Reassignment and redescription of "*Eupagurus*" *microps* Balss, 1911 (Crustacea, Decapoda, Paguridae), with notes on *Bathypaguropsis kuroshioensis* (Miyake, 1978)

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ABSTRACT
Reexamination of the holotype of "*Eupagurus*" *microps* Balss, 1911 has shown that this species actually should be assigned to the genus *Bathypaguropsis* McLaughlin, 1994. Although initially collected at a depth in excess of 1000 m off Somalia, the bathymetric and geographic distributions of this taxon have been markedly expanded with the discovery of a second specimen in the southwestern Pacific at a depth of less than 500 m. The species is redescribed and illustrated. The geographic and bathymetric ranges of *Bathypaguropsis kuroshioensis* (Miyake, 1978), the senior synonym of *B. mrahayuae* McLaughlin, 1997, now have also been increased with the similar discovery of this species in the southwestern Pacific.

KEY WORDS
Crustacea,
Decapoda,
Anomura,
Paguridae,
Bathypaguropsis,
reassignment,
redescription,
range extensions.

RÉSUMÉ
Nouvelle position et redescription d'« Eupagurus *»* microps *Balss, 1911 (Crustacea, Decapoda, Paguridae), et notes sur* Bathypaguropsis kuroshioensis *(Miyake, 1978).*
Un réexamen de l'holotype d'« *Eupagurus* » *microps* Balss, 1911 a montré que cette espèce doit être assignée au genre *Bathypaguropsis* McLaughlin, 1994. Bien qu'initialement récoltée à des profondeurs de plus de 1000 m au large de la Somalie, les répartitions bathymétrique et géographique de ce taxon ont été sensiblement étendues par la découverte d'un second spécimen dans le Pacifique sud-ouest à moins de 500 m de profondeur. L'espèce est redécrite et illustrée. Les répartitions géographique et bathymétrique de *Bathypaguropsis kuroshioensis* (Miyake, 1978), synonyme plus ancien de *B. rahayuae* McLaughlin, 1997, ont aussi été étendues par la découverte de cette espèce dans le Pacifique sud-ouest.

MOTS CLÉS
Crustacea,
Decapoda,
Anomura,
Paguridae,
Bathypaguropsis,
nouvelle position,
redescription,
extensions d'aires.

INTRODUCTION

Balss (1911) described a new deep-water hermit crab species collected during the Deutsche Tiefsee Expedition of 1898-1899, from off Somalia, assigning it to the genus *Eupagurus* Brandt, 1851. However, the International Commission for Zoological Nomenclature (Opinion 472) placed *Eupagurus* (a junior objective synonym of *Pagurus* Fabricius, 1775) on the Official Index of Rejected and Invalid Generic Names in Zoology. Thus in citing the original binomen *Eupagurus microps*, quotation marks have been placed around "*Eupagurus*" to indicate that it is no longer a valid name.

In his original description Balss listed the specimen as a female with 11 pairs of phyllobranch gills and four unpaired left pleopods. In the full account of the hermit crabs of the expedition, Balss (1912) again cited the description of "*Eupagurus*" *microps* as that of a new species. Although the actual text was changed very little from the earlier (Balss 1911) description, Balss (1912) did correct the sex of his specimen and did note that no sexual tube was developed. He also commented that this was the first species of the genus with reduced corneas. The male holotype, and until now only known specimen of *Pagurus microps* (Balss, 1911), has been reexamined and found not to belong to the genus *Pagurus*. Although sexual tube or tubes indeed are absent, the gills are not biserial, but quadriserial (cf. McLaughlin & de Saint Laurent 1998), and a pleurobranch is present on both cephalothoracic somites 12 and 13 (above pereopods 2 and 3) as well as on somite 14 (above pereopod 4). In overall morphology, the specimen corresponds best to the generic diagnosis of *Bathypaguropsis* McLaughlin, 1994, and is herein reassigned to that genus. A second specimen, an ovigerous female, has recently been found among the collections of the French MUSORSTOM expeditions and the characters of this female confirm the reassignment of Balss' (1911) taxon.

Bathypaguropsis was initially established for two species from the southern Ocean, *B. yaldwyni* McLaughlin, 1994, the type species, and *B. mariosnensis* McLaughlin, 1994. McLaughlin (1997) described a third species, *B. rahayuae* from Indonesia. De Saint Laurent & McLaughlin (2000) added a fourth species, *B. cruentus*, from New Zealand and noted that the species described by Miyake (1978) as *Pagurus kuroshioensis* Miyake, 1978, should also be assigned to *Bathypaguropsis*. These authors did not, however, recognize that Miyake's species was the senior synonym of *B. rahayuae*, as has since been shown by Komai & Lemaitre (2002) to be the case. Komai & Lemaitre (2002) also described an additional Japanese species, *B. foresti*, and provided a key for the identification of the five then known species. The reassignment of *Pagurus microps* to *Bathypaguropsis* brings the total number of species now assigned to the genus to six; however, the reduced corneas of *B. microps* n. comb. immediately set it apart from all of the other species, thus not reducing the effectiveness of the Komai & Lemaitre key.

MATERIALS AND METHODS

The holotype of "*Eupagurus*" *microps* has been borrowed from the Naturhistorisches Forschungsinstitut Museum für Naturkunde zu Berlin (formerly Zoological Museum of Berlin) (ZMB). The supplemental MUSORSTOM specimens of *B. microps* n. comb. and *B. kuroshioensis* are from the collections of the Muséum national d'Histoire naturelle, Paris (MNHN). All specimens have been returned to their institutions of origin. The abbreviation stn is used for station, DW for Warén dredge, and CP for beam trawl. MUSORSTOM is the acronym for the joint expeditions by the MNHN and the Office de la Recherche scientifique et technique d'Outre-Mer, now Institut de Recherche pour le Développement (IRD). Station data for the MUSORSTOM cruise has been taken from Richer de Forges & Menou (1993), and is listed from east to west. One measurement, shield length, measured from the tip of the rostrum to the midpoint of the posterior margin of the shield provides and indication of animal size.

SYSTEMATICS

Bathypaguropsis microps (Balss, 1911) n. comb.
(Fig. 1)

Eupagurus microps Balss, 1911: 5, fig. 6; 1912: 107, fig. 16, pl. 8, fig. 1.

Pagurus microps – Gordan 1956: 332 (lit.).

TYPE MATERIAL — Holotype: ♂ 7.4 mm (ZMB 18250), Somalia, Deutsche Tiefsee Expedition, stn 264, 06°18'N, 49°32'E, 1079 m.

MATERIAL EXAMINED — **Southwest Pacific.** Combe Bank, MUSORSTOM 7, stn DW 547, 12°28'S, 177°26'E, 455 m, 17.V.1992, 1 ovigerous ♀ 6.4 mm (MNHN Pg. 6399).
Somalia. Deutsche Tiefsee Expedition, stn 264, 06°18'N, 49°32'E, 1079 m, 30.III.1899, 1 ♂ holotype 7.4 mm (ZMB 18250).

DISTRIBUTION. — Northwestern Indian Ocean off Somalia; Combe Bank, southwestern Pacific; 455-1079 m.

REDESCRIPTION

Shield (Fig. 1A) longer than broad; anterior margin between rostrum and lateral projections concave, anterolateral margins sloping; posterior margin truncate. Rostrum prominent, triangular, reaching to proximal half of ocular acicles, with terminal spinule. Lateral projections obtusely triangular, each with very tiny marginal spinule.

Ocular peduncles 0.35 shield length, broad basally, tapering to reduced, conical corneas, dorsomesial surfaces each with row of sparse setae; basal corneal diameter approximately 0.30 peduncular length. Ocular acicles narrowly triangular, each with tiny terminal spinule, dorsal surface convex but with low, median, longitudinal ridge; separated basally by less than half width of one acicle.

Antennular peduncles overreaching ocular peduncles by approximately 0.25 length of penultimate segment. Ultimate and penultimate segments each with few scattered, moderate to long setae. Basal segment with prominent spine on lateral surface dorsally.

Antennal peduncles exceeding distal corneal margins by approximately half length of fourth peduncular segments. Fifth and fourth segments each with few scattered setae. Third segment with prominent spine and sparse tuft of long setae at ventrodistal margin. Second segment with dorsolateral distal angle produced, triangular; reaching to proximal half of fourth peduncular segment or beyond; terminating in bifid spine, mesial margin unarmed or with small spine distally, lateral margin unarmed or with small spine proximally; dorsomesial distal angle with small spine. First segment with or without small spinule at laterodistal margin; ventral margin with small spine distolaterally. Antennal acicle reaching beyond mid-length of ultimate peduncular segment, slightly arcuate, with row of sparse tufts of setae on mesial margin, terminating in simple spine. Antennal flagella long, considerably overreaching outstretched right cheliped; each article with few to several irregularly set, moderate to long (three to six article-length) setae.

Right cheliped (Fig. 1B) massive, operculate. Dactyl broad, slightly shorter than dorsomesial margin of palm; articulation with chela almost horizontal; cutting edge with calcareous margin faintly cusped, terminating in small, blunt, corneous claw; dorsal surface slightly elevated in the midline proximally, with numerous tufts of moderately long setae, rounded dorsomesial margin and mesial face with numerous tufts of setae accompanying several irregular rows of small spines, decreasing in size distally and extending to distal 0.25; ventromesial margin not delineated, ventral surface with sparse tufts of very short setae. Palm with maximum breadth approximately 0.25 greater than length of dorsomesial margin, dorsomesial distal angle rounded, not very prominently produced; dorsomesial margin only weakly delimited by very irregular double to triple row of small spines, dorsal surface mesially with numerous small spines, remainder of dorsal surface weakly tuberculate, tubercles becoming more prominent laterally, dorsolateral margin not delimited, rounded dorsolateral surface and lateral face with covering of small, low, flattened tubercles and sparse setae; mesial face with irregular rows of low, flattened tubercles extending onto ventral surfaces mesially, each with one to four anteriorly directed short setae, remaining ventral surface unarmed but with few scattered

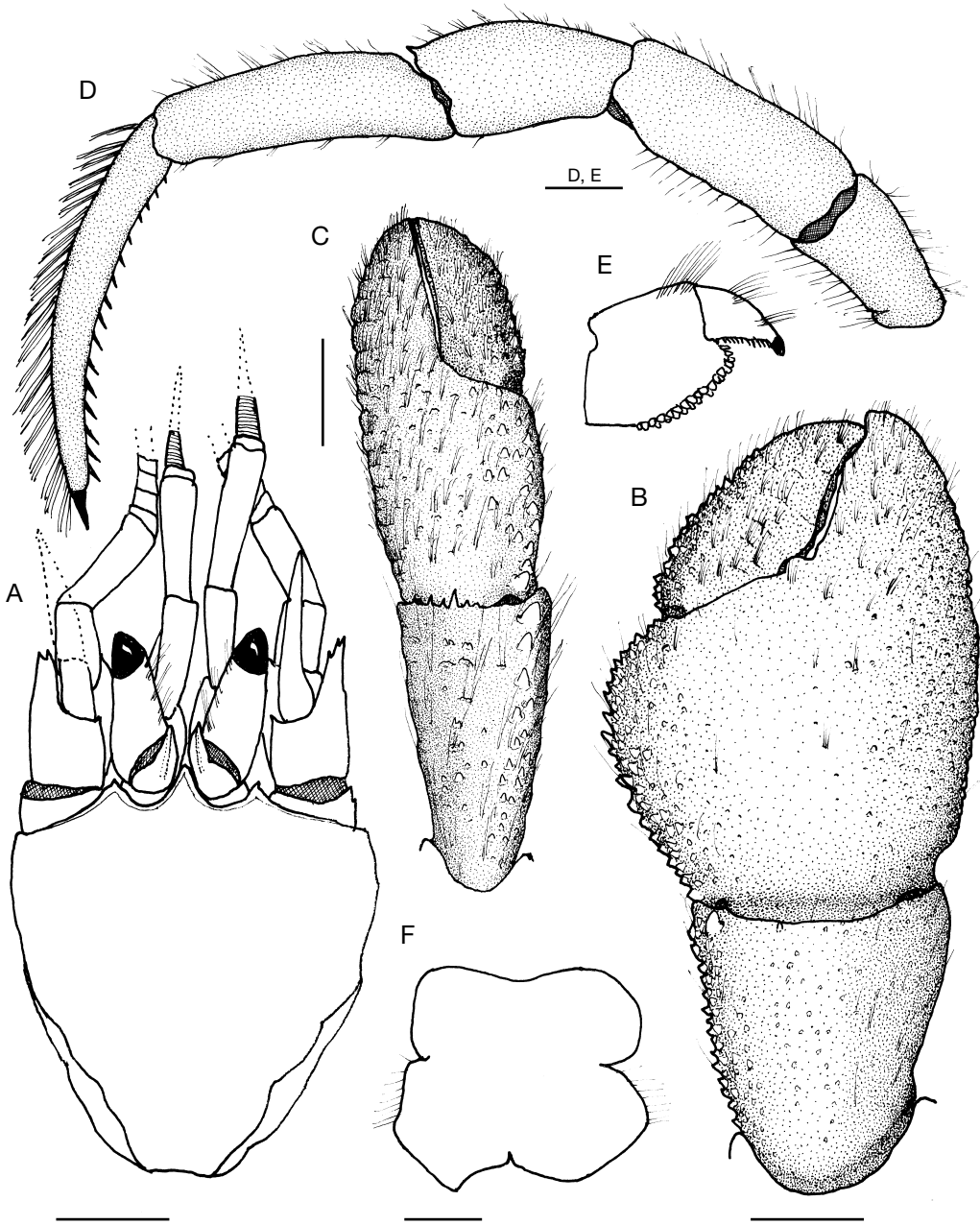

FIG. 1. — *Bathypaguropsis microps* (Balss, 1911) n. comb., holotype, ♂ 7.4 mm (ZMB 18250), off Somalia, Deutsche Tiefsee Expedition, stn 264; **A**, shield and cephalic appendages; **B**, chela and carpus of right cheliped; **C**, chela and carpus of left cheliped; **D**, left third pereopod (lateral view); **E**, dactyl and propodus of right fourth pereopod (lateral view); **F**, telson. Scale bars: A-D, 2 mm; E, F, 1 mm.

short setae; cutting edge of fixed finger with one blunt tooth proximally and very weakly cusped, calcareous margin. Carpus approximately 0.80 length of merus, subtrapezoidal when viewed dorsally; dorsomesial distal angle with small to moderately prominent spine, dorsomesial margin only weakly delimited by single or double row of subacute or acute spines becoming obsolete in proximal 0.35, dorsal surface with scattered very small tubercles, strongest in midline in distal half, dorsodistal margin with few very small, subacute spinules; dorsolateral margin not delimited, lateral face ventrally and ventrolateral margin each with few low spinules or tubercles; mesial face with scattered tubercles or granules in dorsal half, dorsodistal angle unarmed or with small spine. Merus roundly subtriangular; dorsal margin unarmed; ventrolateral margin unarmed; ventromesial margin with row of minute spinules; ventral surface with numerous weak granules (holotype) or subacute tubercles (female). Ischium unarmed (holotype) or with two minute spinules on ventromesial margin (female).

Left cheliped (Fig. 1C) short, slender; rotation of propodal-carpal articulation 25°-35° counterclockwise from perpendicular. Dactyl approximately equal to length of palm; dorsomesial margin not distinctly delimited but holotype with numerous spines or spinules in proximal half, partially obscured by tufts of long setae, dorsal surface distally and mesial face with short, transverse, sometimes spinulose ridges and tufts of long setae; female armature appreciably weaker and setation sparser; cutting edge of dactyl and distal 0.35 of fixed finger each with row of small corneous teeth, proximal 0.65 of fixed finger with calcareous margin; terminating in moderately prominent corneous claws. Palm slightly more than 0.50 length of carpus; dorsomesial margin with double to triple row of small spines and sparse tufts of setae, mesial face with numerous small spinules or granules particularly apparent in dorsal half; dorsal surface with weak to moderately prominent, short, sometimes spinulose, transverse ridges and moderate to long setae, dorsolateral margin not distinctly delimited but with short, transverse ridges and setae, extending in holotype almost to tip of fixed finger, shorter in female. Carpus subrectangular; dorsomesial margin with sparse tufts of long setae not obscuring irregular single to double row of acute and subacute spines, distal-most largest; dorsolateral margin not distinctly delimited, but with prominent spine distally and irregular row of spinules and/or spinulose ridges and sparse tufts of setae; lateral and mesial faces and ventral surface unarmed. Merus with unarmed dorsal margin; ventrolateral and ventromesial margins and ventral surface minutely spinulose or tuberculate. Ischium with one or two tiny tubercles on ventromesial margin in distal half.

Ambulatory legs (Fig. 1D) generally similar. Dactyls 1.20-1.50 length of propodi; dorsal surfaces each with row of tufts of moderately long setae; lateral and mesial faces each with faint longitudinal sulcus proximally, flanked on mesial faces dorsally and ventrally by row of small corneous spines and sparse tufts of short setae; ventral margins each with row of 10-18 corneous spines. Propodi 0.25-0.35 longer than carpi, each unarmed but with sparse tufts of short setae dorsally and ventrally. Carpi 0.70-0.90 length of meri; dorsodistal angles each with small spine, at least on second pereopods; dorsal surfaces unarmed or with row of spinulose protuberances (left second of holotype) and sparse tufts of short setae. Meri and ischia with scattered setae on dorsal and ventral margins. Fourth pereopods with propodal rasp (Fig. 1E) consisting of two or three rows of corneous scales; dactyl with small terminal claw, no preungual process detected. Anterior lobe of sternite of third pereopods subsemicircular, glabrous in male holotype, but with marginal, moderately dense setae in female.

Telson (Fig. 1F) with posterior lobes asymmetrical, marginally somewhat calcified, separated by small median cleft, terminal margins unarmed.

Colour in life

Not known. No colour remaining in preserved specimens.

Reproduction

The female carried relatively few (46 remaining with the specimen) but moderately large eggs

with diameters of 1.20 to 1.40 mm. The absence of larval eye pigment suggests a relatively early stage of development.

REMARKS

In the two specimens of *B. microps* n. comb. now known, there is considerable variation in the strength of the armature of the chelipeds. McLaughlin (1994) reported an increase in the strength of the armature of the chela with increasing animal size in *B. yaldwyni* and the same appears true in *B. microps* n. comb. The armature of the chelae and carpi of the larger male is much more prominently developed than that of the female. However, an exception is seen on the ventral surface of the right cheliped, which is provided with much stronger spines in the female.

In these specimens of *B. microps* n. comb., the propodal rasp consists of two to three rows of corneous spines in contrast to the one or two rows reported for the other species in the genus. However, in *B. microps* n. comb. the rasp is located on the ventral surface of the propodus rather than on the lateral face as in most multiple-rowed genera. Whether this ventral positioning reflects a specialized environmental modification cannot be determined as no habitat data accompanied either specimen.

Bathypaguropsis kuroshioensis (Miyake, 1978)

Pagurus kuroshioensis Miyake, 1978: 115, fig. 48; 1982: 197 (list), 225 (key); 1991: 198 (list), 225 (key); 1999: 198 (list), 225 (key). — Baba 1986: 203, fig. 150.

Bathypaguropsis rahayuae McLaughlin, 1997: 539, figs 291-h, 42c, d.

Bathypaguropsis kuroshioensis – de Saint Laurent & McLaughlin 2000: 117. — Komai & Lemaitre 2002: 43, figs 4-7.

MATERIAL EXAMINED. — **Southwest Pacific.** Combe Bank, MUSORSTOM 7, stn CP 552, 12°16'S, 177°28'W, 786-800 m, 18.V.1992, 1 ♀ 3.7 mm (MNHN Pg. 6341).

DISTRIBUTION. — Sagami and Tosa bays, Japan, Banda Sea, Indonesia, Combe Bank, southwestern Pacific; 120-786, possibly 800 m.

REMARKS

The female specimen from MUSORSTOM 7 is slightly smaller than the majority of specimens reported by Komai & Lemaitre (2002), and slightly larger than the holotype of *B. rahayuae* as described by McLaughlin (1997). The armature of the right cheliped of the present specimen agrees more closely with the Indonesian specimen than with those described from Japan. In particular, the tubercles on the surfaces of the chela of the right cheliped are much weaker and do not show the pits ascribed to the Japanese specimens. Although Komai & Lemaitre (2002) did not discuss armature variation among their 30 specimens, the variation seen in the specimens from the southwestern Pacific and Indonesia follows patterns seen in *B. yaldwyni* from New Zealand. McLaughlin (1994) and de Saint Laurent & McLaughlin (2000) have pointed out that *B. yaldwyni* exhibits considerable variability, particularly in chela morphology. In that species cheliped armature increases in strength with increase animal size regardless of sex. Neither McLaughlin (1994) nor de Saint Laurent & McLaughlin (2000) directly addressed variations in telson armature; although in their descriptions of *B. marionensis* and *B. cruentus*, variation in armature is apparent. In the MUSORSTOM specimen, the terminal margins of the telson are unarmed, whereas they were each described as being armed with a row of small spines by Komai & Lemaitre (2002) for Japanese specimens or five very small spinules by McLaughlin (1997) for the holotype of *B. rahayuae*.

Colour in life

Shield, antennal peduncles, chelipeds and ambulatory legs red-orange; antennular peduncles with basal and penultimate segments red, ultimate segment fading to colorless distally (Komai & Lemaitre 2002).

DISCUSSION

The majority of species of *Bathypaguropsis* have been captured at depths in excess of 100 m; nevertheless, *B. microps* n. comb. is the only species

whose maximum depth of collection approaches abyssal (cf. Sverdrup *et al*. 1959). *B. microps* n. comb. was described from a single specimen collected off Somalia in the northwestern Indian Ocean. It is now known to occur as far eastward as Combe Bank in the southwest Pacific. The bathymetric range of this species at present is 455 to 1079 m. *Bathypaguropsis microps* n. comb. is not the first hermit crab species from the Indian Ocean region to also be found in the western Pacific. McLaughlin & Wang (2002) reported the range of *Nematopagurus diadema* Lewinsohn, 1969 as extending from the Red Sea and east coast of South Africa to the South China Seas while *N. scutellichelis* Alcock, 1905 was found in both the Andaman and South China Seas. Both species have more recently been reported from Indonesia, and *N. diadema* as far eastward as Fiji (McLaughlin in press).

Although *B. yaldwyni*, *B. cruentus* and *B. marionensis* are still known only from the southern Ocean, and *Bathypaguropsis foresti* of Komai & Lemaitre (2002) from a single locality in central Japan, *B. kuroshioensis*, like *B. microps* n. comb., has much broader geographic and bathymetric distributions. The type locality of *B. kuroshioensis* is Sagami Bay, Japan, but it is also known from Tosa Bay, Japan, the Banda Sea of Indonesia and Combe Bank, southwest Pacific at depths ranging from 120 to 786, possibly to 800 m. Komai & Lemaitre (2002) distinguished *B. kuroshioensis* from not only *B. cruentus* and *B. marionensis*, but also *B. foresti* by the lack of a prominently produced dorsomesial distal angle on the right cheliped, and from *B. yaldwyni* by the smaller number of ventral spines on the pereopodal dactyls. The dorsomesial distal angle of the right cheliped is similarly not produced in *B. microps* n. comb., and the number of dactylar spines partially overlaps that of *B. kuroshioensis*; however, as indicated previously, the reduced corneas of Balss' species immediately will differentiate it, not only from *B. kuroshioensis*, but from all of the other species of the genus

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