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REMARKS ON THE FRESHWATER CRABS OF ANGOLA, SOUTHWESTERN AFRICA,
WITH THE DESCRIPTION OF *POTAMONAUTES KENSLEYI*, NEW SPECIES
(BRACHYURA: POTAMOIDEA: POTAMONAUTIDAE)

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A B S T R A C T

A recent collection of freshwater crabs of the family Potamonautidae from central Angola included two species of *Potamonautes* MacLeay, 1838, *P. anchietae* (Brito-Capello, 1871), and *P. kensleyi*, new species, which are described. In addition, *Potamonautes adeleae* Bott, 1968, is recognized as a valid species, and the taxonomic status and biogeographic affinities of other species of freshwater crabs that have been reported from Angola are discussed. The addition of *P. kensleyi* and *P. adeleae* raises the number of species of freshwater crabs known to occur in Angola to seven.

INTRODUCTION

The freshwater crabs reported on here were collected from the Cuanza (Kwanza) River in northern Malanje Province, Angola, which lies in the savanna zone in the central highland region south east of Luanda about 846 meters above sea level. The specimens were trusted for study to the second author by Hamilton Garboggini, the biologist in charge of environmental operations for a Brazilian company involved in the construction of the Capanda hydroelectric dam. The newly collected specimens included two species of *Potamonautes* MacLeay, 1838, belonging to the African freshwater crab family Potamonautidae Bott, 1970. One of these is clearly *P. anchietae* (Brito-Capello, 1871) a well-known species that has been reported to occur in a number of different localities in Angola and the Democratic Republic of the Congo (D. R. Congo) (Bott, 1951, 1953, 1955, 1964, 1968; Cumberlidge, 1998). The second species is new to science and is described here as *Potamonautes kensleyi*, new species, based on a strikingly unusual combination of somatic characters (Figs. 1, 2). The only known specimen is a large female (cw 40 mm) that, despite its size, is still not adult (see Cumberlidge, 1999) judging by the stage of development of the abdomen (Fig. 2). When identifying African freshwater crabs an adult male is usually preferred, but the unique characters of this specimen allow a preliminary description to be provided here. Knowledge of the characters of the gonopods, male abdomen, and male chelipeds of the new species must await the collection of more material that includes an adult male.

The present study recognizes seven species of freshwater crabs from Angola (Table 1) but this has changed several times over the years (Bott, 1951, 1953, 1955, 1964, 1968; Cumberlidge, 1995, 1999). The first two species reported from Angola were *Thelphusa anchietae* Brito-Capello, 1871, and *Potamon* (*Potamonautes*) *biballensis* Rathbun, 1905. *Potamonautes anchietae* is a taxonomically stable species, but the second taxon was treated by Balss (1936) and Bott

(1951) as *Potamonautes biballensis*, by Bott (1953) as the subspecies *P. anchietae f. biballensis*, and later by Bott (1955, 1964, 1968) as a junior synonym of *P. anchietae*. Bott's (1953) revision of the Angolan freshwater crabs recognized five taxa belonging to four species: *P. anchietae*, *P. macrobrachii* Bott, 1953, *P. b. bayonianus* (Brito-Capello, 1864), *P. b. dubius* (Brito-Capello, 1873) and *P. d. depressus* (Krauss, 1843). Two years later, in a comprehensive monograph, Bott (1955) assigned these same taxa to three different subgenera: *P. (Isolapotamonautes) a. anchietae*, *P. (I.) macrobrachii*, *P. (Potamonautes) b. bayonianus*, *P. (P.) b. dubius*, and *P. (Orthopotamonautes) d. depressus*. The most recent additions to the freshwater crab fauna of Angola were those by Bott (1964, 1968) who described three more subspecies, *P. (I.) anchietae machadoi* Bott, 1964, *P. (Lirrangopotamonautes) lirrangensis adeleae* Bott, 1968, and *P. (Orthopotamonautes) depressus dybowskii* (Rathbun, 1905). Finally, Cumberlidge (1995, 1999) extended the range of the West and Central African species *Sudanonautes floweri* (de Man, 1901) to include the Angolan coastal Province of Cabinda that is separated from the Angolan Province of Zaire by a narrow strip of D. R. Congo territory along the north bank of the Congo River.

The present work adds *P. kensleyi* and *P. adeleae* to the species list for this country (Table 1), and compares *P. kensleyi* to morphologically similar species from Angola (*P. macrobrachii* and *P. anchietae*) and the lower Congo (*Erimetopus brazzae* A. Milne-Edwards, 1887) (Cumberlidge and Reed, 2004). The validity of the freshwater crab taxa that have been reported to occur in Angola is discussed, and the biogeographical affinities of these crabs are considered.

Abbreviations.—The terminology is adapted from Cumberlidge (1999), and the higher classification used here follows that of Martin and Davis (2001). Abbreviations: cw, distance across the carapace at the widest point; cl, carapace length measured along the median line, from the frontal margin to the posterior margin; ch, carapace height, the

maximum height of the cephalothorax; fw, front width measured along the frontal margin; s, thoracic sternite; s4/s5, s5/s6, s6/s7, s7/s8, sternal sulci between adjacent thoracic sternites; e, thoracic episternite; s4/e4, s5/e5, s6/e6, s7/e7, episternal sulci between adjacent thoracic sternites and episternites; p1-p5, pereopods 1-5; asl, above sea level. All measurements are given in mm. MZUSP = Museu de Zoologica, Universidade de Sao Paulo, Brazil; SMF = Senckenberg Museum, Frankfurt, Germany.

SYSTEMATICS

Subphylum Crustacea Brünnich, 1772
 Order Decapoda Latreille, 1802
 Infraorder Brachyura Latreille, 1802
 Superfamily Potamoidea Ortmann, 1896
 Family Potamonautidae Bott, 1970
 Genus *Potamonautes* MacLeay, 1838

Type Species.—*Thelphusa perlata* H. Milne Edwards, 1837.

Diagnosis.—Members of the genus *Potamonautes* can be recognized as follows: the mandibular palp is two-segmented, the anterolateral margin lacks an intermediate tooth between the exorbital and epibranchial teeth, the exopod of the third maxilliped has a long flagellum (about 0.75 as long as the exopod), the terminal article of gonopod 1 is about 0.25 to 0.33 as long as the subterminal segment of gonopod 1, and the terminal article of gonopod 2 has a long flagellum (about 0.5-0.75 times as long as the subterminal segment of gonopod 2).

Remarks.—More than 60 species of *Potamonautes* are found in continental Africa (Bott, 1953, 1955, 1959, 1960, 1964, 1968, 1970; Cumberlidge, 1999; Stewart, 1997a, b, Stewart et al., 1995; Stewart and Cook, 1998; Daniels et al., 1998; Corace et al., 2001; Gouws et al., 2000, 2001; Cumberlidge et al., 2002; Cumberlidge and Vannini, 2004; Reed and Cumberlidge, 2004, in press). Bott (1955) assigned the species of *Potamonautes* to 15 subgenera, but a number of authors (Cumberlidge, 1997, 1998, 1999; Cumberlidge and Boyko, 2000; Daniels et al., 2002) have questioned the validity of all of these subgenera, and none of the four subgenera with representatives in Angola used by Bott (1955, 1964, 1968) are recognized here.

Distribution.—*Potamonautes* is a widespread genus of Afrotropical freshwater crabs. The vast majority of the species are found in continental Africa south of the Sahara, although two species [*P. niloticus* (H. Milne Edwards, 1837) and *P. berardi* (Audouin, 1826)] are found along the Nile valley as far north as Cairo, Egypt (Cumberlidge, 1997, 1998, 1999). The addition of *P. kensleyi* and the recognition of *P. adeleae* as a valid species bring the number of species of *Potamonautes* from Angola to six.

Potamonautes anchietae (Brito-Capello, 1871)

Thelphusa anchietae Brito-Capello, 1871:132, pl. 2, fig. 11.—Osorio, 1884:226.

Thelphusa anchieta, Osorio, 1884:226.—A. Milne-Edwards, 1887.—Osorio, 1888:190.—Osorio, 1895:54.—Osorio, 1898:192.

Table 1. Present identifications of freshwater crabs from Angola compared with those of Bott (1955, 1964, 1968).

Literature identification	Authority	Present identity	Distribution
<i>Potamonautes</i> (<i>Lirrangopotamonautes</i>) <i>lirrangensis adeleae</i>	Bott, 1968	<i>Potamonautes adeleae</i>	Angola
<i>Potamonautes</i> (<i>Isopotamonautes</i>) <i>a. anchietae</i>	(Brito-Capello, 1871)	<i>Potamonautes anchietae</i>	Angola D. R. Congo
<i>Potamonautes</i> (<i>Potamonautes</i>) <i>b. bayonianus</i>	(Brito-Capello, 1864)	<i>Potamonautes bayonianus</i>	Angola, Zambia, Zimbabwe, Botswana, D. R. Congo
—	Present study	<i>Potamonautes kensleyi</i>	Angola
<i>Potamonautes</i> (<i>Potamonautes</i>) <i>bayonianus dubius</i>	(Brito-Capello, 1873)	<i>Potamonautes dubius</i>	Angola, Botswana
<i>Potamonautes</i> (<i>Isopotamonautes</i>) <i>macrobrachii</i>	Bott, 1953	<i>Potamonautes macrobrachii</i>	Angola
<i>Sudanonautes floweri</i>	de Man, 1901	<i>Sudanonautes floweri</i>	West and Central Africa, Angola (Cabinda)

Potamon (Potamonautes) anchietae, Rathbun, 1900:283.—Rathbun, 1905:166.—Sendler, 1912:199.—Balss, 1929:117.

Potamon anchietae, Chace, 1942:204.—Capart, 1954:827, fig. 3.

Potamonautes anchietae, Bott, 1953:136-138, fig. 1, 3 (not fig. 2).—Cumberlidge, 1998:197.

Potamonautes (Isopotamonautes) anchietae anchietae, Bott, 1955:247-249, pl. IX, figs. 1a-d, figs. 24, 76, 77.—Bott, 1964:25-26, figs. 1a-c.—Bott, 1968:168.

Material Examined.—Angola. Adult male, cw 51.7, cl 36.6, ch 17.8, fw 16.6 mm; adult female, 5 subadult males, subadult male (damaged) (MZUSP 16878), upstream from the Capanda hydroelectric dam (9°29'S, 15°50'E), northern Malanje Province, 150 km southeast of the city of Malanje on the Cuanza (Kwanza) River, from a rocky riverbed, no ciliary vegetation, water temperature 26°C, pH 7.3, coll. Hamilton Garboggini, October 2002.

Diagnosis.—Postfrontal crest complete, epigastric lobes continuous with postorbital crests, lateral ends of postorbital crests meeting anterolateral margins without curving backward. Exorbital tooth small, broad; epibranchial tooth granular; anterolateral margin between exorbital and epibranchial teeth granulated, curving slightly outward, lacking intermediate tooth; anterolateral margin posterior to epibranchial tooth granulated, continuous with posterolateral margin. Suborbital margin granulated. Carapace medium height (ch/fw 1.07); front very broad, measuring almost one-third carapace width (fw/cw 0.32). Sidewall of carapace with distinctly granulated vertical sulcus, continuing downward to pterygostomial region, dividing sidewall into four parts. Exopod of third maxilliped with long flagellum, ischium of third maxilliped with deep vertical sulcus. Epistomial tooth large, triangular, edges lined by large round granules. Thoracic sternal sulcus s2/s3 deep, running horizontally across sternum; thoracic sternal sulcus s3/s4 incomplete, deep at sides, absent in middle, sides slanted inward toward anterior margin of sterno-abdominal cavity.

Table 2. Taxa recorded from Angola based on specimens with questionable identifications.

Literature identification	Authority	Present identity	Distribution
<i>Potamonautes</i> (<i>Isopotamonautes</i>) <i>anchietae machadoi</i>	Bott, 1964	Species inquirenda	Angola
<i>Potamon</i> (<i>Potamonautes</i>) <i>biballensis</i>	Rathbun, 1905	Species inquirenda	Angola (D. R. Congo localities doubtful)
<i>Potamonautes</i> (<i>Orthopotamonautes</i>) <i>depressus depressus</i>	(Krauss, 1843)	<i>Potamonautes</i> <i>depressus</i>	South Africa (Angolan localities doubtful)
<i>Potamonautes</i> (<i>Orthopotamonautes</i>) <i>depressus dybowskii</i>	(Rathbun, 1905)	<i>Potamonautes</i> <i>dybowskii</i>	D. R. Congo (Angolan localities doubtful)

Thoracic episternal sulci s4/e4, s5/e5, s6/e6, and s7/e7 smooth, none marked by visible groove. Major cheliped of adult male with swollen palm, and long straight dactylus and propodus. First carpal tooth of inner margin of carpus of cheliped large, slender, pointed; second carpal tooth a small low tooth. Lateral, medial inferior margins of merus of cheliped granulated, with single large pointed distal meral tooth at distal end; superior surface of merus granulated. Terminal article of gonopod 1 short (about one-third as long as subterminal segment), longitudinal groove visible on dorsal and superior sides (but not on ventral side); entire terminal article slim, directed slightly outward at 30° angle to vertical, tapering to upcurved tip; medial fold on terminal article of gonopod 1 slightly higher than lateral fold, terminal article slightly thickened in middle. Gonopod 2 terminal article long, flagellum-like. Adult size range from cw 45 to 50 mm.

Description.—For a detailed description, photographs, and illustrations see Bott (1953, figs. 1, 3; 1955, pp. 247-249, figs. 24, 76, 77, pl. IX, fig. 1a-d; 1964, figs. 1a-c).

Remarks.—*Potamonautes anchietae* is closest to *P. macrobrachii* Bott, 1953 a medium-sized species from the Kuketa River, a tributary of the Catumbela River, at Serro do Moco in Benguela Province (12°28'S, 15°10'E) (Brito-Capello, 1871; Bott, 1953, 1955, 1964). The specimens of *P. anchietae* from Malanje Province were compared here with the male paratype of *P. macrobrachii* (SMF 1892, collected by A. de Barros Machado). These species are similar in that both have a prominent and complete postfrontal crest, a greatly reduced epibranchial tooth (either granular or missing), a v-shaped thoracic sternal groove s3/s4 that is deep at the sides and shallow in the middle, and the medial inferior margin of the merus of the cheliped is either granular or smooth. Other shared characters include the medium carapace height (ch/fw 1.08, *P. macrobrachii*, 1.07, *P. anchietae*), and the wide frontal margin (fw/cw 0.34, *P. macrobrachii*, 0.32, *P. anchietae*). Characters that distinguish *P. anchietae* from *P. macrobrachii* include the following: the merii of the chelipeds of *P. anchietae* are not greatly elongated (whereas these segments are remarkably elongated in *P. macrobrachii*), the first and second carpal teeth of the cheliped of *P. anchietae* are both pointed teeth

(whereas these teeth are rounded and low in *P. macrobrachii*), and the carapace sidewalls of *P. anchietae* are divided by sutures into four parts (whereas the sidewalls are divided into three parts in *P. macrobrachii*). In addition, the medial fold of the terminal article of gonopod 1 of *P. anchietae* is low and only slightly higher than the lateral fold, whereas the medial fold of *P. macrobrachii* is strikingly widened in the middle, and is significantly higher than the lateral fold (Bott, 1955, figs. 24, 25).

Bott (1953, 1955, 1964) recognized two subspecies of *P. anchietae*: *P. (I.) a. biballensis* Rathbun, 1905, and *P. (I.) a. machedoi* Bott, 1964, both of which occur in Angola. However, comparison of literature descriptions of these taxa with *P. anchietae* indicates that each of these taxa differs from *P. anchietae*. For example, the validity of *P. (P.) biballensis* is uncertain because this taxon was established by Rathbun (1905) based on a specimen from Biballa, Angola (= Bibala, Namibe Province, 14°46'S, 13°21'E) that was among a series of specimens described as *Telphusa anchietae* by Brito-Capello (1871). Further complications arose when Bott (1951) described a specimen from Thysville, Belgian Congo (now Mbanza-Ngungu, D. R. Congo) as '*Potamonautes biballensis* Rathbun'. The specimen illustrated by Bott (1951, figs. 1-4) differs from *P. anchietae* in that the ends of the postfrontal crest curve strongly backward, and the left anterolateral margin has strikingly large and pointed exorbital and epibranchial teeth. However, this individual specimen is unusual in that these teeth on the right anterolateral margin are blunt and low, i.e., they are probably damaged. These characters do not correspond to those of *P. anchietae* and argue against Bott's (1955) assignment of *P. (P.) biballensis* as a subspecies of *P. anchietae*. Differences of this sort would support the recognition of the specimen from the D. R. Congo as a valid species other than *P. anchietae* (either one that is already described, or new to science). In summary, neither Rathbun (1905), Balss (1936), nor Bott (1951) described characters of the first gonopod of their specimens and the identification of the specimens from the D. R. Congo as *P. (P.) biballensis* Rathbun, 1905, in Bott (1953) is therefore questionable. For these reasons, *P. (P.) biballensis* Rathbun, 1905, is treated here as species inquirenda (Table 2).

Similarly, there are a number of differences between *P. (I.) a. machedoi* Bott, 1964 from Cuango, Uíge Province, northern Angola (6°17'S, 16°42'E) and *P. anchietae*. For example, the adult size of *P. (I.) a. machedoi* (cw 27 mm) is significantly smaller than that of *P. anchietae* (cw 56 mm), the exorbital tooth of *P. (I.) a. machedoi* is small, low, and blunt (Bott, 1964, fig. 2c, plate 1, fig. 1), whereas that of *P. anchietae* although blunt, is distinctly larger by comparison (Bott, 1953, figs. 1c, 2c, plate 1), the first carpal tooth of the cheliped of *P. (I.) a. machedoi* is a large broad-based triangle (whereas that of *P. anchietae* is a large slim spine), and there are differences in the shape of the terminal article of the first gonopod of the two taxa (Bott, 1953, figs. 1a, 2a; Bott, 1964, figs. 1a, 2a). These characters do not correspond to those of *P. anchietae* and argue against Bott's (1964) assignment of *P. (I.) a. machedoi* as a subspecies of *P. anchietae*. Differences of this sort support the recognition of the specimens from northern Angola as a valid species other

than *P. anchetiae* (either one that is already described, or new to science). However, because the type material of *P. (I.) a. machedoi* has not been examined in the present study this taxon is treated here as a species inquirenda (Table 2).

Ecology.—The specimens of *P. anchetiae* were caught in the Cuanza River in central Angola which flows west to the Atlantic from the savanna woodlands of the escarpment. Other ecosystems where *P. anchetiae* has been collected (Bott, 1953) include localities in the forests of the north of Angola and a number of other sites in the lower Congo River basin across the border in the D. R. Congo. Interestingly, there are no records of this species from the lowland coastal plain of Angola that stretches from the Provinces of Namibe in the south to Zaire in the north. This species has not been recorded to occur in the savanna region of eastern and southeastern Angola in the Luando-Bunga, Cuango, and Cubango Rivers in Lunda Sul, Moxico, and Cuando Cubango Provinces that are part of the Zambezi River basin. There are also no records of *P. anchetiae* from the southwest of Angola (in the Provinces of Namibe and Cunene) in the drainage basin of the Cunene River and in the desert that borders with the Kaokoveld of northern Namibia.

Distribution.—Angola and the D. R. Congo. The type locality of *P. anchetiae* is reported as Dondo (8°58'S, 15°18'E), Punto-Adondo, and Ambaca in the Cuanza River basin, in Cuanza Sul Province of central Angola. The following account of the distribution of *P. anchetiae* is based on localities from the literature (Bott, 1953, 1955, 1964, 1968; Rathbun, 1905; Cumberlidge, 1998), and on museum specimens identified by the first author. In Angola, *P. anchetiae* is found in the western and northwestern Provinces of Benguela, Cuanza Norte, Cuanza Sul, Malanje, and Huila (and probably also in Uige, Huila, and Bié Provinces). In the D. R. Congo, *P. anchetiae* is found in the tributaries of the Congo River in the Provinces of Bas-Congo, Bandundo, and Kasai Occidental that share a border with the northern provinces of Angola. The literature reports of *P. anchetiae* from the D. R. Congo by Balss (1936, fig. 4) and Bott (1955) refer to a number of specimens they identified as *P. biballensis*. This is problematic because Bott (1955) viewed *P. biballensis* as a junior synonym of *P. anchetiae*, but this synonymy is considered here to be questionable, as are the locality records attributed to material from the D. R. Congo that was identified by Bott (1955) as *P. biballensis*. These records are not included here. According to Osorio (1887, 1888) as quoted in Rathbun (1905), *P. anchetiae* is also found on the island of Príncipe in the Gulf of Guinea, which, together with the island of São Tomé, constitutes the Democratic Republic of São Tomé and Príncipe. The single report of *P. anchetiae* from the island of Príncipe is biogeographically surprising and is considered here to be doubtful given the undeveloped taxonomy of the group in the late 19th Century. It is more likely that the specimen from Príncipe may actually be *Potamonautes principe* Cumberlidge, Clark, and Baillie, 2002, a species endemic to the island and the only species known to occur there (Cumberlidge et al., 2002). Finally,

the records of *P. anchetiae* from Cameroon by Balss (1929) are unreliable because they are based on the misidentification a number of specimens that are now known to belong to *Potamonemus mambilorum* Cumberlidge and Clark, 1992.

Potamonautes kensleyi, sp. nov.

Figs. 1-2

Material Examined.—Angola. Holotype subadult female, cw 40, cl 28.6, ch 8.8, fw 13.2 mm (MZUSP 16879), upstream from the Capanda hydroelectric dam (9°29'S, 15°50'E), northern Malanje Province, 150 km southeast of the city of Malanje on the Cuanza (Kwanza) River, from rocky riverbed, no ciliary vegetation, water temperature 26°C, pH 7.3, coll. Hamilton Garboggini, October 2002.

Diagnosis.—Carapace extremely flat (ch/fw 0.66). Frontal margin conspicuously bilobed, deeply indented in center; exorbital, epibranchial teeth large, pointed, directed forward; postfrontal crest sharply defined, spanning entire carapace, ends curving backward before meeting epibranchial teeth; anterolateral margin posterior to epibranchial tooth smooth. Ischium of third maxilliped smooth, completely lacking vertical groove. Inferior margins of merus of cheliped completely smooth, distal meral tooth missing; carpus of cheliped smooth, first and second carpal teeth completely reduced (missing); pereopods p2-p4 slender, elongated, dactylus of p4 extremely long (as long as propodus of p4, merus of p5, dactylus of major cheliped).

Description.—Carapace surface smooth, widest in anterior third (cw/fw 3.0), extremely flat (ch/fw 0.66), semi-circular, urogastric, transverse branchial grooves very deep; cardiac region weakly marked, cervical grooves present but weak. Frontal margin conspicuously bilobed, deeply indented in center; front relatively broad, about one-third carapace width (fw/cw 0.33). Exorbital, epibranchial teeth large, sharp, pointed forward. Postfrontal crest sharply defined, spanning entire carapace, straight part consisting of fused epigastric, postorbital crests first curving backward then curving at ends to meet anterolateral margins at epibranchial teeth. Anterolateral margin smooth posterior to epibranchial tooth.

Carapace sidewalls mostly smooth with faint granules in suborbital regions. Each sidewall with two sutures, one longitudinal, one vertical, dividing sidewall into three parts. Longitudinal (epimeral) suture dividing suborbital, subhepatic regions from pterygostomial region, beginning medially at lower margin of orbit, curving backward across carapace sidewall; vertical suture meeting epibranchial tooth, suture dividing suborbital from subhepatic region. Thoracic sternal groove s1/s2 short, complete, thoracic sternal groove s2/s3 complete, horizontal, thoracic sternal groove s3/s4 consisting only of two small notches at sides of sternum. Thoracic episternal sulci s4/e4, s5/e5, s6/e6, s7/e7 each marked by visible groove. Third maxillipeds filling entire oral field, except for transversely oval efferent respiratory openings at superior lateral corners; long flagellum on exopod of third maxilliped; ischium of third maxilliped smooth, completely lacking vertical groove.

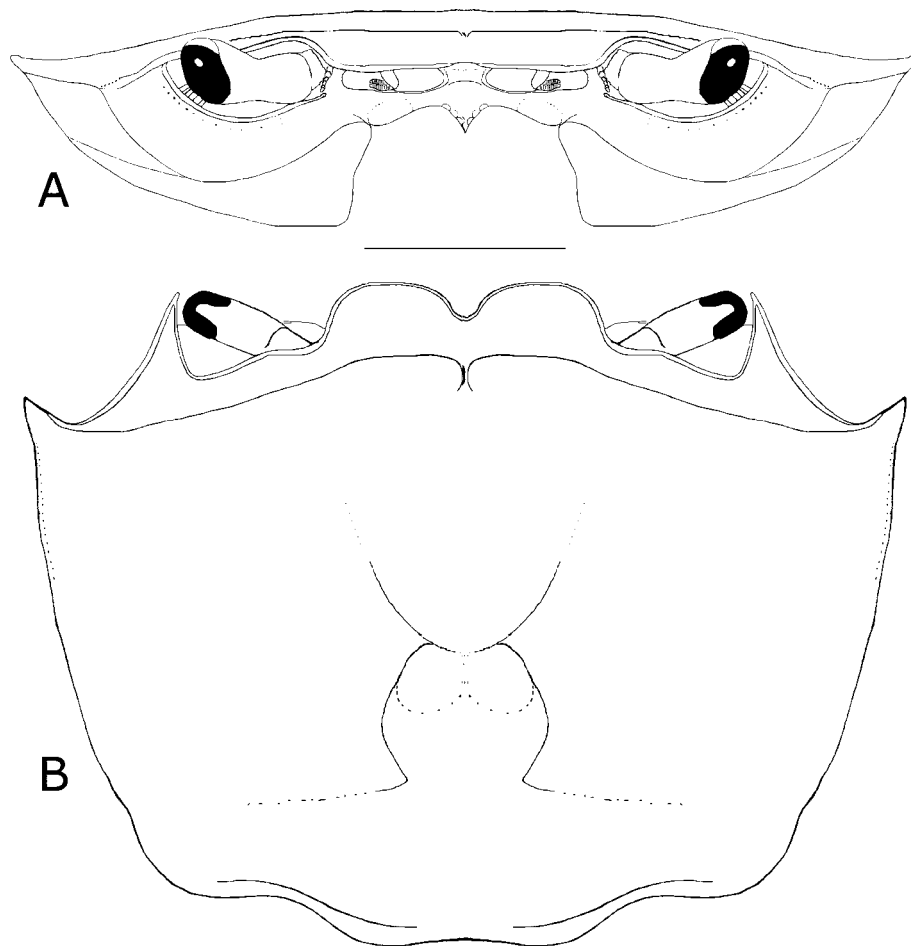


Fig. 1. *Potamonautes kensleyi*, new species. Holotype subadult female, cw 40.5 mm, MZUSP 16879. A, carapace and eyes, frontal view; B, cephalothorax, carapace and eyes, dorsal view. Scale = 10 mm.

Mandibular palp two-segmented; terminal segment single, undivided, with setae but no hard flap at junction between segments. Segments a1-a6 of female abdomen four-sided, segments a5-a6 broadest, telson (a7) broad rounded triangle, sides forming smooth curved, rounded margin.

Dactylus of left (major) cheliped long, slim, gently curved, with small even teeth; immovable finger slim, slender, with small even teeth, long slim interspace between fingers when closed, palm of propodus slim, not swollen. Inferior margins of merus of chelipeds completely smooth, distal meral tooth lacking. Carpus of cheliped smooth, first and second carpal teeth completely reduced (missing); pereopods p2-p4 with slender, elongated limb segments (merus, carpus, propodus and dactylus); p4 longest limb, p5 shortest limb; dactylus of p4 extremely long (as long as propodus of p4, merus of p5, and dactylus of major (left) cheliped); dactyli of p2-p5 tapering to point, each bearing four rows of downward-pointing sharp bristles.

Etymology.—The species is named for the late Dr. Brian F. Kensley for his remarkable contributions to crustacean biology, and in recognition of his African origins.

Remarks.—The new species is assigned to *Potamonautes* because it conforms to the diagnosis for the genus (Cumberlidge, 1999) based on the possession of the following characters: the anterolateral margin lacks an intermediate tooth between the exorbital and epibranchial teeth, the mandibular palp is two-segmented, and the third maxilliped exopod has a long flagellum. Although it is not normally good practice to describe new species from a female specimen we have decided to establish this taxon in the light of the distinct nature of the available morphological characters, given that it is unlikely that more material will become available soon because of the rarity of this species, and because of the difficulties faced in collecting crabs from this country. Indeed, the general lack of any recent specimens of freshwater crabs from Angola is no doubt related to the long-term political unrest suffered by that country. Because the only specimen of *P. kensleyi* is a female characters of the gonopods, adult male chelipeds, abdomen and sternum are not available. Nevertheless, there are a number of unique characters that clearly distinguish *P. kensleyi* from all other species in this large and varied genus. These characters include the deeply bilobed front, the extremely flattened carapace, the extremely elongated propodus and dactylus of p4, the lack of carpal teeth on the

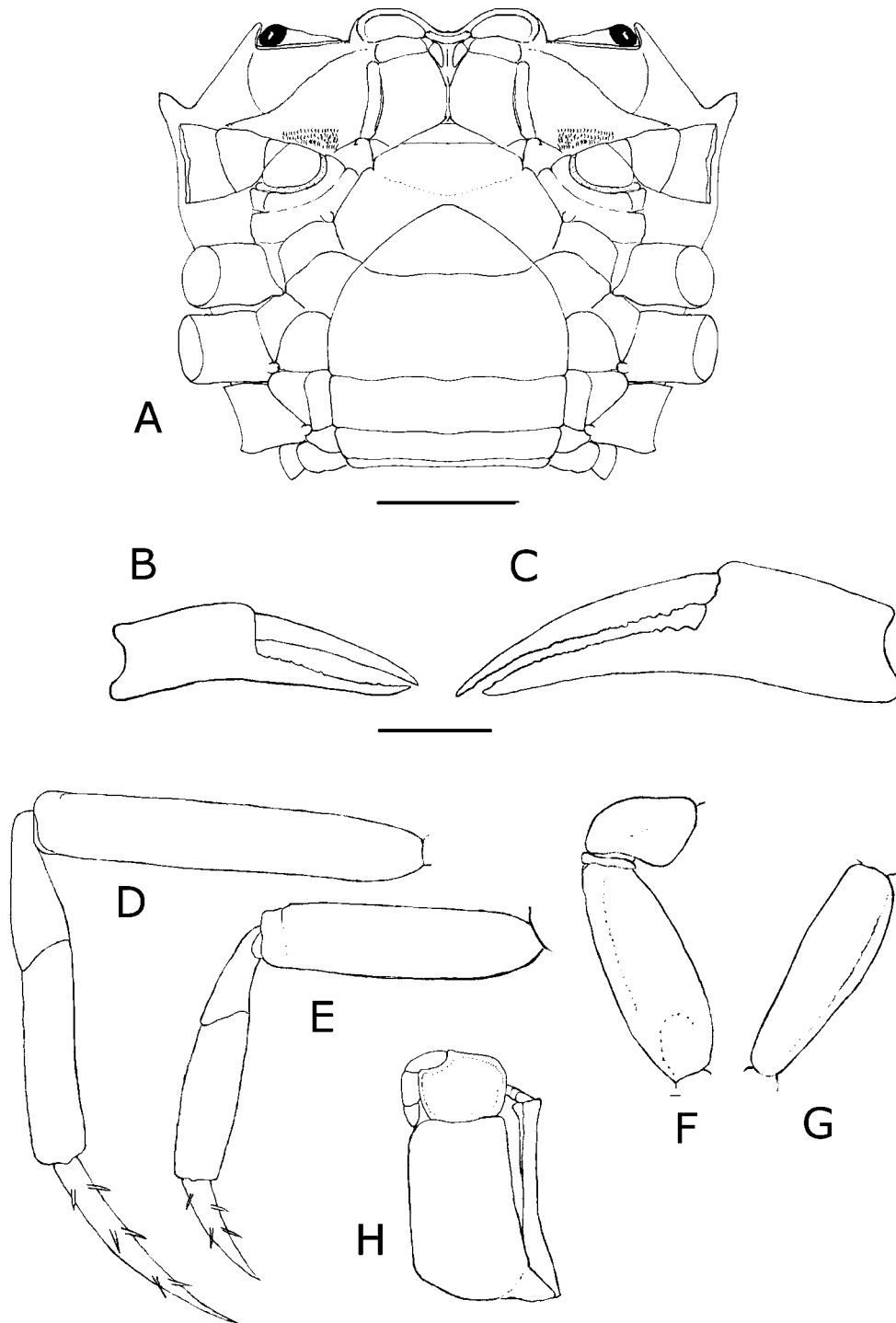


Fig. 2A-H. *Potamonautes kensleyi*, new species. Holotype subadult female, cw 40.5 mm, MZUSP 16879. A, thoracic sternum and abdomen; B, right cheliped, frontal view; C, left cheliped, frontal view; D, left fourth pereiopod, lateral view; E, left fifth pereiopod, lateral view; F, carpus and merus of left cheliped, dorsal view; G, merus of left cheliped, ventral view; H, left third maxilliped, frontal view. Scale A = 10 mm, B-H = 10 mm.

carpus of the cheliped, and the lack of teeth on the merus of the cheliped. When considered together this character combination is not shared with any other species of *Potamonautes* from Angola (or anywhere else in Africa).

Potamonautes kensleyi is most likely to be confused with *P. macrobrachii*, another large-bodied, slender-limbed

species from Angola. *Potamonautes kensleyi* and *P. macrobrachii* share characters such as a smooth anterolateral margin of the carapace, the lack a vertical groove on the ischium of the third maxilliped, the granular (almost missing) second carpal tooth on the cheliped, and long slender pereiopods p2-p4. Characters that distinguish *P.*

kensleyi from *P. macrobrachii* include the frontal margin (deeply indented and bilobed vs. straight), the front (projecting forward without bending downward vs. deflexed), the exorbital and epibranchial teeth (large forward-pointing spines vs. very low and inconspicuous), the postfrontal crest (sharp-edged with ends curving backward at the sides vs. low and straight with ends not curving backward), and the first carpal tooth on the cheliped (reduced to the size of a granule vs. small, distinct, and pointed).

Characters that distinguish *P. kensleyi* from *P. anchietae* include the anterolateral margin of the carapace (smooth vs. granulated), the ischium of the third maxilliped (smooth lacking a vertical groove vs. with a distinct vertical groove), the first carpal tooth on the cheliped (very small and granular vs. large and pointed), and the dactylus of pereopod p4 (slender and elongated vs. short). Other characters that distinguish *P. kensleyi* from *P. anchietae* include the frontal margin (deeply indented and bilobed vs. straight), the front (projecting forward without bending downward vs. deflexed), the exorbital and epibranchial teeth (large forward-pointing spines vs. a small granule and a low and broad tooth, respectively), the postfrontal crest (sharp-edged with ends curving backward at the sides vs. low and straight with ends not curving backward), and the first and second carpal teeth on the cheliped (both reduced to the size of a granule vs. both large and pointed).

The conspicuously bilobed frontal margin and the large, sharp, forward-pointing epibranchial tooth of *P. kensleyi* are superficially similar to those seen in *E. brazzae* from the lower Congo region in central Africa (Bott, 1955; Cumberlidge and Reed, 2004). However, these two taxa can be easily distinguished as follows: (1) the body size of *P. kensleyi* is large (adult size range well above cw 40 mm), whereas that of *E. brazzae* is small (adult size range between cw 23.5 and 33.5 mm), (2) the carapace outline of *P. kensleyi* is transversely oval, whereas that of *E. brazzae* is subhexagonal/rounded, (3) the orbit of *P. kensleyi* is broad (1/4 cw) and the upper orbital margin is curved, whereas those of *E. brazzae* are narrow (1/7 cw) and semi-circular respectively, (4) the first and second carpal teeth on the inner margin of the carpus of cheliped are reduced to granules in *P. kensleyi*, and the outer margin of the carpus of p1 is smooth, whereas the carpal teeth of *E. brazzae* are large, slender, and pointed, and (5) there is a series of pointed teeth on the outer margin of the carpus of p1, and the anterior margins of the carpi and propodi of p2-p4 of *P. kensleyi* are smooth whereas all of these margins in *E. brazzae* are lined by spines (Cumberlidge and Reed, 2004).

Distribution.—*Potamonautes kensleyi* is known only from a single locality in the Cuanza River (9°29'S, 15°50'E) in northern Malanje Province 150 km southeast of the city of Malanje in the savanna region of central Angola.

Potamonautes adeleae Bott, 1968

Potamonautes (Lirrangapotamonautes) lirrangensis adeleae, Bott, 1968: 168-169, pl. I, figs. 1-4.

Material Examined.—Angola. Paratype, adult male, cw 55.9, 41.3, 17.2, 15.6 mm; right propodus length along

inferior margin 55.1 mm, height of palm of right propodus 18.2 mm; left propodus length along inferior margin 50.3 mm, height of palm of left propodus 15.5 mm (SMF 4444), Province of Lunda Norte, Cuango River, Cafunfo (08°47'S, 18°01'E), collector and date unrecorded. Bott (1968) described this taxon from 38 specimens all from the same locality, designating an adult male (cw 60, cl 45, ch 23, fw 17 mm) as the holotype and the remainder of these specimens (28 males and 9 females) as paratypes.

Diagnosis.—Postfrontal crest complete, epigastric lobes continuous with postorbital crests, lateral ends of postorbital crests curving forward to meet anterolateral margins at epibranchial teeth. Exorbital tooth large, pointed, edges granulated; epibranchial tooth large, broad, triangular, edges granular; anterolateral margin between exorbital, epibranchial teeth granulated, curving slightly outward, lacking intermediate tooth; anterolateral margin posterior to epibranchial tooth raised rim, granulated, posterior end curving inward, not continuous with posterolateral margin. Carapace of medium height (ch/fw 1.12), front measuring almost one-third carapace width (fw/cw 0.28). Sidewall of carapace with distinct granulated vertical sulcus dividing sidewall into three parts; subhepatic region heavily granulated, suborbital, pterygostomial regions smooth. Exopod of third maxilliped with long flagellum, ischium of third maxilliped with deep vertical sulcus. Thoracic sternal sulcus s2/s3 deep, running horizontally across sternum; thoracic sternal sulcus s3/s4 incomplete, deep at sides, absent in middle, sides slanted inward toward anterior margin of sterno-abdominal cavity. Thoracic episternal sulci s4/e4, s5/e5, s6/e6, s7/e7 smooth, none marked by visible groove. Propodus of (right) major cheliped of adult male long (55.1 mm), almost as long as cw (55.9 mm), palm of propodus not enlarged, fingers of propodus, dactylus, straight, slim, each with 2-3 large teeth interspersed with smaller teeth. First carpal tooth of inner margin of carpus of cheliped large, slender, pointed; second carpal tooth subequal, pointed. Lateral, medial inferior margins of merus of cheliped granulated, with single large pointed distal meral tooth on medial margin; superior surface of merus granulated. First half of terminal article of gonopod 1 straight with parallel sides, angled slightly outward, second half bent sharply outward at 90° angle to longitudinal axis of gonopod, tapering to narrow upcurved tip; lateral side of terminal article of gonopod 1 significantly widened in middle by enlarged lateral fold; medial fold smaller, lower in dorsal view; distal margin of subterminal segment at dorsal membrane running diagonally from lateral to medial edges, dorsal membrane broadest at medial margin, tapering sharply to lateral margin. Adult size range from cw 55 to 60 mm.

Description.—For a detailed description and photographs see Bott (1968, pl. 1, figs. 1-4).

Remarks.—The recognition of this taxon as a valid species is based on the comparison of an adult male paratype of *P. adeleae* from Angola (cw 55.9 mm) with the adult female type of *Potamon (Potamonautes) lirrangensis* Rathbun, 1904 (cw 53.9, cl 37.8, fw 12 mm) from Lirringa, D. R. Congo, collected by J. Dybowski, 5.ix.1891, which was

photographed by Rathbun (1904, pl. XIV, fig. 8) and illustrated by Capart (1954, fig. 28). *Potamonautes adeleae* can be distinguished from *P. lirrangensis* as follows: the anterolateral margin of the carapace of *P. adeleae* is raised and granulated, whereas this margin is raised but distinctly toothed in *P. lirrangensis*; the thoracic episternal sulci s4/e4, s5/e5, s6/e6, and s7/e7 of *P. adeleae* are all smooth, whereas each of these sulci is marked by a visible groove in *P. lirrangensis*; the major cheliped of *P. adeleae* is slim and elongated, the palm of the propodus is not enlarged, and the fingers of the propodus and dactylus are straight and slim, and each has 2-3 large teeth interspersed with smaller teeth, whereas the major cheliped of *P. lirrangensis* is enlarged with a swollen palm of the propodus, and the broad fingers of the propodus and dactylus are each lined by a series of large teeth; the ventral margins of the merus of pereopod 1 of *P. adeleae* are both heavily granulated, whereas these margins are both lightly granulated in *P. lirrangensis*; and the distal margin of the subterminal segment at the dorsal membrane of *P. adeleae* is diagonal, whereas the distal margin of the subterminal segment at the dorsal membrane of *P. lirrangensis* is deeply v-shaped.

Potamonautes adeleae is a large species that is endemic to Angola. It is known only from a single locality in the Cuango River, a northward flowing tributary of the Congo River in the forested Lunda Norte Province that is part of the central African region.

BIOGEOGRAPHY

Angola occupies more than 1.2 million sq km in southwestern Africa, and is bordered to the north and east by the D. R. Congo, to the southeast by Zambia, to the south by Namibia, and to the west by the Atlantic Ocean. The country is divided into 18 provinces, one of which (Cabinda) is separated from the others by the D. R. Congo and the Congo River. The landscape of Angola consists of a narrow coastal lowland plain, a line of escarpments running north-south, and a vast inland plateau (1000 to 2620 m asl). The vegetation includes equatorial lowland forest in the north, desert in the south, and savanna of some kind (savanna-forest mosaic, grassland with scattered trees, and thorn scrub) in the rest of the country.

The forested northern part of Angola (in Zaire, Uige, Malanje, Lunda Norte, and Lunda Sul Provinces) is drained by the major rivers that flow north into the D. R. Congo (the Cuango (Kwango), Cassai (Kasai) and Cuilo (Kwilu) Rivers). The freshwater crabs found in these rivers and their tributaries (*P. anchietae*, *P. bayonianus*, *P. dubius*, and *P. adeleae*), together with *S. floweri* from Cabinda, have affinities with the fauna of the central African region. Of these, *P. anchietae* and *P. bayonianus* are also found in the D. R. Congo in the neighboring Provinces of Bas-Congo and Bandundo (*P. anchietae*), and Katanga (*P. bayonianus*) (Bott, 1953, 1955, 1964, 1968), while *S. floweri* from Cabinda has a wide distribution in West and Central Africa that includes Nigeria, Cameroon, the Central Africa Republic, Sudan, the Republic of the Congo, the D. R. Congo, and Gabon (Cumberlidge, 1995, 1999). *Potamonautes adeleae* is endemic to Angola, and is found only in the rainforests of northern Angola in Lunda Norte Province. Bott

(1964) identified a number of specimens from Lunda Norte Province as *P. (P.) d. depressus* but these records are considered doubtful because there is good reason to believe (Barnard, 1935, 1950; Gouws et al., 2000) that *P. depressus* does not occur this far north of South Africa. *Potamonautes depressus* is therefore not included here in the list for Angola due to the lack of reliable evidence that it occurs there.

The savannas of the central and southern parts of Angola are drained by the Cubango and Cuito Rivers that flow southeast to the Okavango delta in Botswana, by the Cuando (Kwando) and Lungué-Bungo Rivers that are tributaries of the Zambezi River, and by the Cunene River that flows west along the Namibian border to the Atlantic Ocean. The freshwater crabs found in these rivers and their tributaries either have affinities with the fauna of southern Africa (*P. bayonianus* and *P. dubius*), or are endemic to Angola (*P. macrobrachii* and *P. kensleyi*). For example, *P. bayonianus* has a broad distributional range that includes the neighboring countries of D. R. Congo, Zambia, Zimbabwe, Namibia, and Botswana (Table 1). The only species found in the southwestern part of Angola is *P. dubius* from the Cunene River basin. The opinion of Bott (1953, 1955) that *P. dubius* is a subspecies of *P. bayonianus* is not accepted here, and we consider it likely (based on morphological comparison) that *P. dubius* is a valid species. *Potamonautes macrobrachii* is known from two localities in the savannas of Huambo and Bié Provinces in central Angola, while *P. kensleyi* is known only from a single locality in the Cuanza River in the savanna zone in Malanje Province in central Angola. The Cuanza River (like the Cunene and Catumbela Rivers) rises in the central mountains of Angola and flows west to the Atlantic Ocean.

DISCUSSION

The number of species of freshwater crabs from Angola is still far from certain but seven taxa (Table 1) are considered here to be valid species. These are *P. adeleae*, *P. anchietae*, *P. bayonianus*, *P. dubius*, *P. kensleyi*, *P. macrobrachii*, and *Sudanonautes floweri*. A further four taxa (*P. depressus*, *P. dybowskii*, *P. biballensis*, and *P. machadoi*) have been recorded from Angola, but in each case there is some doubt as to the validity of the literature identification of the specimens. For example, *P. machadoi* was described by Bott (1964) as a subspecies of *P. anchietae*, and *P. biballensis* was treated as a junior synonym of *P. anchietae* (Bott, 1955, 1968), but each of these assignments is questionable (see above). Similarly, the identification by Bott (1968) of specimens from Angola as *P. (O.) depressus dybowskii* is unreliable for a number of reasons. First, *P. depressus* is found in Kwa-Zulu Natal (and possibly Eastern Cape) in South Africa, and the Angolan records of this often-confused species are suspect and could well be based on the misidentification of material (Barnard, 1935, 1950; Gouws et al., 2000). Second, *P. dybowskii* Rathbun, 1904, from the D. R. Congo is treated here as a valid species (and not a subspecies of *P. depressus*) based on direct examination of the type material of *P. (P.) dybowskii* and on differences apparent in the illustrations of the first gonopods of *P. depressus* and *P. dybowskii* as illustrated in Bott (1955, figs. 44, 45). Bott (1955) also synonymized *P. (P.) choloensis*

Chace, 1953, with *P. depressus dybowskii* but this opinion is not supported here because of distinct differences in characters of the first gonopod of *P. depressus*, *P. dybowskii*, and *P. choloensis* (Bott, 1955, figs. 44, 45; Chace, 1953, figs. 1, 2). We therefore follow the opinions of Chace (1953) and Cumberlidge (2004) who treated *P. choloensis* as a valid species. The 22 specimens identified by Bott (1968) as *P. (O.) depressus dybowskii* from three localities in Angola were neither described nor illustrated by him, and the assignment of these specimens to a species from South Africa and a subspecies from the D. R. Congo is therefore considered to be doubtful. Because of these widespread taxonomic uncertainties, definitive statements about the number of species in Angola must wait until all of the relevant the type material has been examined and a comprehensive revision completed, tasks that are well beyond the scope of the present work. The fact that three out of seven species of Angolan freshwater crabs (*P. macrobrachii*, *P. adeleae*, and *P. kensleyi*) are endemic makes this country worthy of further attention. Undoubtedly, the number of species of freshwater crabs known to occur in Angola will rise as exploration continues and the taxonomy of the crabs of this region becomes more refined.

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