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New Species of *Nannocharax* (Characiformes: Distichodontidae) from the  
Northwestern Congo River Basin, with an Appraisal of *Hemigrammocharax*

Fernando C. Jerep<sup>1,2</sup> and Richard P. Vari<sup>1</sup>



# New Species of *Nannocharax* (Characiformes: Distichodontidae) from the Northwestern Congo River Basin, with an Appraisal of *Hemigrammocharax*

Fernando C. Jerep<sup>1,2</sup> and Richard P. Vari<sup>1</sup>

***Nannocharax hastatus*, new species, is described from the Lékoli River in the Likouala River system, Pool Malebo, and the Luilaka and Tshuapa rivers of the Momboyo river basin in the northwestern and central portions of the Congo River basin. The new species shares with *N. ocellicauda* and *N. maculicauda* a distinctive coloration pattern of a nearly completely unpigmented body other than for dark lines along the bases of the anal and dorsal fins and a longitudinally elongate, ovoid, dark spot on the posterior portion of the caudal peduncle and basal region of the central caudal-fin rays. That pigmentation pattern is unique to these three species in what was defined as the *Hemigrammocharax–Nannocharax* clade. In addition to coloration the three species share a distinctive overall elongate form of the head and body. *Nannocharax hastatus* differs from *N. ocellicauda* and *N. maculicauda* in the extent of poring along the lateral line and number of lateral line and circumpeduncular scales. Variation in the degree of poring of the lateral line in the species complex formed by these three species provides further evidence that the feature used-to-date to delimit *Hemigrammocharax* from *Nannocharax*—the extent of poring along the lateral line—fails to define monophyletic assemblages, and *Hemigrammocharax* is placed into the synonymy of *Nannocharax* which now forms a monophyletic assemblage.**

**H**EMIGRAMMOCHARAX plus *Nannocharax* were proposed to constitute a monophyletic subunit of the characiform family Distichodontidae by Vari (1979:331) on the basis of a series of synapomorphies of the dentary, dentition, suspensorium, neurocranium, anterior portion of the vertebral column, and pectoral girdle. Species of those genera range from the Nile River basin in North Africa to sub-Saharan portions of the continent with maximum species-level diversity in West Africa and the Congo basin and decreasing numbers of species in surrounding regions (Poll, 1973; Daget and Gosse, 1984; Jerep and Vari, 2013). Analysis recently revealed that the Likouala River basin in northwestern reaches of the Congo River basin was inhabited by a species previously unknown to science—*Hemigrammocharax rubensteini* Jerep and Vari (2013). Continuing studies of the ichthyofauna of that river system and other portions of the Congo River basin revealed a second undescribed species assignable to what was recognized as the *Nannocharax–Hemigrammocharax* clade (Vari, 1979), with that species described herein.

For the last eight decades, *Nannocharax* and *Hemigrammocharax* have been differentiated following the concept advanced by Pellegrin (1923) involving the degree of poring of the lateral line; with the lateral line incompletely pored to varying degrees in *Hemigrammocharax* versus completely pored in *Nannocharax*. Vari (1979) questioned the monophyly of these two genera, a point reiterated by other authors in light of intraspecific variation in the extent of the number of pored lateral-line scales of multiple species assigned to *Hemigrammocharax* (Roberts, 1967; Jubb and Gaigher, 1971; Vari and Géry, 1981; Jerep and Vari, 2013). The results of this analysis provide evidence for the non-monophyly of groupings within the *Hemigrammocharax–Nannocharax* clade delimited by reduction, or lack thereof, in the extent of lateral-line poring. *Hemigrammocharax* is consequently placed into the synonymy of *Nannocharax*.

## MATERIALS AND METHODS

Body measurements were taken point-to-point under a microscope using a digital caliper (0.1 mm of precision); preferentially on the left side of specimens. Measurements are given as percentages of the standard length (SL), except for subunits of the head that are presented as percentages of the head length (HL). Measurements and counts follow those used by Vari and Ferraris (2004) and Dunz and Schliewen (2009); but with head width measured immediately above the area of articulation of the opercle with the suspensorium to eliminate variation resulting from variation in the degree of opercular flexure. Paired scales to each side of the midline were counted as one scale in totals of the median scales anterior to the dorsal-fin origin, between the dorsal and adipose fins and between the genital papilla and the anal-fin origin. The posteriormost branched and small terminal unbranched ray of the anal fin are counted as a single element split to the base. Counts for the holotype are presented in the description in square brackets and the number of examined specimens with a particular count is indicated in parentheses. Cleared-and-stained specimens, prepared according to Taylor and Van Dyke (1985), were used to assess details of dentition, the number and shape of infraorbitals, and the number of branchiostegal rays. Vertebral counts were taken from radiographs and include the four vertebrae of the Weberian apparatus and the terminal centrum. Museum abbreviations are listed at <http://www.asih.org/node/204>.

## *Nannocharax hastatus*, new species

Figure 1, Table 1

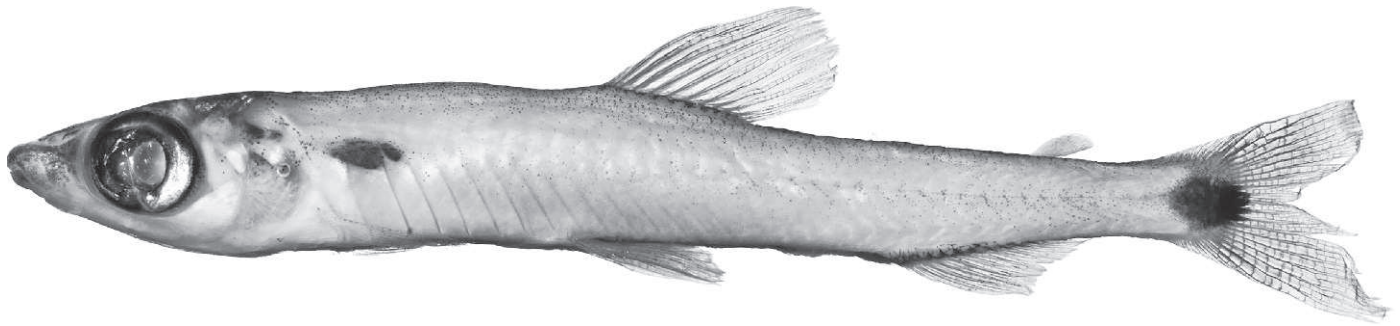
*Hemigrammocharax ocellicauda*.—Vari, 2007:429 [photographed specimen, fig. 16.9].—Iyaba and Stiassny, 2013:250 [photographed specimen, fig. 4d], 253 [listed for Salonga National Park, table 3].

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**Fig. 1.** *Nannocharax hastatus*, new species, CUMV 89072, 31.6 mm SL, holotype, Africa, Republic of the Congo, Cuvette-Ouest, Likouala River drainage, small canal around island in Lékoli River, Odzala National Park.

**Holotype.**—CUMV 89072, 31.6 mm SL, Republic of the Congo, Cuvette-Ouest, Likouala River drainage, small canal around island in Lékoli River, Odzala National Park, 0°37'12"N, 14°55'5.9"E, J. P. Friel, S. Lavoué, J. P. Sullivan, 15 August 2002.

**Paratypes.**—Republic of the Congo, Cuvette-Ouest, Likouala River drainage: CUMV 97555, 12, 22.8–27.2 mm SL (9 measured 23.9–27.2 mm SL), collected with holotype. AMNH 259203, 2, 24.5–25.6 mm SL; BMNH 2013.4.16.2–3, 2, 24.3–24.7 mm SL; CUMV 87637, 18, 22.3–30.6 mm SL (8 measured 24.6–30.6 mm SL, 2 CS 22.7–24.3 mm SL); MRAC B3-07-P-1–2, 2, 23.6–25.2 mm SL; USNM 409953, 5, 23.2–25.0 mm SL; ZSM 42271, 2, 23.3–24.5 mm SL; Lékoli River, Odzala National Park, 0°37'15.9"N, 14°55'5.2"E, J. P. Friel, S. Lavoué, J. P. Sullivan, 7 August 2002. CUMV 87638, 2 measured, 24.6–27.8 mm SL, Lékoli River, Odzala National Park, 0°36'51.1"N, 14°56'11.0"E, P. Friel, S. Lavoué, J. P. Sullivan, 7 August 2002. CUMV 89142, 2 measured, 24.1–26.6 mm SL, Lékoli River, Odzala National Park, 0°37'32.9"N,

14°54'6.8"E, J. P. Friel, S. Lavoué, J. P. Sullivan, 23 August 2002. CUMV 89163, 1, 24.2 mm SL, Lékoli River, Odzala National Park, 0°37'15.9"N, 14°55'5.2"E, J. P. Friel, S. Lavoué, J. P. Sullivan, 7 August 2002. CUMV 89491, 1, 21.0 mm SL, Lékoli River, Odzala National Park, 0°37'15.9"N, 14°55'5.2"E, J. P. Friel, S. Lavoué, J. P. Sullivan, 9 August 2002. Democratic Republic of the Congo, Salonga National Park: AMNH 241885, 7, 21.3–25.9 mm SL, Nkombe-Dunda, Luilaka River, downstream of village, near confluence of Luilaka and Lila rivers, 2°40'17.3"S, 21°43'15.5"E, R. C. Schelly, R. Monsembula, 9 July 2006. AMNH 241887, 5, 21.4–25.8 mm SL, Monkoto, Luilaka River (Momboyo River), 1°45'0"S, 20°40'49.8"E, R. C. Schelly et al., 19 July 2006. MRAC P-118977–78, 2, 27.8–34.3 mm SL, Stanley Pool, river affluent of the canal, 3°56'S, 15°54'E, P. Brichard, April 1958. MRAC P-125092, 1, 26.5 mm SL, Stanley Pool, 4°20'S, 15°23'E, Congo Aquaria, 1959. MRAC P-177596, 1, 25.0 mm SL, Stanley Pool, Kinshasa, 4°18'S, 15°18'E, P. Brichard, 1967. MRAC P-177914, 1, 29.8 mm SL, Boende, Tshuapa River basin, 0°14'S, 20°50'E, P. Brichard, 1969.

**Table 1.** Morphometrics of *Nannocharax hastatus*, new species. Range, mean, and standard deviation (SD) include values for the holotype.

	Holotype	<i>n</i>	Range	Mean	SD
Standard length	31.6	22	23.7–31.6	26.4	2.0
<b>Percentage of SL</b>					
Head length	26.6	22	26.6–29.4	28.2	0.7
Predorsal length	50.2	22	48.6–52.5	50.9	1.1
Prepectoral length	26.5	22	26.5–29.1	27.9	0.7
Prepelvic length	46.8	22	45.5–49.7	47.3	1.1
Preanal length	75.2	22	71.8–76.3	74.1	1.4
Head width	10.9	22	10.2–12.3	11.4	0.5
Body width	8.1	22	6.7–9.3	7.8	0.7
Head depth	13.8	22	13.5–15.3	14.3	0.6
Body depth	13.8	22	13.1–15.7	14.3	0.7
Dorsal-fin length	19.3	21	17.6–22.3	20.5	1.3
Pectoral-fin length	12.6	22	11.6–14.7	13.1	0.9
Pelvic-fin length	13.5	21	13.2–15.6	14.4	0.7
Anal-fin length	11.9	21	11.0–12.8	11.8	0.6
Caudal-peduncle length	13.5	22	10.0–14.6	12.0	1.1
Caudal-peduncle depth	5.9	22	5.8–7.1	6.5	0.4
<b>Percentage of HL</b>					
Eye horizontal diameter	36.0	22	33.8–38.5	35.7	1.1
Snout length	27.3	22	25.1–28.9	26.9	1.0
Upper-jaw length	21.5	22	17.9–22.2	19.9	1.2
Interorbital width	20.9	22	17.4–23.6	20.0	1.4

**Diagnosis.**—*Nannocharax hastatus* is distinguished from all congeners except *N. maculicauda* and *N. ocellicauda* by the possession of a largely unpigmented body except for a dark line along the bases of the dorsal and anal fins and a longitudinally elongate, ovoid, dark spot on the posterior portion of the caudal peduncle and bases of the central caudal-fin rays. The elongate form of the head and body are also unique to these three species in the genus. *Nannocharax hastatus* differs from *N. maculicauda* in the numbers of scale rows around the caudal peduncle (18 to 20 versus 14 to 16) and pored scales along the lateral line (6 to 9 versus 55 to 61). *Nannocharax hastatus* is distinguished from *N. ocellicauda* in the number of scales along the lateral-line scale series (59 to 68 versus 50 to 56) and scale rows around the caudal peduncle (18 to 20 versus 13 to 16).

**Description.**—Morphometric data presented in Table 1. Small body size with maximum length 31.6 mm SL. Body distinctly elongate and laterally compressed. Snout anteriorly rounded in lateral view. Dorsal profile of head slightly convex from tip of snout to tip of supraoccipital spine. Dorsal profile of body overall convex from tip of supraoccipital spine to dorsal-fin origin; sometimes slightly concave immediately anterior to dorsal-fin origin. Profile straight to slightly convex along dorsal-fin base; straight from insertion of last dorsal-fin ray to mid-length of caudal peduncle, and straight to slightly concave anterior to insertion of dorsal procurent caudal-fin rays. Ventral profile of head convex along anterior portion of dentary; slightly convex from that point to isthmus. Ventral profile of body slightly concave from isthmus to pelvic-fin insertion; straight in region of pelvic-fin insertion; straight to slightly concave from pelvic-fin insertion to anal-fin origin; straight to slightly convex along anal-fin base; and slightly concave along caudal peduncle. Ventral surface of body transversely flattened between pelvic-fin insertions.

Head pointed in lateral profile. Eye large and laterally positioned; pupil ovoid with anterior emargination of iris. Mouth terminal; located on horizontal through middle of eye. Premaxilla with one tooth row of 7 elongate, bicuspid, slightly distally expanded teeth. Premaxillary teeth gradually decreasing in size posteriorly; posteriormost tooth approximately one-half size of tooth proximate to symphysis. Contralateral premaxillae attached medially through syndesmotomic articulation. Dentary with one row of 7 elongate, bicuspid, slightly distally expanded teeth. Dentary teeth gradually decreasing in size posteriorly with posteriormost tooth approximately one-half size of symphyseal tooth. Contralateral dentaries medially attached through immovable, syndesmotomic articulation. Dentary movably articulated posteriorly with anterodorsal region of anguloarticular and lacking laterosensory canal segment. Maxilla toothless, transversely flat and posteriorly expanded. Ventral margin of maxilla slightly convex and posterior border rounded. Maxilla extending posteriorly to vertical through anterior margin of posterior naris. Middle and posterior portions of maxilla situated medial to anterior portion of first infraorbital when mouth closed. Anterior naris rounded, separated from posterior naris by flap of skin. Posterior naris narrow and semicircular. Infraorbital series with infraorbitals 1 and 2 well developed and infraorbitals 4 to 6 absent.

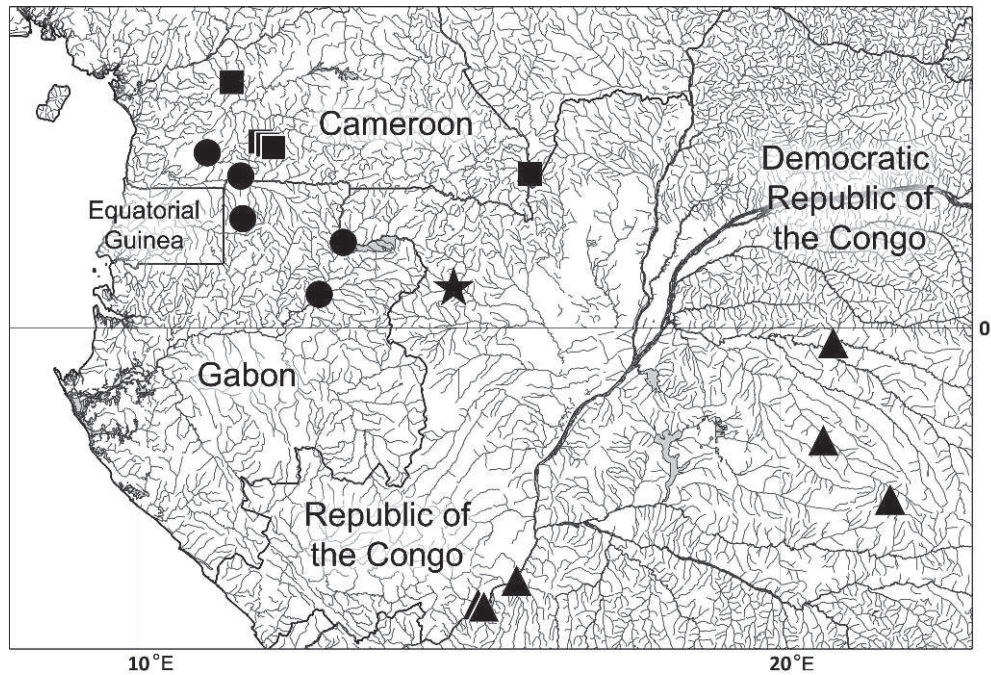
Dorsal-fin origin located approximately at middle of SL and posterior to vertical through pelvic-fin insertion. Distal profile of fin straight to slightly convex. Branched dorsal-fin rays

progressively decreasing in size posteriorly. Unbranched dorsal-fin rays ii (7) or iii (15); branched rays 9 (4), 10 (16), or 11 (2) [ii,11]. Pectoral fin pointed in profile. Pectoral-fin rays i,7 (2), i,8 (13), i,9 (6) or i,10 (1) [i,8]. Distal profile of pelvic fin straight to slightly convex. Pelvic-fin rays i,7 (21) or i,8 (1) [i,7]. Adipose fin well developed with origin situated along vertical slightly anterior of base of ultimate or penultimate anal-fin ray. Distal profile of anal fin straight to slightly concave. Unbranched anal-fin rays ii (1) or iii (21); branched rays 11 (21) or 12 (1) [iii,11]. Forked caudal-fin lobes short, distally pointed and of similar size. Caudal-fin rays i,17,i (33) [i,17,i].

Scales ctenoid (*sensu* Roberts, 1993) with serrations formed by separate, distally narrowing ossifications along free margin of each scale. Lateral-line scale at vertical through dorsal-fin origin with ctenii formed of 10 independent ossifications along posterior margin of scale. Pre-dorsal region unscaled in most specimens; few individuals with small fragile scales situated immediately anterior to dorsal-fin origin. Lateral line straight, but incompletely pored with 59 (5), 61 (4), 62 (7), 63 (1), 64 (2), 66 (1), or 67 (1) [62] scales; posteriormost one or two scales extending beyond point of flexure at posterior margin of hypural plate. Anteriormost 6 (6), 7 (10), 8 (4), or 9 (2) [7] scales pored. Scale rows between dorsal-fin origin and lateral line 6 (1), 7 (13), or 8 (6) [7]. Scale rows between pelvic-fin origin and lateral line 6 (17) or 7 (1) [6]. Scales from posterior terminus of dorsal-fin base to adipose fin 17 (1), 18 (2), 19 (10), 20 (6), 21 (1), or 22 (2) [20]. Scales between anus and anal-fin origin 2 (4), 3 (9), or 4 (9) [2]. Scale rows around caudal peduncle 18 (20), 19 (1), or 20 (1) [18]. Branchiostegal rays 4. Vertebrae 40 (1), 41 (17), or 42 (6). Morphology of pseudotympanum comparable to that in *Hemigrammocharax* (= *Nannocharax*) *rubensteini* (Jerep and Vari, 2013).

**Coloration in alcohol.**—Overall color of head and body whitish to very light tan (Fig. 1). Dorsal region of head and snout, maxilla, and first infraorbital darker than remaining portions of head and body. Lateral portion of snout and maxilla dark pigmented. Body with sparse, scattered, dark chromatophores more densely distributed over dorsal and posterolateral region of body; chromatophores sometimes more concentrated along posterior margin of scales. Dark chromatophores forming longitudinal dark lines along bases of anal and dorsal fins. Dark blotch surrounding anus and urogenital papillae usually merges posteriorly with dark line along anal-fin base. Posterior portion of caudal peduncle with longitudinally elongate, ovoid, dark spot extending posteriorly onto basal 1/5 of interradial membranes of middle caudal-fin rays. Dark region in humeral area of holotype in Figure 1 not result of dark pigmentation, but rather of presence of extensive pseudotympanum at that location. Dorsal, pectoral, pelvic, anal, and caudal fins with sparse dark chromatophores positioned on interradial membranes along ray margins.

**Distribution.**—*Nannocharax hastatus* is known from several localities in the northwestern and central portions of the Congo River basin (Fig. 2). In the northwestern Congo River basin within the Republic of the Congo, the species was collected at several localities within the Odzala-Kokoua National Park along the Lékoli River system, a tributary of the Mambili River in the Likouala River basin (star). In the Democratic Republic of the Congo, *N. hastatus* has a broad distribution (triangles), including Pool Malebo (formerly



**Fig. 2.** Map of central western Africa showing geographic distribution of *Nannocharax hastatus* (star = holotype locality, triangles = paratype localities), *N. maculicauda* (dots), and *N. ocellicauda* (squares) in the northwestern portion of Congo River basin and coastal Atlantic drainages of West Africa. Some symbols represent more than one collecting locality and/or lot of specimens.

Stanley Pool) and the Luilaka and Tshuapa rivers, tributaries of the Ruki and Busira rivers, respectively, in the Momboyo River basin.

**Etymology.**—The adjectival species name *hastatus*, from the Latin, *hasta*, meaning spear, is an allusion to the spear-shaped body of the new species.

**Status of Hemigrammocharax.**—*Hemigrammocharax* was initially proposed by Pellegrin (1923) as a subgenus of *Nannocharax* to host *N. ocellicauda* Boulenger 1907, at that time, the only described species of the *Nannocharax*–*Hemigrammocharax* assemblage with an incomplete lateral line. Under the generic definition proposed by Pellegrin (1923), *Nannocharax hastatus* would be assigned to *Hemigrammocharax* in accordance with the one defining feature of that genus versus the morphologically very similar *Nannocharax*—the presence of a variable number of unpored scales along the posterior portion of the lateral line. The evolutionary significance of this character and more so the utility of such a reduction from the complete poring of *Nannocharax* for the purpose of delimiting a monophyletic subunit within the *Hemigrammocharax*–*Nannocharax* assemblage was repeatedly questioned given the intraspecific variability of lateral-line poring in multiple species in that lineage (e.g., Jubb and Gaigher, 1971:15; Vari and Géry, 1981:1082; Coenen and Teugels, 1989:317; Vari and Ferraris, 2004:557). Equally or more notably, incomplete poring of the lateral-line arose independently in at least three clades within the not particularly species-rich family Distichodontidae (*Hemistichodus*, *Neolebias*, and the *Hemigrammocharax*–*Nannocharax* clade [Vari, 1979:315]) casting further doubt on the utility of this feature to delimit monophyletic groups of species.

*Nannocharax hastatus* and its close relatives are prime examples of the quandary. Within the spectrum of the morphological diversity across the *Hemigrammocharax*–*Nannocharax* assemblage, *Nannocharax hastatus* (with incomplete poring of the lateral line) shares distinctive morphological and pigmentation pattern similarities exclu-

sively with *N. maculicauda* (with complete poring of the lateral line) and *N. ocellicauda*, the type species of *Hemigrammocharax* (with incomplete poring of the lateral line). Notwithstanding the difference in the extent of lateral-line poring that would result in their assignment to different genera under traditional definitions, these species share distinctly elongate heads and bodies (see Fig. 1 for *N. hastatus*; Vari and Géry [1981:fig.1] for *N. maculicauda*, and Boulenger [1909:fig. 209] for *N. ocellicauda*) not found in any other members of that clade and also have in common relatively small body sizes. Additionally, the coloration pattern of these species (a largely unpigmented, lightly colored body with a dark line along the anal-fin base and a less intense dark line along the base of the dorsal fin and a longitudinally elongate, ovoid, dark spot on the posterior portion of the caudal peduncle and the basal portion of the middle caudal-fin rays) was not encountered in any other species of the *Hemigrammocharax*–*Nannocharax* assemblage. Based on these attributes, *Nannocharax hastatus*, *N. maculicauda*, and *N. ocellicauda* are hypothesized to form a monophyletic species complex in which the reduction in the extent of lateral-line poring in *N. maculicauda* and *N. ocellicauda* occurred independent of variably extensive reductions in other species traditionally assigned to *Hemigrammocharax*, all of which have dramatically different pigmentation patterns and overall head and body forms (e.g., *H. rubensteini*, Jerep and Vari, 2013:fig. 1). The sum of this evidence demonstrates that reduction in lateral-line poring fails to delimit *Hemigrammocharax* as now recognized as a natural unit and furthermore that the close relatives of the type species of the genus, *H. ocellicauda*, lack that feature. We therefore synonymize *Hemigrammocharax* into *Nannocharax*. *Nannocharax* in this expanded sense constitutes a natural lineage defined by a series of synapomorphies involving multiple skeletal components (Vari, 1979:331).

**Remarks.**—The species complex formed by *Nannocharax hastatus*, *N. maculicauda*, and *N. ocellicauda* occurs within a



*Nannocharax pteron*: ANSP 65560, holotype, 45.5 mm SL, Central African Republic, Tomi River, tributary of Ubangi, at Fort Sibut, Ubangi-Shari, French Equatorial Africa.

*Nannocharax reidi*: USNM 304046, holotype, 62.7 mm SL; USNM 375193, paratypes, 16, 34.3–59.0 mm SL, 2 CS; Cameroon, Cross River system, southern Munaya River draining northern Korup, on Basep River at junction with Munaya River.

*Nannocharax rubensteini*: CUMV 89502, holotype, 23.6 mm SL, Republic of the Congo, Cuvette-Ouest, Likouala River Drainage, Lékoli River at Mboko dock, Odzala National Park.

*Nannocharax rubrolabiatus*: MRAC 95-22-P-1-7, 7, 45.4–59.8 mm SL, Cameroon, Mi River, tributary of Lom River, Sanaga River basin, Igoum.

*Nannocharax schoutedeni*: AMNH 241889, 5, 22.9–29.7 mm SL, Democratic Republic of Congo, Salonga National Park, Ifumu, Luilaka River, just downstream from Monkoto; AMNH 241891, 14, 14.4–39.3 mm SL, Democratic Republic of the Congo, Salonga National Park, Luilaka River, Monkoto.

*Nannocharax seiboldi*: USNM 118757, holotype, 32.9 mm SL, Liberia, Bellyella; USNM 118758, paratypes, 3, 34.8–41.3 mm SL, Liberia, Bromley.

*Nannocharax taenia*: CUMV 91682, 3, 29.6–31.2 mm SL, Central African Republic, Ouaka, Ouaka/Oubangui drainage, Mbourou River at AXMIN Ndassima mine camp; CUMV 91684, 1, 35.0 mm SL, Central African Republic, Ouaka, Ouaka/Oubangui drainage, Baïdou River, above and below pontoon crossing.

*Nannocharax uniocellatus*: CUMV 89494, 7, 23.6–26.1 mm SL, Republic of the Congo, Cuvette-Ouest, Likouala River Drainage, Lékoli River, Odzala National Park; CUMV 89495, 7, 20.2–26.9 mm SL, Republic of the Congo, Cuvette-Ouest, Likouala River drainage, small canal around island in Lékoli River, Odzala National Park.

*Nannocharax usongo*: USNM 303795, 1, 27.7 mm SL, Cameroon, Southwest Province, Manyu, main Cross River downstream of Mamfe, at Mam River junction with Cross River.

*Nannocharax wittei*: MRAC P.36247–311, cotypes, 65, 27.1–34.9 mm SL, Kando River de Tenke.

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