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On the validity of *Pelvicachromis sacrimontis* Paulo, 1977 (Perciformes, Cichlidae), with designation of a neotype, and redescription of the species

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Abstract

Pelvicachromis sacrimontis Paulo, 1977 was originally described on the basis of an iconotype in an aquarium journal. Herein, the validity of the name as well as the species status is discussed, an updated diagnosis and description of the species is given, and a neotype and a series of paraneotypes is designated. The species differs from congeners in a combination of coloration features including a broad dark midlateral band, the absence of blue and reddish dots in the caudal fin of males, and the specific coloration of the dorsal fin in females.

Key words*:* type series

Introduction

The genus *Pelvicachromis* (Perciformes, Cichlidae) in its current definition sensu Thys van den Audenaerde (1968) and Greenwood (1987), contains eight described species. One of these species, *P. sacrimontis* Paulo, 1977, lacks a type specimen or type series, as the original description, published in an aquarium journal, only referenced an iconotype illustrated in the same article. Despite the fact that this publication does not present a complete diagnosis, it constitutes a valid description, following the applicable regulations for zoological nomenclature, mainly articles 8, 10, 23, 50 and 61 of International Code for Zoological Nomenclature.

For a long time, the validity of this taxon had either not been recognized, or the name had been defined as an "unjustified substitute" for "*Pelvicachromis camerunensis*", a name that appeared in Thys van den Audenaerde (1968), and was noted to be a commercial name that was not available (Daget *et al*. 1991). Nevertheless, specimens of this species from the MRAC collection were mentioned in Thys van den Audenaerde (1968) as *P. pulcher* B and *P.* aff. *pulcher* B, and recognized as being a distinct species, different from *P. pulcher* mainly in coloration patterns. The first recognition of the validity of *P. sacrimontis* Paulo, 1977 was by Lamboj (1999, 2004). It is the aim of this paper to present a detailed examination of the material for this species, including MRAC specimens and live aquarium imports, to discuss the status of the species as well as the validity of the name, and to give a formal diagnosis and description along with neotype designations for *P. sacrimontis*.

Material and methods

External counts and measurements follow Barel *et al*. (1977). All measurements were taken on the left side with digital calipers with an accuracy of +/- 0.03 mm. Additional specimens examined in this study are listed under Comparative materials. Radiographs were taken of some specimens for vertebral counts. In addition, live wild-caught specimens of *P. sacrimontis* and *P. pulcher* imported for the ornamental fish trade from Nigeria/Niger River system have been used for colour comparison, description of live specimens, and behavioural observations, but not included in morphological examinations or type series.

Abbreviations used throughout the text include TL: total length; SL: standard length; and HL: head length.

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Institutional abbreviations used are: AMNH, American Museum of Natural History, New York; BMNH, British Museum of Natural History, London; MRAC, Royal Museum for Central Africa, Tervuren.

Pelvicachromis sacrimontis Paulo, 1977

(Figs. 1–3, Table 1)

Neotype. MRAC 86-10-P-102, male, 66.4 mm SL, Nigeria: Chokoche, Imo River, Rivers State, 04° 59' N, 07° 59' E, collected by P.J. Akiri, August 1985.

Paraneotypes. All from Nigeria. MRAC 138748–138755, 8 males, 68.5–77.8 mm SL, d'Aba, collected by E.R. Smykala & van de Weyer, 1967.—MRAC 154410-154412, 2 males, 1 female, 57.4–77.6 mm SL, d'Aba, 05° 07' N, 07° 22' E, collected by E.R. Smykala, January 1965.—MRAC 154513–154514, 1 male, 1 ex., 56.2–57.9 mm SL, d'Aba, 05° 07' N, 07° 22' E, collected by E.R. Smykala, January 1967.—MRAC 154520–154530, for counts and measurements 3 females, 2 ex. 34.1–49.2 mm SL, d'Aba, 05° 07' N, 07° 22' E, collected by E.R. Smykala, January 1967.—MRAC 86-08-P-33, male, 65.3 mm SL, Umuayara Village, Mba Etche, Kelga Rivers State, collected by P.J. Akiri, October 1983.—MRAC 86-08-P-34, male, 71.5 mm SL, Odiemudie, Sombreiro River, Rivers State, collected by P.J. Akiri, October 1983.—MRAC 86-10-P-101, male, 66.4 mm SL, Okosos, Nun River, Rivers State. Collected by P.J. Akiri, November 1985.—MRAC 86-10-P-103, male, 66.0 mm SL, same collection data as neotype.—MRAC 88-37-P-138-142, 1 male, 2 females, 2 ex., 32.8–90.6 mm SL, River Umuayara at Umuede about 25 km NNW of Port Harcourt. Collected by T. Roberts, June 1987.—MRAC 93-039-P-0149–0150, 2 males, 65.8–65.9 mm SL, Abak, Kwa Ibo River, 04° 59' N, 07° 47' E, collected by R.P. King, February 1992.

Diagnosis. A species of *Pelvicachromis,* distinguished from all congeners by a combination of characters as follows: Differs from *Pelvicachromis taeniatus* (Boulenger, 1901) and *Pelvicachromis subocellatus* (Guenther, 1871) in absence of a pattern of pale blue and reddish dots on the caudal fin of adult males. Differs from *Pelvicachromis roloffi* (Thys van den Audenaerde, 1968) in a broader midlateral band on the body, absence of small dots in the male caudal fin, absence of red margin with whitish to bluish submargin in the female dorsal fin. Differs from *Pelvicachromis humilis* (Boulenger, 1916), *Pelvicachromis rubrolabiatus* Lamboj, 2004 and *Pelvicachromis signatus* Lamboj, 2004 in absence of dark vertical bars on body. Differs from *Pelvicachromis pulcher* in a broader midlateral band on the body, usually as broad or broader than a pale yellowish band dorsal to this dark band, iridescent blueish to turquoise coloration band on cheeks and a different coloration of the dorsal fin in females (no margin, spiny portion pale to dark and dusky orange, soft parts yellowish to clear in most posterior regions *vs*. black margin, yellow submargin and black fin base in *P. pulcher*).

FIGURE 1, Neotype of *Pelvicachromis sacrimontis*, MRAC 86-10-P-102, male, 66.4 mm SL, Nigeria: Chokoche, Imo River, Rivers State, Niger River system, 4° 59' N, 7° 59' E, Collected by P.J. Akiri, August 1985.

FIGURE 2. Comparison of coloration of males of *P. sacrimontis* and *P. pulcher*; A. male of *P. sacrimontis* in aquarium, Nigeria, Rivers State, yellow morph, SL 53 mm, not preserved; B. male of *P. sacrimontis* in aquarium, Nigeria, Rivers state, red morph, SL 67 mm, not preserved; C. male of *P. pulcher*, selected from a commercial import from Nigeria, not measured, not preserved; D. male of *P. pulcher*, F2 of commercially imported specimens from Nigeria, not measured, not preserved.

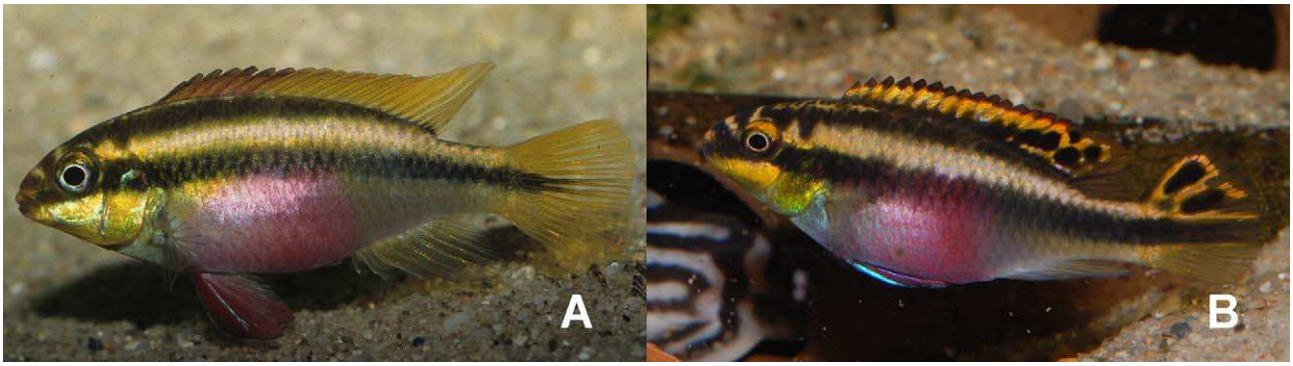

FIGURE 3. Comparison of coloration of females: A. female of *P. sacrimontis* in aquarium, Nigeria, Rivers state, SL 45 mm, not preserved; B. female of *P. pulcher* selected from a commercial import from Nigeria, not measured, not preserved.

Description. Measurements and counts for neotype and 29 paraneotypes are given in Table 1. Sexual dimorphism and dichromatism well developed. First ray of pelvic fin always longest in males, tip of pelvic fin reaching anterior base of anal fin or beyond. In females, first ray of the pelvic fin shorter or of equal length to second ray. Caudal fin rounded in both sexes. Some rays in posterior parts of dorsal and anal fins pronounced, but always much longer in males. Adult males usually 15–25% larger in TL than females.

Osteology and dentition. Infraorbital series with lachrymal and three additional tubular bones and a distinct gap between second and third (dermosphenotic) tubular infraorbital. Lachrymal with four laterosensory pores. Total vertebrae 26 or 27 (14 or 15 abdominal plus 12 or 13 caudal).

Premaxilla with 2–4 rows, dentary with 2 or 3 rows of regularly set unicuspid teeth. Anteriorly in lower jaw a few teeth are rotated and point inward. Lower pharyngeal bone triangular, with unicuspid to weakly bicuspid teeth on lateral parts of this bone, and asymmetric bicuspid teeth in central field.

Gill rakers on first gill arch. Eight to 13 tuberculate gill rakers on ceratobranchials (only one specimen with 13, which could be an aberration, the range of all other specimens is 8–10), 2–6 pointed gill rakers on epibranchials. Well-developed hanging pad on roof of the pharynx.

TABLE 1. Morphometrics and meristics of neotype and 29 paraneotypes of *Pelvicachromis sacrimontis*.

	neotype	mean	SD	range		
Standard length in mm	66.4	59.6		25.6	–	78.1
% of standard length						
Body depth	35.8	33.3	2.0	29.0	–	36.5
Head length	27.8	28.9	1.3	27.0	–	32.0
Caudal peduncle length	15.7	15.4	0.8	13.7	–	16.8
Caudal peduncle depth	15.1	14.7	0.4	14.0	–	15.3
Length of dorsal-fin base	59.4	58.4	2.1	54.1	–	61.8
Length of anal-fin base	19.2	18.7	1.4	16.1	–	22.0
Predorsal distance	26.7	27.3	1.5	25.3	–	31.1
Preanal distance	68.2	67.6	1.6	64.5	–	70.8
Prepectoral distance	28.9	32.0	2.0	28.9	–	36.0
Prepelvic distance	36.0	37.5	2.3	30.5	–	42.8
% of head length						
Head depth	77.6	72.3	4.6	62.6	–	80.6
Snout length	30.5	32.3	3.1	26.2	–	38.7
Eye diameter	31.2	30.7	2.2	27.1	–	34.2
Postorbital distance	38.3	37.0	2.5	31.7	–	41.8
Interorbital distance	40.0	36.0	3.7	29.4	–	45.3
Cheek depth	32.3	30.1	4.8	21.2	–	36.0
Lower jaw length	35.5	32.1	4.4	23.8	–	37.5
Premaxilla-dentigerous arm length	31.2	28.9	2.8	23.7	–	34.2
Preorbital distance	22.4	22.4	2.0	18.7	–	26.5
% of caudal peduncle depth						
Caudal peduncle length	103.7	105.1	6.8	91.1	–	117.1
Meristics		median				
Upper lateral-line scales	19	19		17	–	21
Lower lateral-line scales	9	9		7	–	10
Total lateral-line scales	29	29		27	–	30
Circumpeduncular scales	16				16	
Dorsal-fin spines	16	16		15	–	17
Dorsal-fin rays	9	9		8	–	10
Anal-fin spines	3				3	
Anal-fin rays	7	7		6	–	8
Pectoral-fin rays	11	11		11	–	12
Gill rakers on lower limb of first arch	11	10		9	–	13
Total gill rakers on first arch	15	15		11	–	18

Scales. Cycloid, 2 or 3 rows of scales on cheek; four horizontal rows on opercle. Dark spot on outer edge of opercle unscaled. Chest-scales smaller than body scales, 5–7 scales between pectoral and pelvic fins. Upper lateral-

line separated from dorsal-fin base anteriorly by two and a half to four scales, at 8th pored scale by one and a half to two and a half scales, and at last pored scale by a half to one and a half scale. End of upper lateral-line rarely overlapping lower lateral-line, usually separated from beginning of lower lateral line by 1–3 rows of scales (but overlap by one scale in three specimens, no scale row in between in five specimens). About 1⁄4 of caudal fin covered with scales, all other fins unscaled.

Coloration. Live specimens of both sexes are shown in Figures 2 & 3. Head and body pale brown to greyish brown. Dorsum darker than ventral parts of body. Dark scaleless spot on outer edge of opercle, often bordered at upper and lower parts by light blue to turquoise iridescent margins. Upper lip brownish to black, lower lip greyish to brown, red in males of red morph. A black mid-lateral band from posterior edge of opercle extending to middle parts or end of the caudal fin. A black dorso-lateral band reaching from front of head to about end of dorsal fin, contiguous with a soft dorsal-fin base, separated from the mid-lateral band by a pale, whitish to yellowish band of equal or lesser depth than dark mid-lateral band. Dark interorbital stripe and a second dark stripe from anterior edge of eye to upper margin of upper lips. Bluish to turquoise iridescent stripe from angle of the mouth to the posterior edge of cheek. Upper edge of eye golden-yellow. Pelvic fins with a blue margin on anterior edge, followed by a red and a blue submargin; rest of this fin reddish to violet. Pectoral fins clear to pale yellowish. Some individuals with a few black spots in upper parts of caudal fin and/or in soft dorsal-fin parts.

Male specific coloration. Dorsal fin with red margin, followed by a white submargin and black base in anterior parts and a greyish to clear base in posterior parts. Caudal fin clear to pale reddish, with a red margin on upper half, followed by a whitish to iridescent bluish part. Anal fins with red margin on anterior edge; rest of fin bluish to violet.

In coloration of ventral head and body parts (below dark mid-lateral band), three color morphs are distinguishable: one with yellowish to bluish cheeks, yellow throat, flanks and vent and a red blotch on the belly (= yellow morph; Fig. 2A). Second morph with bright red on lower half of head including lower lip, the whole vent and the flanks until close to the origin of the anal fin (= red morph; Fig. 2B), third with greenish parts corresponding to those that are yellowish in the yellow morph (= green morph). Red blotch on belly can disappear in submissive or stressed specimens.

Female specific coloration. No clear distinction between females of the three color-morphs. Dorsal fin without margin, spiny portion pale dark and dusky orange, soft parts yellowish to clear in most posterior regions (Fig. 3A). Spiny parts can be dark grey to blackish when courting. Caudal and anal fin transparent yellow. Lower caudal body parts grey to black. Bright red belly, but pale after spawns and in breeding coloration. Flanks and breast pale yellow to bluish, same with lower opercula and subopercular region of head, sometimes pale reddish in females of red morph and more dusky to blackish in aggressive and courting females of all color morphs.

Juveniles of both sexes (before acquiring adult coloration) exhibit a pattern of two, rarely three rows of irregular dark spots on brown coloration, up to about 12–15 mm SL. With increasing size, sex-specific coloration is seen.

Preserved specimen coloration. Head and body brown, darker dorsally (Fig. 1). Dark spot on outer edge of opercle. Both dark longitudinal stripes visible in most individuals, reaching from posterior edge of eye, extending into the caudal fin, but absent in few, possibly in cause of condition or duration of preservation. Dark interorbital stripe and a second dark stripe from anterior edge of eye to upper margin of upper lips visible in some specimens, but front of head often uniformly dark brown.

Breeding behaviour. In aquaria, this species is a monogamous, pair bonding cave-spawner. Eggs are guarded by both sexes, but always more intensively and more often by the female. Hatching occurs after three days post-spawn. Larvae are usually deposited on the bottom of the cave, rarely in other caves nearby the original cave. Juveniles are free swimming eight or nine days post-hatching and guarded by both parents for about five to six weeks. Breeding and guarding individuals of both sexes regularly exhibit a more prominent midlateral black stripe. This is typical for breeding and guarding specimens of both sexes in many other cave breeders within the chromidotilapiine lineage, especially in congeners.

Distribution. This species is only known from southwestern parts of Nigeria and seems to be restricted to the Niger and Cross river systems. Detailed locality descriptions are not available.

Etymology. Sacri from Latin *sacer*, meaning holy, and montis from Latin *mons/montis* meaning mountain - in total the name serves as a Latin translation for Heiligenberg, a German biologist cited by Paulo in his description of the species.

Discussion. The history of the name of *Pelvicachromis sacrimontis* is a somewhat confusing one. It was mentioned in Thys van den Audenaerde (1968) as *Pelvicachromis* aff. *pulcher* , but also in the same paper as *P. pulcher* type 2 and *P. pulcher*—B. This is in contrast to *P. pulcher* A and *P. pulcher* type 1—working titles in Thys van den Audenaerde (1968) referring to the species originally described by Boulenger in 1901 as *Pelmatochromis pulcher* (= *Pelvicachromis pulcher*). In the same paper Heiligenberg (1965) was cited for the recognition, without a formal description, of the undescribed species as a polymorphic *Pelmatochromis* species with two color morphs in males and one in females. However, *Pelvicachromis pulcher* A was clearly identified by Thys van den Audenaerde (1968) as identical with the specimens of the type series of *P. pulcher*, which can be confirmed by this study.

Thys van den Audenaerde (1968) also wrote that his *P. pulcher* B was a distinct species and had often occurred in the aquarium trade as "*Pelmatochromis camerunensis*", however, a valid description with use of this name had not been published. In subsequent years, the proper use of names for *P.* aff. *pulcher* was rare. Very often it has been imported as *Pelvicachromis pulcher* "Red", also in scientific collections it has been mostly labelled as *P. pulcher* or *P.* aff. *pulcher* (pers. obs.).

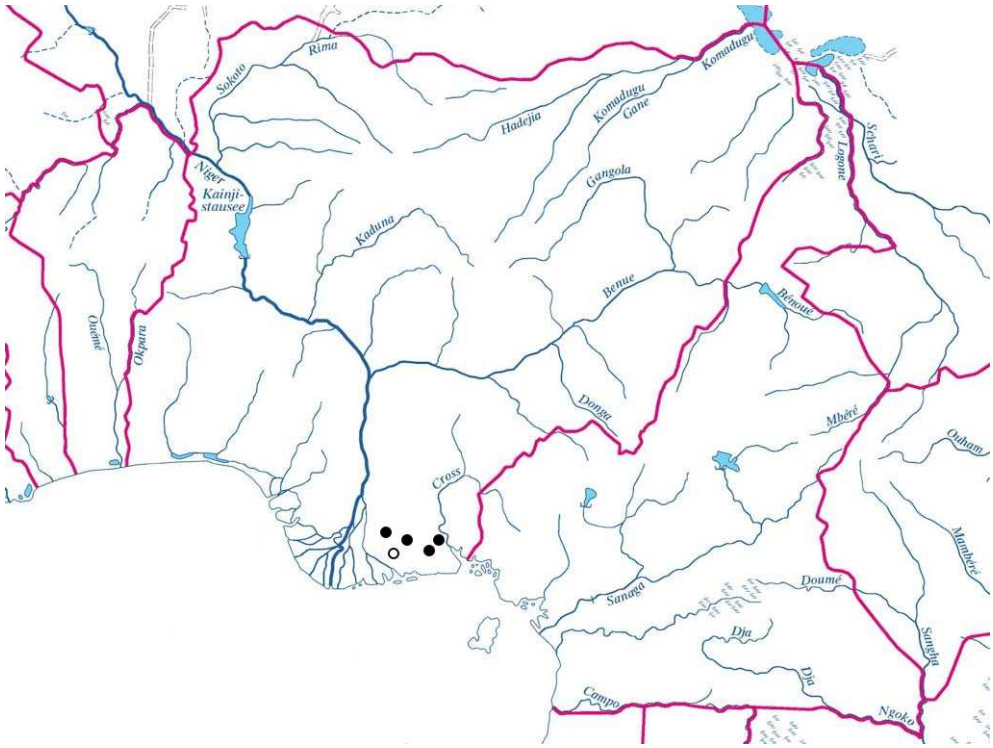

FIGURE 4. Distribution map for *P. sacrimontis*, based on collection data of neotype and paraneotypes; unfilled dot = type locality for neotype.

In 1977, German aquarist J. Paulo published an article in the monthly journal of the German Cichlid Association (DCG-Info) that mainly dealt with general comments about the genus *Pelvicachromis*, with a special focus on the taxon *P. kribensis* (Boulenger, 1911). In this paper, Paulo also discussed comments by Thys van den Audenaerde (1968) about *P. pulcher* B and wrote that, this species now is known as *Pelvicachromis sacrimontis* (original text: "…kennen wir heute als *Pelvicachromis sacrimontis* (nach Heiligenberg)"). In the following passages of the article Paulo gave a rough description of the species based on coloration, always using the name in a scientific writing style. He also gave black and white pictures of the species, labelling these pictures as *P. sacrimontis*. He never gave any reference for the origin of this name. Therefore it is not clear if Paulo used this name by error or misinterpretation of a paper by Heiligenberg, or intentionally. Curiously, the name "*sacrimontis*" is a Latin translation for the name of Heiligenberg. Whatever the case, this paper satisfies the requirements in effect at that time for a formal description of *P. sacrimontis*, even though it is based on an iconotype and lacks morphometric data or a type series.

Regarding Thys van den Audenaerde (1968) and the results of the present study, both species are nearly identical anatomically, but show some differences in coloration pattern, as also recognized by Heiligeberg (1965) and Paulo (1977). Strongly conserved morphologies are common between *Pelvicachromis* species, as shown in

other publications as well; nevertheless, coloration differences are established as sometimes the only characters available to distinguish several species of the genus (e.g., Lamboj & Stiassny 2007). Some of the coloration patterns in *P. sacrimontis*, especially the dorsal-fin coloration in females and the broad mid-lateral band can be seen as autapomorphic characters, occurring neither in any population or color morph of *P. pulcher* nor in any other congener.

Additionally, our observations and those of Paulo (1977) demonstrate that hybridization between *P. pulcher* and *P. sacrimontis* seems not to occur, at least not under aquarium conditions. Also, preliminary results of an on-going study of DNA-sequences in *Pelvicachromis* species reveal 20% differences in the mitochondrial protein-coding gene NADH dehydrogenase subunit 2 (ND2) and 17.3% in cytochrome *b* (CytB). This supports the separation of these two species, and confirms the validity of *Pelvicachromis sacrimontis* Paulo (1977).

Comparative materials

Pelvicachromis pulcher: All from Nigeria, Niger River system. BMNH 1901.1.28.13-20, syntypes, 5 males, 3 females, 55.7–90.0 mm SL, Mouth of Ethiop River, Sapele station, coll. W.J. Ansorge.—BMNH 1902.11.10.221–228, 4 males, 4 females, 31.7–45.7 mm SL, Assay, coll. W.J. Ansorge.—BMNH 1902.11.10.229–230, 1 male, 1 female, 29.2–32.7 mm SL, Agbera, coll W.J. Ansorge.—BMNH 1912.2.2.9, male, 50.1 mm SL, Wari, lower Niger, coll. J.P. Arnold.—BMNH 1984.7.27.1048–1053, 1 male, 4 ex., 20.6–34.2 mm SL, Akio, Aye River, 06° 44' 30“ N, 03° 45' 0“ E, coll. D.H.J. Sidenham.—MRAC 154804–807, 2 males 2 females, 46.9–68.2 mm SL, Lagos, 06° 27' N, 03° 23' E, coll. F. Gagelmann, March 1951.—MRAC 154809-810, 2 males, 66.1–70.6 mm SL, Sapelle, 05° 55' N, 05° 42' E, coll. F. Gagelmann, January 1951.—MRAC P 154821, female, 53.3 mm SL, Lagos, 06° 27' N, 03° 23' E, coll. F. Gagelmann, June 1951.—MRAC 84-20-P-262, female, 56.8 mm SL, New Calabar River, 04° 55' N, 06° 52' E, coll. L. Risch, March 1984.—MRAC 84-51-P-17, male, 48.2 mm SL, 2 km SW of Aking (Awsawmba, Cross River State, 05° 04' N, 08° 30' E, coll. J.C. Reid, October 1980.—MRAC 84-51-P-68–69, 2 males, 38.2–41.1 mm SL, Ayip Eku Palm Oil Estate, Cross River State, 05° 24' N, 08° 42' E, coll. J.C. Reid, September 1980.—MRAC 86-08-P33, male, 65.3 mm SL, Umuayara village, Mba Etche Kelga, Rivers State, 05° 12' N, 07° 06' E, coll. P.J. Akirir, October 1983.—MRAC 86-08-P-34, male, 71.5 mm SL, Sombreiro River, coll. P.J. Akiri, August 1985.—MRAC 86-10-P-101, male, 66.4 mm SL, Nun River, 05° 07' N, 06° 21' E, coll. P.J. Akiri, November 1985.—MRAC 88-35-P 434–435, 2 males, 75.6–77.1 mm SL, New Calabar River, 04° 55‘ N, 06° 49‘ E, coll. C.B. Powell, January 1986.—MRAC 88-35-P-436–438, 2 males, 1 female, 57.869.4 mm SL, 3 km south of Isiokpo, New Calabar, coll. C.B. Powell, January 1988.—MRAC 88-43-P-439–442, 2 males, 1 females, 40.7–52.2 mm SL, Taylor Creek at Joinkrama, 05° 11' N, 06° 30' E, coll. C.B. Powell, February 1988.—MRAC 90-019-P-0463–0489, 16 males, 11 females, 31.564.2 mm SL, New Calabar River, 3 km south of Isiokpo, 04° 57' N, 06° 53' E, coll. C.B. Powell, May 1988.—MRAC 91-01-P-411–414, 4 males, 35.8–54.7 mm SL, Taylor Creek, 05° 14' N, 06° 32' E, coll. C.B. Powell, December 1990.—MRAC 91-067-P-0549, female, 43.4 mm SL, Okoso Creek, 05° 08' N, 06° 23' E, coll. C.B. Powell, July 1991.—MRAC 91-055-P-0602–0603, 1 male, 1 female, 50.9–56.8 mm SL, Orashi River, 05° 01' N, 06° 27' E, coll. C.B. Powell, June 1991.—MRAC 91-010-P-0653, male, 48.4 mm SL, Orashi River, 05° 01' N, 06° 27' E, coll. C.B. Powell, January 1988.—MRAC 92-014-P-0125, male, 53.7 mm SL, Orashi River at Odieke, 05° 01‘ N, 06° 27' E, coll. C.B. Powell, November 1991.—MRAC 93-039-P0147–0148, 2 males, 44.5–54.1 mm SL, Kwa Ibo River, 04° 44' N, 08° 02' E, coll. R.P. King, July 1992.

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