

***Geophagus parnaíbae* sp. n. – a new species of cichlid fish (Teleostei: Perciformes: Cichlidae) from the rio Parnaíba basin, Brazil**

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Abstract. *Geophagus parnaíbae* sp. n. is described from the drainage of the rio Parnaíba in the states of Piauí and Maranhão (northeastern Brazil). It can be distinguished from all other described *Geophagus* species by the following combination of characters: caudal fin with a pattern of parallel longitudinal bands, no infraorbital stripe or black preopercular mark, 30–31 scales in a lateral line and small size.

Resumo. *Geophagus parnaíbae*, espécie nova, é descrita da drenagem do rio Parnaíba (Estados de Piauí e Maranhão, região nordeste do Brasil). *Geophagus parnaíbae* é distinta das demais espécies descritas do gênero *Geophagus* pela combinação de seguintes caracteres: pradrão de colorido da nadadeira caudal (presença de listras estreitas longitudinais), sem faixa infraorbital ou mancha preopercular, 30–31 escamas no linha lateral e tamanho pequeno.

Resumen. Se describe una nueva especie de cíclido, *Geophagus parnaíbae*, de la cuenca del río Parnaíba en los Estados Piauí y Maranhão (noroeste de Brasil). La nueva especie se distingue de todas las demás especies del género *Geophagus* por la siguiente combinación de caracteres diagnósticos: aleta caudal con bandas longitudinales, ausencia de franja infraorbital o marca preopercular, 30–31 escamas en una serie longitudinal y talla pequeña.

Kurzfassung. *Geophagus parnaíbae* sp. n. wird aus Zuflüssen des rio Parnaíba beschrieben, die in den beiden Bundesstaaten Piauí and Maranhão im nordöstlichen Brasilien liegen. Dieser Cichlide unterscheidet sich von allen anderen bisher beschriebenen *Geophagus*-Arten durch die Kombination folgender diagnostischer Merkmale: Schwanzflosse mit deutlichem Muster von Längslinien, ohne Infraorbitalstreifen oder Präopercularfleck, 30–31 Schuppen in der Längsreihe und die geringe Totallänge.

Key words. Systematics, ichthyology, freshwater, ecology, Cichlidae, new species, Brazil.

Introduction

The South American cichlid genus *Geophagus* HECKEL, 1840 was reviewed and redescribed by GOSSE in 1976. Ten years later KULLANDER revised the genus again and restricted it to include only species with more caudal than abdominal vertebrae and a particular swimbladder morphology (KULLANDER, 1986). The genus, which contains medium-sized to moderately large geophagine cichlids (TL approximately 12 to 25 cm), is widely distributed in the Amazon and Orinoco basins and on the Guyana Shield. Three species are known from the northern foothills of the Brazilian Highlands where they are distributed in the drainages of Rio Parnaíba, Rio Pinaré and Rio Gurupi in the three states of Pará, Maranhão and Piauí. As currently recognized, *Geophagus* includes fourteen nominal species (LÓPEZ-FERNÁNDEZ & TAPHORN, 2004), but numerous others remain to be described (WEIDNER, 2000; STAWIKOWSKI & WERNER, 2004).

The species described below is an example of the many cichlid, loriciariid and callichthyid catfish species which are well-known both in the aquarium trade and the popular literature long before their formal description is available. In the genus *Geophagus* there are more than two dozens of such species (cf. STAWIKOWSKI & WERNER, 2004), referred to by popular names. The species provisionally referred to as *Geophagus* sp. “Parnaíba” appears to have been known in the aquarium trade since 1988 when it was first imported as an aquarium fish to Germany (STAWIKOWSKI, 1988).

Subsequently the species was described or depicted in a colour photo by STAWIKOWSKI (1988), WEIDNER (2000), STAECK (2004) and STAWIKOWSKI & WERNER (2004). The purpose of the present paper is to give a formal description of this species bringing the total number of described species in the genus to fifteen.

Material and Methods

The holotype and paratypes were fixed in formalin and later transferred into 75% ethanol. The type specimens are deposited in the Museum für Tierkunde Dresden (MTD F).

The techniques for taking measurements and meristic data follow those described in KULLANDER (1986, 1990) and KULLANDER & NIJSSEN (1989). Measurements were made with a dial caliper reading to the nearest 0.1 mm. Number in brackets after counts indicate the number of specimens examined with that condition.

Abbreviations: E1 = row of scales in the horizontal series directly above the longitudinal row including the lower lateral line; SL = standard length; TL = total length; MTD F = Staatliche Naturhistorische Sammlungen Dresden, Museum für Tierkunde, Fischsammlung.

Geophagus parnaiba sp. n. (Figs. 1–3, Tables 1–2)

Holotype. MTD 28759, 66.2 mm SL, Northeastern Brazil (Estado Maranhão), Richao Ponti near Timon (drainage of the rio Parnaíba), SERGIO MARTINS & W. STAECK, *leg.* April 1989.

Paratypes. MTD F 28664–28671, 8 specimens 57.8–75.9 mm SL, collecting data like holotype.

Diagnosis. A small species of *Geophagus* (largest type 75.9 mm SL), which differs from all the other described species in the genus in the combination of (1) the lack of a dark infraorbital stripe or black preopercular markings, (2) a caudal fin with distinct longitudinal bands, (3) only 30 or 31 scales in E1 row and (4) the small size (max. TL approx. 160 mm).

Etymology. The species epithet *parnaiba* is a noun in the genitive case and refers to the distribution of the species in the basin of the rio Parnaíba.

Description. Based on the holotype, with notes on the paratypes. See figs. 1 and 3 for general shape and colour patterns. Measurements are summarized in Table 1, selected counts in Table 2. Body moderately deep; dorsal outline more arched than ventral outline. Snout moderately long. Dorsal head profile slightly curved. Orbit in about middle of head length, close to frontal contour. Snout moderately long. Lips in larger specimens comparatively thick; lower lip with caudally expanded fold. Soft dorsal and anal fin pointed. Caudal fin truncate, tip of both lobes with pointed prolongation. Pelvic fins pointed, produced into a filament reaching posterior end of anal-fin base. Scales on body and nape ctenoid; cheek and pre-pelvic scales cycloid. Cheeks with 4 or 5 scale rows; interopercle with 1, 2 or 3 scales. Anal, pelvic and pectoral fin naked. Dorsal fin with minute scales along its base; some specimens with additional small interradiation scales in the posterior soft-rayed part. Caudal fin densely scaled up to $\frac{3}{4}$ of its length in its upper and lower parts; middle of caudal fin scaled only at its base. Jaw teeth unisupid, slightly recurved. Teeth in outer row larger than those of inner rows. In upper jaw 3 teeth rows; outer row with 16–26 teeth (4); lower jaw with 3 or 4 teeth rows; outer row with 19–23 teeth (4). Lower pharyngeal tooth plate elongate; width of bone 85% of its length; length of dentigerous area 80% of its width; 23 teeth in posterior row, 6 teeth in median row (2). External gill rakers on first gill arch, 8–9 epibranchial lobe, 1 in angle and 9 (1), 10 (4) or 11 (1) on ceratobranchial. 14 pre- and 17 caudal vertebrae (1).



Fig. 1: *Geophagus parnaibae* sp. n., holotype.

Table 1: Morphometry of *Geophagus parnaibae*. Measurements of holotype and 8 paratypes in percents of SL (except SL in mm); min = lowest value, max = highest value, mean = arithmetic mean, sd = standard derivation.

| Measurement | min | max | mean | sd |
|------------------------------|------|------|-------|------|
| Standard length | 57.8 | 75.9 | 64.72 | |
| Head length | 31.7 | 35.5 | 33.81 | 1.39 |
| Snout length | 11.1 | 13.1 | 12.07 | 0.59 |
| Body depth | 38.8 | 42.3 | 40.96 | 1.12 |
| Eye diameter | 10.4 | 12.4 | 11.44 | 0.81 |
| Interorbital width | 7.9 | 9.6 | 8.83 | 0.52 |
| Preorbital depth | 10.9 | 12.4 | 11.43 | 0.50 |
| Caudal peduncle depth | 13.2 | 14.2 | 13.57 | 0.34 |
| Caudal peduncle length | 14.4 | 16.6 | 15.63 | 0.87 |
| Pectoral fin length | 31.6 | 35.8 | 34.52 | 1.19 |
| Last dorsal fin spine length | 16.1 | 19.2 | 17.65 | 0.86 |

Dorsal fin XVII.9 (1), XVII.10 (6), XVII.11 (2). Anal fin III.7 (8), III.8 (1). Pectoral fin 13 (1), 14 (7), 15 (1). Pelvic fin I.5 (9). Caudal fin 16 (9). Scales in E1 row 30(3), 31(6). Scales on upper lateral line: 20 (3), 21 (6); on lower lateral line 11, (1), 12 (5), 13 (2), 14 (1).

Colouration in life. The species was illustrated in colour photos by STAWIKOWSKI (1988), WEIDNER (2000), STAECK (2004) and STAWIKOWSKI & WERNER (2004).

Adult specimens with metallic greenish to golden ground colour. Forehead and nape dark grey. Lower region of head often with more or less confluent iridescent bluish dots. Chest and belly greyish white. Scales on the body sides mostly with an orange dot, forming approximately ten thin longitudinal lines. Dorsal, caudal and anal fin with a distinct pattern of alternating maroon and whitish horizontal bands. Pelvic fins with similar longitudinal banding. In the middle of the flanks with a black lateral blotch situated on the upper lateral line and extending dorso-ventrally to the scales of E1.



Fig. 2: The ventral view of *Geophagus parnaibae* sp. n. (left holotype, right paratype of similar length) shows the variation of the size of lips.

Table 2: Selected counts (mode value) of species of the *Geophagus surinamensis*-complex. Data according to 1 = LOPEZ-FERNANDEZ & TAPHORN (2004), 2 = GOSSE (1976), 3 = HECKEL (1840), 4 = KULLANDER (1986), 5 = KULLANDER & NIJSSEN (1989), 6 = present study.

| Species | Scales in E1 row | Number of dorsal-fin spines | Number of dorsal-fin rays | Number of anal-fin rays |
|---------------------------------------|------------------|-----------------------------|---------------------------|-------------------------|
| <i>G. camopiensis</i> ² | 31 | XVI | 11 | 7 |
| <i>G. parnaibae</i> ⁶ | 31 | XVII | 10 | 7 |
| <i>G. abalios</i> ¹ | 34 | XVIII | 11 | 8 |
| <i>G. altifrons</i> ³ | 37 | XVIII | 11 | 8 |
| <i>G. brachybranchus</i> ⁵ | 33 | XVII | 12 | 8 |
| <i>G. brokopondo</i> ⁵ | 33 | XVII | 12 | 8 |
| <i>G. dycrozoster</i> ¹ | 36 | XVII | 12 | 8 |
| <i>G. megasema</i> ³ | 37 | XVII | 12 | 8 |
| <i>G. proximus</i> ⁴ | 33 | XVII | 12 | 8 |
| <i>G. surinamensis</i> ⁵ | 33 | XVII | 12 | 8 |
| <i>G. winnemilleri</i> ¹ | 35 | XIX | 11 | 8 |

Colouration in alcohol. Ground colour yellowish white. Front and nape dark grey. Lower portion of head, chest and belly white. On the flanks up to ten narrow horizontal lines formed by the brown margins of the scales on the body sides. In the middle of the side a dark brown or black lateral spot on and below the upper lateral line. Unpaired fins with pattern of alternating grey and light horizontal bands.

Geographical distribution. As currently known, *Geophagus parnaibae* has a restricted distribution for it seems to be endemic to the drainage of the rio Parnaíba in northeastern Brazil (Estados of Piauí and Maranhão).



Fig. 3: *Geophagus parnaibae* sp. n., topotype, approx. 9 cm TL.



Fig. 4: Collecting site of *Geophagus parnaibae* sp. n. in the drainage of the rio Parnaíba approx. 20 km west of Teresina (Estado Maranhão).

The species is known from the following localities: tributary of the rio das Balsas between Richão and Balsas, small tributaries to rio Longa near Esperantina and near Barras, Richão Pontal near Timon and small tributary to rio Poti near Monsenhor Gil.

Ecological notes. Field observations indicate that the habitats preferred by *Geophagus parnaibae* are bare sandy bottoms in brooks and small rivulets which may have a remarkably strong current during the rainy season (STAWIKOWSKI, 1988). But during the dry season and the period of low water this species is frequently also found in pools and ponds with more or less stagnant water.

Water data collected between April and September at several collecting sites: pH 6,5–7,6; electrical conductivity 20–350 $\mu\text{S}/\text{cm}$; water temperature 24–31 °C. The stomach and adjacent intestine of a specimen with a SL of 65 mm contained 80% plant matter (mainly seeds), aquatic insect larvae, detritus and sand grains. The associated fish fauna included *Crenicichla menezesi*, *Apistogramma piauensis*, *Hoplias malabaricus*, *Micropoecilia branneri*, *Aspidoras raimundi*, *Otocinclus hasemani*, *Pimelodus* sp. and several characid species.

Reproductive behaviour. *Geophagus parnaibae* is a larvophile primitive mouthbrooder and practices biparental custodial care of its eggs and fry (STAWIKOWSKI & WERNER, 2004). Like several of its congeners this species starts reproduction like a substratum spawner, but switches over to mouthbrooding as soon as the larvae hatch.

Discussion

Geophagus parnaibae is a species of the *G. surinamensis*-complex (as diagnosed by LOPEZ-FERNANDEZ & TAPHORN, 2004). It can be distinguished from all the described species outside this species-complex by the lack of a complete infraorbital stripe. Within the *surinamensis*-complex the lack of a preopercular mark distinguishes *Geophagus parnaibae* from *G. dicrozoster*, *G. winemilleri*, *G. proximus* and *G. brachybranchus*. It can be distinguished from other *Geophagus* species without head markings except *G. camopiensis* by the low number of only 30 or 31 scales in E1 row. It differs from *G. abalios* (max. TL 20 cm), *G. altifrons* (23 cm), *G. camopiensis* (20 cm) and *G. megasema* (20 cm) by its smaller size (max. TL approx. 160 mm versus 200–250 mm) and from *G. surinamensis* and *G. brokopondo* by parallel horizontal bands versus light round spots in the caudal fin (cf. KULLANDER & NIJSSEN, 1989).

We recognize two different subclades within the *surinamensis*-complex: One with species having a higher number of scales in E1 and usually 8 anal fin rays, and another subclade with the two species *G. camopiensis* and *G. parnaibae* with a lower number of scales in E1 and usually only 7 anal fin rays (see Table 2). These diagnostic characters may reflect a closer phylogenetic relationship.

Geophagus parnaibae differs from *G. camopiensis* by a smaller (versus large) lateral spot, distinct longitudinal bands (versus light blotches) in the caudal fin, usually XVII (versus XVI) dorsal fin spines and usually 10 (versus 11) dorsal fin rays.

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