geothelphusa miyazakii*. Abbreviations are as follows: abd.seg., abdominal segment; amb.leg, ambulatory leg; CH, carapace height; CL, carapace length; CW, carapace width; dac., dactylus; EXW, the width between external orbital angles; flag., flagellum of G2; FW, frontal width; G1, first gonopod; G2, second gonopod; L, length; mer., merus; n, number of individuals; pro., propodus; ter.seg., terminal segment; TL, total length; W, width.

|                                     | <i>G. marginata marginata</i> |           |    | <i>G. marginata fulva</i> |           |    | <i>G. miyazakii</i> |           |    |
|-------------------------------------|-------------------------------|-----------|----|---------------------------|-----------|----|---------------------|-----------|----|
|                                     | median                        | range     | n  | median                    | range     | n  | median              | range     | n  |
| CW/CH                               | 2.19                          | 2.04–2.31 | 15 | 2.25                      | 2.13–2.41 | 23 | 2.19                | 2.09–2.27 | 23 |
| CW/CL                               | 1.30                          | 1.25–1.33 | 17 | 1.26                      | 1.21–1.31 | 23 | 1.26                | 1.22–1.30 | 23 |
| CH/CL                               | 0.59                          | 0.56–0.62 | 15 | 0.57                      | 0.53–0.59 | 23 | 0.58                | 0.55–0.60 | 23 |
| FW/CW                               | 0.29                          | 0.26–0.31 | 17 | 0.29                      | 0.27–0.31 | 23 | 0.31                | 0.29–0.32 | 23 |
| FW/EXW                              | 0.47                          | 0.44–0.50 | 18 | 0.46                      | 0.44–0.48 | 23 | 0.49                | 0.46–0.52 | 23 |
| Male (telson-sternite4/sternite1-3) | 0.91                          | 0.80–1.27 | 9  | 1.01                      | 0.71–1.39 | 14 | 1.09                | 0.87–1.49 | 12 |
| Male telson (L/W)                   | 0.84                          | 0.80–0.91 | 10 | 0.88                      | 0.82–1.05 | 14 | 0.86                | 0.70–0.96 | 12 |
| Male 6th abd.seg. (L/W)             | 0.51                          | 0.49–0.55 | 10 | 0.57                      | 0.48–0.63 | 14 | 0.51                | 0.47–0.54 | 12 |
| Male (telson L/6th abd.seg. L)      | 1.30                          | 1.19–1.39 | 10 | 1.24                      | 1.17–1.49 | 14 | 1.36                | 1.25–1.52 | 12 |
| Male (telson W/6th abd.seg.W)       | 0.78                          | 0.73–0.84 | 10 | 0.81                      | 0.74–0.85 | 14 | 0.81                | 0.74–1.03 | 12 |
| 2nd amb.leg pro. (L/W)              | 2.51                          | 2.28–2.91 | 18 | 2.55                      | 2.27–2.94 | 23 | 2.19                | 2.06–2.40 | 21 |
| 2nd amb.leg (pro.L/dac.L)           | 0.88                          | 0.78–0.95 | 17 | 0.88                      | 0.82–0.98 | 22 | 0.88                | 0.80–0.99 | 21 |
| 2nd amb.leg mer.(L/W)               | 3.67                          | 3.26–4.14 | 18 | 3.53                      | 3.16–4.18 | 23 | 3.46                | 3.04–3.83 | 22 |
| (2nd amb.leg TL)/CL                 | 2.17                          | 2.00–2.27 | 17 | 2.15                      | 1.99–2.33 | 22 | 1.97                | 1.78–2.05 | 15 |
| (2nd amb.leg TL/3rd amb.leg TL)     | 1.07                          | 1.03–1.09 | 15 | 1.07                      | 0.91–1.22 | 21 | 1.07                | 0.99–1.10 | 15 |
| G1 (TL/W)                           | 3.49                          | 3.05–3.62 | 10 | 3.49                      | 2.97–3.61 | 13 | 3.32                | 3.04–3.50 | 11 |
| G1 ter.seg.(L/W)                    | 2.24                          | 2.00–2.67 | 10 | 2.38                      | 2.13–2.67 | 13 | 2.13                | 1.63–2.64 | 11 |
| G1 (ter.seg.L/TL)                   | 0.12                          | 0.11–0.14 | 10 | 0.13                      | 0.11–0.15 | 13 | 0.12                | 0.09–0.17 | 11 |
| G1 sm (L/W)                         | 4.11                          | 3.63–5.85 | 10 | 4.13                      | 3.41–5.67 | 13 | 3.62                | 2.61–4.04 | 10 |
| G1 (sm L/ter.seg.L)                 | 1.71                          | 1.56–1.94 | 10 | 1.67                      | 1.34–2.00 | 13 | 1.82                | 1.13–2.15 | 10 |
| G2 (flag./TL)                       | 0.14                          | 0.13–0.15 | 6  | 0.13                      | 0.12–0.15 | 11 | 0.14                | 0.13–0.17 | 12 |
| (G2TL/G1TL)                         | 0.77                          | 0.76–0.80 | 6  | 0.74                      | 0.72–0.79 | 11 | 0.79                | 0.77–0.89 | 11 |

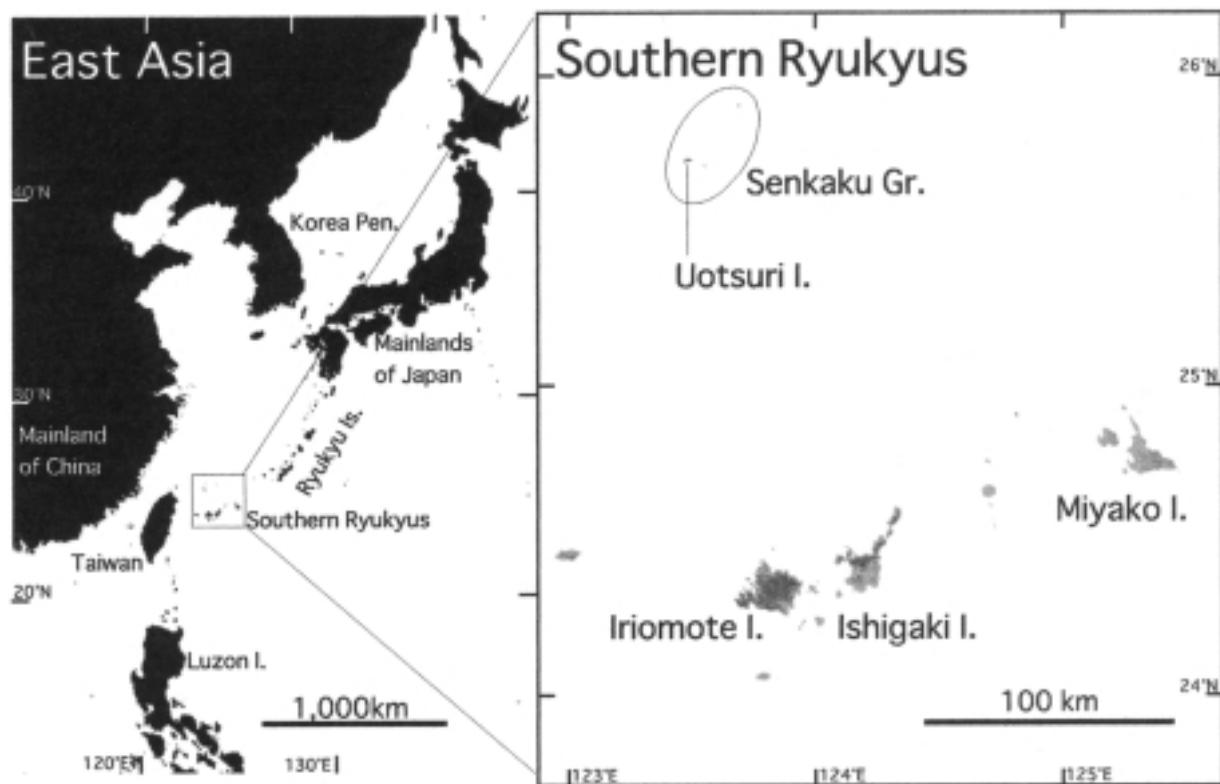


Fig. 1. The location of Ishigaki and Iriomote Islands in Southern Ryukyus and East Asia.

Table 2. Comparisons of the measurements of the second ambulatory legs along their growth among *Geothelphusa miyazakii*, *G. marginata marginata*, and *G. m. fulva*. The characters were compared by ANCOVA with Bonferroni test using CL as the covariate. Abbreviations as follows: *df*, degrees of freedom; *F*, *F* statistic; *L*, length; *m*, *G. miyazakii*; *mf*, *G. m. fulva*; *mm*, *G. m. marginata*; *MS*, mean squares; *P*, probability; *SS*, sum of squares; *W*, width. The taxa sharing the same superscript letter indicated no significant difference in Bonferroni test.

| Characters | SS      | df | MS      | F      | P      |                          |                           |                           |
|------------|---------|----|---------|--------|--------|--------------------------|---------------------------|---------------------------|
| total L    | 310.082 | 2  | 155.041 | 38.505 | <0.001 | <sup>m<sup>a</sup></sup> | <sup>mf<sup>b</sup></sup> | <sup>mm<sup>b</sup></sup> |
| propodus L | 24.175  | 2  | 12.087  | 48.567 | <0.001 | <sup>m<sup>a</sup></sup> | <sup>mf<sup>b</sup></sup> | <sup>mm<sup>b</sup></sup> |
| propodus W | 0.002   | 2  | 0.001   | 0.030  | 0.970  |                          |                           |                           |

size was provisionally defined for males as the smallest individual whose distal end of G1 reaches sternal knob and for females as the smallest individual whose abdominal fifth segment width was equal to, or wider than the third abdominal segment width. The puberty moult sizes were estimated as follows: *Geothelphusa marginata marginata*, male, CL 22.2 mm; female, CL 25.6 mm; *G. m. fulva*, male, CL 21.5 mm; female, CL 22.4 mm; *G. miyazakii*, male, CL 21.3 mm; female, CL 21.7 mm. Significant differences between populations of the leg length of *G. m. marginata* and *G. m. fulva* were identified using ANCOVA with the Bonferroni test (Table 2).

## TAXONOMY

### FAMILY POTAMIDAE

#### *Geothelphusa marginata*, new species

*Geothelphusa miyazakii* - Minei, 1973: 214, Fig. 8, 9G, H; 1981: 80, Pl. 2 (lower); Sakai, 1976: 562 (English text), 347 (Japanese text); Hirata et al., 1988: 25; Environment Agency, 1991: 228; Shy et al., 1994: 807; Okinawa Prefecture, 1996: 382; Shokita, 1996: 348; Segawa, 2000: 243; Kasai & Naruse, 2003: 283. *Geothelphusa* sp. 2 - Yoshigou, 1999: 22, Pl. III. *Geothelphusa* sp. 3 - Yoshigou, 1999: 22, Pl. 2N.

**Material examined.** - Refer to subspecies accounts (see later). Comparative material. *Geothelphusa miyazakii* (Miyake & Minei) (all specimens collected in Taiwan): 1 male (holotype), CL 24.6 mm, ZLNU 10983, Alilao Village, Shi-Men district, Taipei County, coll. Jui-Kuang Chiu, 28 Jan. 1964; 1 female (paratype), CL 26.4 mm, ZLNU 10984, data same as holotype; 3 males CLs 20.0–23.2 mm, 3 females, CLs 20.8–28.3 mm, ZLNU 10137, Shenkeng, Taipei County, coll. Jui-Kuang Chiu, 3 Oct. 1963; 1 male, CL 21.3 mm, 1 female, CL 26.7 mm, ZLNU 10985, Shenkeng, Taipei County, coll. Jui-Kuang Chiu, 3 Oct. 1963; 2 males, CLs 22.1, 23.3 mm, 1 female, CL 16.2 mm, ZLNU 13752, Patoutzu, Keelung City, coll. Hsiang-Ping Yu, 22 Jun. 1972; 2 males, CLs 15.6, 18.8 mm, 1 female, CL 27.0 mm, RUMF-ZC-76, Tinmu, Taipei City, coll. Jhy-Yun Shy, 2 Sep. 2001; 1 male, CL 23.6 mm, 1 female, CL 22.3 mm, RUMF-ZC-77, Tinmu, Taipei City, coll. Jhy-Yun Shy, Kari Lee & Tohru Naruse, 18 Feb. 2002; 1 male, CL 23.0 mm, NTOU F10094, National Taiwan Ocean University, Keelung City, coll. Ping-Ho Ho, 1 Jul. 1986; 1 male, CL 23.5 mm, 1 female, CL 22.5 mm, NTOU F10095, Shuangshi, Shihfan, Shangsi, Taipei City, 1 Jun. 1982; 1 female, CL 26.3 mm, NTOU F10096, Wanli/Kingshan, Chishiangshan, Taipei City, 17 Jun. 1984; 1 male, CL 11.9 mm, 1 female, CL 22.4 mm, NTOU F10116, National Taiwan Ocean University, Keelung City, coll. Dar-Yi Wang, 1 Jan. 1989; 1 male, CL 21.4 mm, NTOU F10091, Rayping, Taipei County, coll. Jhy-

Yun Shy, 8 May. 1993; 3 males, CLs 12.8–19.4 mm 1 female, CL 20.9 mm, NTOU F10317, Tinmu, Taipei City, coll. Jhy-Yun Shy, 4 Sep. 2001; 2 males, CLs 14.3, 18.5 mm, NMNS 3999-001, Luchiaokeng, Yanmingshan, Taipei City, coll. Yu-Hsi Wang, 25 Jul. 1997; 3 males, CLs 10.3–26.6 mm, 2 females, CLs 13.0, 15.1 mm, NMNS 3999-002, Luchiaokeng, Yanmingshan, Taipei City, coll. L.-S. Chen, 9 Jun. 1997; 1 male, CL 10.5 mm, TMCD 2225, Alilan stream, Taipei County, coll. Tsun-Hsien Wu, Dec. 1986; 1 female, CL 20.0 mm, TMCD 2041, Pingteng Li, Yangmingshan, Taipei City, coll. Chiu-Chu Lu, 20 Jul. 1983; 1 male, CL 14.9 mm, TMCD 2043, Nankung, Taipei City, coll. Yuang Wei, 5 Aug. 1984; 1 male, CL 24.8 mm, 1 female, CL 21.9 mm, ZRC 1995.606, Yangmingshan, Taipei City, coll. C.-J. Leu, 26 Jul. 1983; 1 male, CL 25.3 mm, 1 female, CL 21.7 mm, ZRC 1998.213, Keelung City, 1 Jul. 1986. *Geothelphusa nanshi* Shy, Ng & Yu: male (holotype), CL 18.4 mm, NTOU F10198, Nanshi, Tainan, Taiwan, coll. Jhy-Yun Shy & W. L. Tsay, 7 Aug. 1992. *Geothelphusa shokitai* Shy & Ng: male (holotype), CL 20.5 mm, NSMT-Cr 15176, Uotsuri Island, Senkaku Group, coll. Masatsugu Yokota, 28 May. 1991; 1 female (paratype), CL 29.7 mm, NSMT-Cr 15177, data same as holotype.

**Diagnosis.** - Carapace slightly convex longitudinally and transversely; anterolateral margin cristated, convex, faintly granulated, external orbital angle blunt, epibranchial tooth represented only by small granules. Eyes with relatively small cornea, subdistal part shorter to almost same height with base of peduncle in frontal view. Ambulatory legs relatively long, total length of second ambulatory legs more than two times as long as CL. Male telson bell-shaped, tip of telson reaching imaginary line joining posterior 2/3 of the coxae of chelipeds. G1 sinuous to straight, proximal half of subterminal segment and terminal segment directing inward, and distal half of subterminal segment directing outward; G1 slender, subterminal segment with a knob on proximal outer margin, with rounded lobe on proximal inner margin; synovial membrane variable in shape, distal margin forked, inner margin just swollen laterally or hooked proximally.

**Description.** - Carapace slightly convex longitudinally and transversely; orbital and frontal margins cristated, infraorbital margin faintly granulated, frontal margin slightly concave medially, anterolateral margin cristated, convex, faintly granulated, present on anterior 2/5 of carapace, external orbital angle blunt, epibranchial tooth represented only by small granules; postorbital and postfrontal cristae low, gradually raised backward, anterolateral region of carapace with several oblique ridges and small pits, posterolateral region with short carinae; H-shaped gastric groove distinct, two large pits on anterior outer part of H-shaped gastric groove, on either side of cervical groove, one large pit located halfway between H-shaped gastric groove and epibranchial tooth, inside of cervical groove, branchial groove represented by wide and shallow transverse hollow.

Eyes with relatively small cornea, subdistal part shorter to almost same height with base of peduncle in frontal view.

Mouth parts similar to those of *Geothelphusa miyakoensis* Shokita, Naruse & Fujii, 2002, except for longer distal segment of mandibular palp and longer coxa of maxilla.

Male chelae asymmetric in size and shape, outer surface of manus of major chela smooth, lower margin rough.

Ambulatory legs relatively long, total length of second ambulatory legs more than two times as long as CL; propodus with elliptic cross-section and four longitudinal margins, only anterior dorsal margin lacking row of spines; propodus of first and second ambulatory legs lined by long setae along outer, inner margins, and along midline of ventral surface; dactylus with rectangular cross-section and four longitudinal margins, distal spine of outer dorsal margin of fourth ambulatory leg thin, sharp, locating about middle of dorsal surface.

Male telson bell-shaped, tip of telson reaching imaginary line joining posterior 2/3 of the coxae of chelipeds.

G1 sinuous to straight, proximal half of subterminal segment and terminal segment directing inward, and distal half of subterminal segment directing outward; G1 slender, subterminal segment with a knob on proximal outer margin, with rounded lobe on proximal inner margin; synovial membrane variable in shape, distal margin forked, inner margin just swollen laterally or hooked proximally.

**Habitat.** – *Geothelphusa marginata* is formed in shallow, narrow, slow-flowing streams and in small muddy swamps in forests. Crabs were collected under large stones and from burrows.

**Distribution.** – Ishigaki and Iriomote Islands, Yaeyama Group, Southern Ryukyus, Japan.

**Etymology.** – *Geothelphusa marginata* is named for the Latin “marginatum”, meaning “margined”, because of the distinctly convex anterolateral margins of carapace.

**Remarks.** – Miyake & Chiu (1965) originally described *Geothelphusa miyazakii* on the basis of specimens obtained from Alilao Village, Shimen District, Taipei County, Taiwan. Minei (1973) was the first to report on specimens from Ishigaki and Iriomote Islands, Southern Ryukyus, which he identified as *G. miyazakii*. Later, Shy et al. (1994) doubted whether the specimens from Taiwan and Southern Ryukyuan were conspecific. The present study has identified a number of differences between *G. marginata* and *G. miyazakii* sensu stricto, viz., the proximal inner margin of the subterminal segment of G1 (roundly swollen in *G. marginata* vs. straight in *G. miyazakii* sensu stricto), the size of the knob on the proximal outer margin of G1 (small vs. large), and the size of the epibranchial tooth (rudiment vs. absent). In addition, there are significant differences between *G. marginata* and *G. miyazakii* in the ratio of the total length of the second

ambulatory leg to CL, and in the ratio of the length to width of the propodus of the second ambulatory legs (Tables 1, 2).

Shy et al. (1994) remarked that the terminal segment of the G1 of *G. marginata* is slender and more elongated than *G. miyazakii* sensu stricto. However, the ratio of the total length to width of G1 of *G. miyazakii* sensu stricto is in almost the same range as *G. marginata*, and the length to the width ratio of the terminal segment of G1 is wider than in *G. marginata* (Table 1).

The respective populations of *G. marginata* occurring on Ishigaki and Iriomote Islands differ slightly from one another in morphology and live colouration. We regard these differences as infraspecific in nature because each population does not show any differences in the shape of G1, which is reproductively and taxonomically most important character. As such, we regard two subspecies for the two islands. The subspecific accounts follow (see later).

*Geothelphusa marginata* also resembles *G. nanshi* Shy, Ng & Yu, 1994. However, *G. marginata* can be distinguished from *G. nanshi* by the shape of G1 (sinuous in *G. marginata* vs. gently curved outward in *G. nanshi*), the shape of the proximal inner margin of the subterminal segment of G1 (roundly swollen vs. straight), the shape of the external orbital angle (blunt vs. sharp), the form of the anterolateral margin (barely granulated vs. certainly granulated), the condition of the cervical groove (distinct vs. invisible), and the accessory of the propodus of the second ambulatory leg (three rows of spines vs. only two rows of spines on the inner margins).

*Geothelphusa marginata* is also close to *G. shokitai* Shy & Ng. However, *G. marginata* is easily differentiated from *G. shokitai* by the shape of G1 (sinuous in *G. marginata* vs. almost straight in *G. shokitai*), the shape of the dorsal surface of the carapace (convex vs. almost flat), the form of the anterolateral margin (very low granules vs. distinct granules), the shape of the external orbital angle (blunt vs. acute), and the shape and the relative position of the male telson (tip narrow, reaching imaginary line joining proximal 2/3 of the coxae of the chelipeds vs. tip obtuse, reaching imaginary line joining proximal 1/2 of the coxae of the chelipeds).

### *Geothelphusa marginata marginata*

Japanese name: Murasaki-Sawagani  
(Figs. 2a, b, 3)

*Geothelphusa miyazakii* - Minei, 1973: 214, Fig. 8, 9G, H (part); 1981: 80 (part), Pl. 2 (lower); Sakai, 1976: 562 (English text), 347 (Japanese text) (part); Hirata et al., 1988: 25 (part), plate (middle of p. 25); Environment Agency, 1991: 228(part); Okinawa Prefecture, 1996: 382 (part); Shokita, 1996: 348; Segawa, 2000: 243 (part); Kasai & Naruse, 2003: 283 (Part). *Geothelphusa* sp. 2 - Yoshigou, 1999: 22, Pl. II (Part).

**Material examined.** – All specimens of *G. m. marginata* were collected in Ishigaki Island, Yaeyama Group, Southern Ryukyus, Japan.

Holotype – male, CL 27.7 mm, RUMF-ZC-59, a stream of Mt. Omoto-Dake (type locality), coll. Tohru Naruse & Yoko Okamoto, 11 Jul.2001.

Paratypes – 2 females, CLs 27.7, 27.9 mm, RUMF-ZC-87, data same as holotype; 2 males, CLs 22.4, 26.8 mm, 1 female, CL 28.0 mm, NSMT-Cr 15172, upstream of Sukubaru Dam Reserve, coll. Tohru Naruse, 9 Aug.2001; 1 male, CL 26.7 mm, 1 female, CL 26.0 mm, NSMT-Cr 15173, a stream of Mt. Omoto-Dake, coll. Tohru Naruse, 11 Aug.2001; 1 male, CL 29.9 mm, CBM-ZC 6723, a stream of Mt. Omoto-Dake, coll. Hsi-Te Shih & Tohru Naruse, 9 Apr.2002; 2 females, CLs 28.3 32.1 mm, CBM-ZC 6724, a stream of Mt. Omoto-Dake, coll. Ryoko Segawa, 19 Mar.1997.

Others – 2 males, CLs 21.7, 22.2 mm, RUMF-ZC-60, a stream of Mt. Omoto-Dake, coll. Ryoko Segawa, 19 Mar.1997; 3 males, CLs 14.4–20.9 mm, 1 female, CL 21.1 mm, ZRC 2003.0596, a stream of Mt. Omoto-Dake, coll. Tohru Naruse, 22 Mar.2001; 1 male, CL 26.2 mm, 2 females, CLs 25.6, 27.2 mm, ZLNU 12648, a stream of Mt. Omoto-Dake, coll. Y. Hashiguchi, 31 Jul.1968; 3 males, CLs 19.2–27.1 mm, 3 females, CLs 20.1–23.4 mm, ZLNU m1092, a stream of Mt. Omoto-Dake, coll. Y. Hashiguchi, 31 Jul.1968; 1 male, CL 27.5 mm, HMNH-C9, Ohama, coll. Hidenori Yoshigou, 11 Aug.1999.

**Diagnosis.** – Carapace with convex anterolateral margin, frontal margin slightly concave medially, cervical groove distinct as *Geothelphusa* species, barely connected from distinct H-shaped gastric groove to epibranchial tooth.

G1 sinuous, subterminal segment with small knob on proximal outer margin, proximal inner margin roundly swollen.

Carapace, chelipeds, and ambulatory legs purple, fingers of chelipeds, articulations of ambulatory, and about distal half of dactylus yellow/orange.

**Distribution.** – Ishigaki Island, Yaeyama Group, Southern Ryukyus, Japan.

**Remarks.** – *Geothelphusa marginata marginata*, can be easily differentiated from *G. m. fulva* by their live colouration. However, morphological differences are limited to the size of the proximal outer knob of the subterminal segment of G1 (small in *G. m. marginata* vs. large in *G. m. fulva*), the condition of the cervical groove (barely connected from H-shaped gastric groove to epibranchial tooth vs. visible between H-shaped gastric region to hepatic region), and the shape of the frontal margin (slightly concaved medially vs. almost straight). Because *G. m. marginata* and *G. m. fulva* do not have large differences even in G1, subspecific status are considered for these two taxa.

*Geothelphusa marginata marginata* has a similar colouration to *G. miyazakii*, but the former tend to have softer colour than *G. miyazakii*. Furthermore, *G. miyazakii* has bright

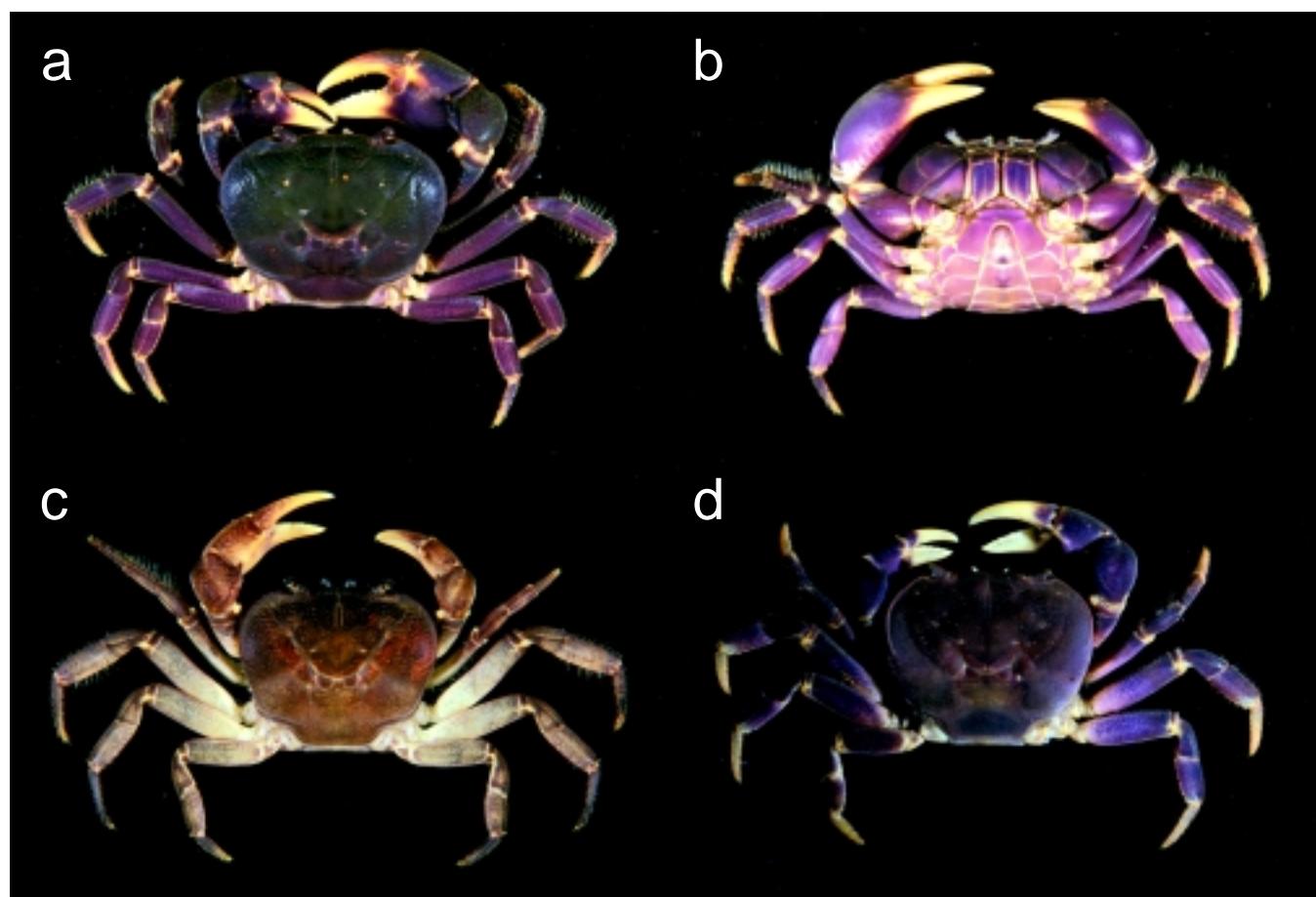


Fig. 2. Colouration of *Geothelphusa marginata marginata*, *G. m. fulva*, and *G. miyazakii*.

a, *G. m. marginata* (holotype, RUMF-ZC-59), dorsal view; b, *G. m. marginata* (holotype, RUMF-ZC-59), ventral view; c, *G. m. fulva* (paratype, RUMF-ZC-75); d, *G. miyazakii* (RUMF-ZC-76).

yellow rings on articulation of ambulatory legs and their dactylus are totally yellow.

Yoshigou (1999) recorded *Geothelphusa* sp. 2 from Ishigaki and Iriomote Islands and *G. sp.* 3 from Iriomote Island. As far as I examined his materials, *G. sp.* 2 and *G. sp.* 3 correspond to *G. m. marginata* and *G. m. fulva*, respectively. *Geothelphusa* sp. 2 of Iriomote Island is most likely a misidentification due to the choice of unsuitable characters, such as relative width of the cornea and the direction of the projection of anterolateral margin. Furthermore, Yoshigou (1999) reported ambulatory leg proportions that are beyond the values found in the present study (Table 3).

#### *Geothelphusa marginata fulva*, new subspecies

Japanese name: Kasshoku-Sawagani  
(Figs. 2c, 4)

*Geothelphusa miyazakii* - Minei, 1973: 214 (part); 1981: 80 (part); Sakai, 1976: 562 (English text), 347 (Japanese text) (part); Hirata et al., 1988: 25 (part); Environment Agency, 1991: 228 (part); Okinawa Prefecture, 1996: 382 (part); Shokita, 1996: 348; Segawa, 2000: 243 (part); Kasai & Naruse, 2003: 283 (Part).

*Geothelphusa* sp. 2 - Yoshigou, 1999: 22, Pl. III (Part).  
*Geothelphusa* sp. 3 - Yoshigou, 1999: 22, Pl. 2N.

**Material examined.** - All specimens of *G. m. fulva* were collected in Iriomote Island, Southern Ryukyus, Japan.

Holotype - male, CL 30.7 mm, RUMF-ZC-62, upstream of Nakama River (near Nishifunatsuki, Ohtomi forest road) (type locality), coll. Tohru Naruse, 12 Aug.2001.

Paratypes - 2 males, CLs 18.2, 20.1 mm, 2 females, CLs 17.0, 30.0 mm, RUMF-ZC-88, data same as holotype; 1 male, CL 22.8 mm, 1 female, CL 25.2 mm, NTOU F10220, data same as holotype; 1 male, CL 22.8 mm, 1 female, CL 24.0 mm, NSMT-Cr 15174, coll. Masayuki Osawa, Near Nadara Bridge, 4 Dec.2000; 1 male, CL 28.6 mm, NSMT-Cr 15175, Aira River, coll. Shigemitsu Shokita, Jul.2001; 1 female, CL 31.1 mm, CBM-ZC 4594, Near Kanpireh Waterfall, Urauchi River, coll. Tomoyuki Komai, 3 Jul.1998; 1 male, CL 23.3 mm, CBM-ZC 6725, Ohmija River, coll. Tohru Naruse, Mohamed Idha Salim, Yoshihisa Fujita and Akane Ito, 19 Mar.2001.

Others - 4 males, CLs 17.7–25.0 mm, RUMF-ZC-63, upstream of Nishifunatsuki, Nakama River, coll. Tohru Naruse & Mohamed Idha Salim, 12 Mar.2001; 1 female, CL 31.3 mm, RUMF-ZC-64, Midara River, coll. Tohru Naruse & Mohamed Idha Salim, 14 Mar.2001; 3 males, CLs 15.7–22.2 mm, RUMF-ZC-65, Ohmija River, coll. Tohru Naruse, 16 Mar.2001; 2 males, CL 15.2, 21.5 mm, 1 female, CL 22.6 mm, RUMF-ZC-66, Cape Kasa-saki, coll. Tohru Naruse,

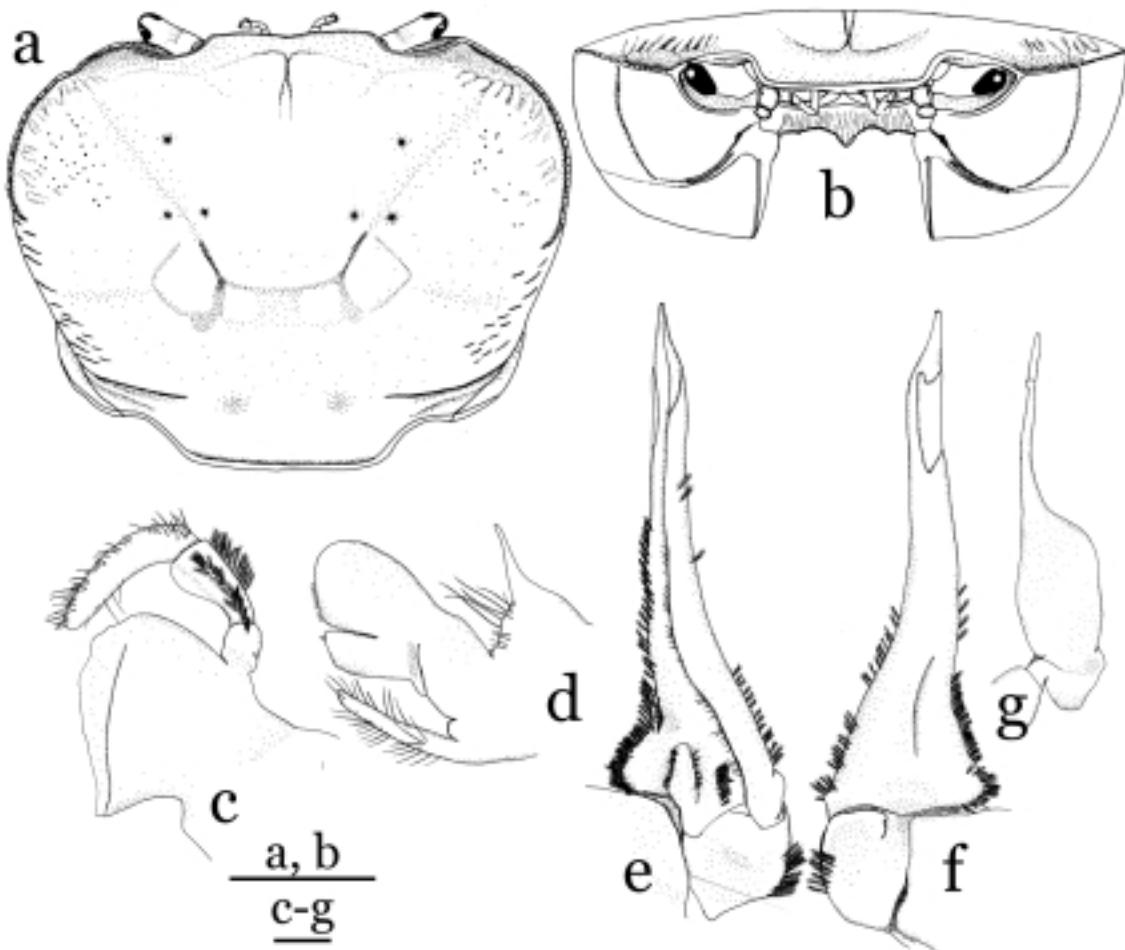


Fig. 3. *Geothelphusa marginata marginata*. a, carapace, dorsal view; b, carapace, frontal view; c, left mandible; d, maxilla; e, gonopod 1, ventral view; f, gonopod 1, dorsal view; g, gonopod 2. a, b, e-g, RUMF-ZC-59 (holotype); c, d, RUMF-ZC-87. Scales: a, b, 10 mm; c-g, 1 mm.

Table 3. Comparisons of the ratios of the second ambulatory leg of *Geothelphusa marginata marginata* and *G. m. fulva* between present study and Yoshigou (1999). The results of the present study are expressed by the median values with range (inside the brackets). Abbreviations as follows: CL, carapace length; HMNH, Yoshigou's specimen deposited in the Hiwa Museum for Natural History; L, length; TL, total length; W, width.

| <i>Geothelphusa marginata marginata</i> |         |            | <i>Geothelphusa marginata fulva</i> |          |            |
|---|---------|------------|-------------------------------------|----------|------------|
| Yoshigou (1999)                         | HMNH-C9 | this study | Yoshigou (1999)                     | HMNH-C81 | this study |
| 2nd ambulatory leg                      |         |            |                                     |          |            |
| TL/CL                                   | 2       | 2.23       | 2.17 (2.00–2.27)                    | 1.8      | 2.17       |
| merus L/W                               | 4.2     | 3.93       | 3.67 (3.26–4.14)                    | 4.4      | 3.23       |
|   |         |            |                                     |          |            |

17 Mar.2001; 1 male, CL 20.9 mm, 2 females, CLs 17.0, 25.5 mm, RUMF-ZC-67, upstream of Nishifunatsuki, Nakama River, coll. Tohru Naruse, 3 Dec.1999; 1 female, CL 24.1 mm, RUMF-ZC-68, Shirahama forest road, coll. Tohru Naruse, 5 Aug.2001; 1 male, CL 15.2 mm, RUMF-ZC-69, Midara River, coll. Tohru Naruse, 6 Aug.2001; 1 male, CL 21.4 mm, RUMF-ZC-70, Urauchi River (near the confluence with Itajiki River), coll. Tohru Naruse, 12 Oct.1999; 1 female, CL 21.9 mm, RUMF-ZC-71, Urauchi River (near the confluence with Itajiki River), coll. Tohru Naruse, 13 Oct.1999; 1 female, CL 19.9 mm, RUMF-ZC-72, upstream of Nishifunatsuki, Nakama River, coll. Tohru Naruse, 30 Nov.1999; 1 male, CL 23.8 mm, RUMF-ZC-73, Urauchi River, coll. Chieko Matsumoto, 29 Apr.2002; 1 male, CL 19.3 mm, RUMF-ZC-74, Shirahama forest road, coll. Shinichi Watanabe & Nozomi Nakanishi, 25 Apr.2002; 2 males, CLs 14.8, 21.8 mm 2 females, CLs 19.8, 27.1 mm, ZRC 2003.0597, a stream near Kanokawa Bay, coll. Tohru Naruse, 30 Dec.2001; 5 males, CLs 19.2–30.0, 2 females, CLs 18.3, 19.9 mm, ZLKU m1117, Urauchi River, coll. Shigemitsu Shokita, 2 May.1971; 1 female, CL 25.81 mm, HMNH-C81, Urauchi River (near the

confluence with Itajiki R.), coll. Hidenori Yoshigou, 17 Aug.2000.

**Diagnosis.** – Carapace with convex anterolateral margin, frontal margin straight, cervical groove visible between H-shaped gastric region to hepatic region.

G1 sinuous to straight, subterminal segment with large knob on proximal outer margin, and proximal inner margin roundly swollen.

Carapace and ambulatory legs dark brown to yellowish brown, outer surface of chelae orange, brown, or reddish, and inner surface of manus and fingers white to yellow.

**Distribution.** – Iriomote Island, Yaeyama Group, Southern Ryukyus, Japan.

**Etymology.** – *Geothelphusa marginata fulva* is named after the Latin “fulvus” meaning “brown colour”, because of their colouration.

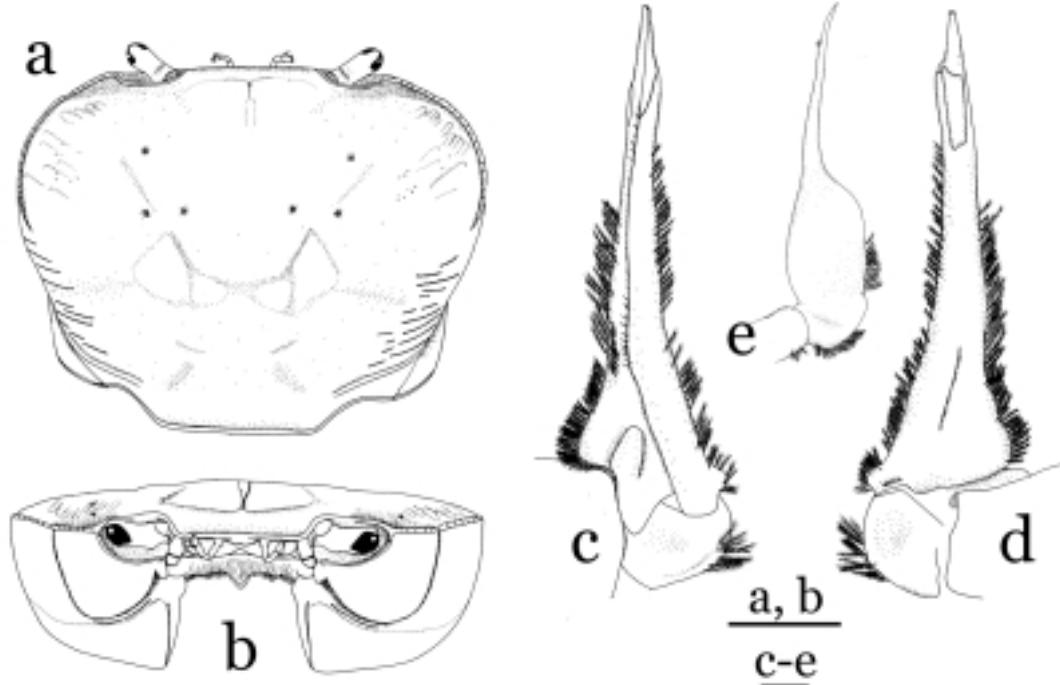


Fig. 4. *Geothelphusa marginata fulva*. a, carapace, dorsal view; b, carapace, frontal view; c, gonopod 1, ventral view; d, gonopod 1, dorsal view; e, gonopod 2. All figures indicate holotype (RUMF-ZC-62). Scales: a, b, 10 mm; c–e, 1 mm.

**Remarks.** – See “Remarks” of *Geothelphusa marginata marginata*.

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