*Zootaxa* 1039: 57–64 (2005)
www.mapress.com/zootaxa/


ISSN 1175-5326 (print edition)
**ZOOTAXA**
ISSN 1175-5334 (online edition)

**1039**

# *Simpsonichthys nielseni* sp. n. (Teleostei: Cyprinodontiformes: Rivulidae): a new annual killifish from the São Francisco River basin, Brazil

WILSON J. E. M. COSTA

*Laboratório de Ictiologia Geral e Aplicada, Departamento de Zoologia, Universidade Federal do Rio de Janeiro, Caixa Postal 68049, CEP 21944-970, Rio de Janeiro, RJ, Brasil. wcosta@acd.ufrj.br*

## Abstract

*Simpsonichthys nielseni*, new species, is described from the middle São Francisco River basin, Brazil. It is a member of the *S. notatus* species group (which includes *S. notatus*, *S. stellatus*, *S. similis*, *S. rufus*, *S. trilineatus*, *S. auratus*, and *S. radiosus*), which is characterized by a derived pattern of frontal squamation. The new species differs from congeners by possessing a unique color pattern of the caudal fin in males, which includes six or seven light blue stripes diverging from the fin base, terminating in sharp tips on the fin margins. *Simpsonichthys nielseni* and *S. stellatus* share an apomorphic color pattern consisting of elongated light spots alternating with black zones on the dorsal-fin base in males.

**Key words:** Annual fish, killifish, Cyprinodontiformes, Rivulidae, *Simpsonichthys*, São Francisco River, systematics, taxonomy, new species

## Resumo

*Simpsonichthys nielseni*, espécie nova, da bacia do médio rio São Francisco, é descrita. Ela é um membro do clado grupo de espécies *S. notatus*, que inclui *S. notatus*, *S. stellatus*, *S. similis*, *S. rufus*, *S. trilineatus*, *S. auratus* e *S. radiosus*, diagnosticado por um padrão derivado de escamação frontal. A nova espécie difere de outros congêneres por possuir um padrão exclusivo de colorido de nadadeira caudal em machos, no qual seis ou sete faixas divergem da base da nadadeira, terminando em pontas agudas nas margens da nadadeira. *Simpsonichthys nielseni* e *S. stellatus* compartilham um padrão apomórfico de colorido consistindo de manchas claras alongadas alternando com zona negras na base da nadadeira dorsal em machos.

*Accepted by C. Gilbert: 5 Jul. 2005; published: 23 Aug. 2005*

## Introduction

*Simpsonichthys* de Carvalho is a speciose assemblage of Neotropical aplocheiloid annual killifishes, comprising 43 species from an area encompassing northeastern, central, and eastern South America (Costa, in press). It includes several well-corroborated clades, often diagnosed by unique morphological characters (Costa, 1996, 2003, in press). The *S. notatus* species group, diagnosed by a derived frontal squamation, includes seven species: *S. notatus* (Costa, Lacerda & Brasil) and *S. radiosus* Costa & Brasil, from the Tocantins River basin; and *S. stellatus* (Costa & Brasil), *S. rufus* Costa, Nielsen & De Luca, *S. trilineatus* (Costa & Brasil), *S. auratus* Costa & Nielsen, and *S. similis* Costa & Hellner, from the rio São Francisco River basin in Brazil and (Costa & Brasil, 2004; Costa, in press). A new species of this group is herein described.

## Material and Methods

Measurements and counts follow Costa (1995). Measurements are presented as percentages of standard length (SL), except for those relative to head morphology, expressed as percentages of head length. Fin-ray counts include all elements; number of vertebrae, gill-rakers, and pectoral, pelvic and caudal-fin rays were recorded only from cleared and stained specimens; the compound caudal centrum was counted as a single element. Osteological preparations were made according to Taylor and Van Dyke (1985). Terminology follows Hoedeman (1958) for frontal squamation and Costa (2001) for cephalic neuromast series. The abbreviation c & s means specimens cleared and stained for bone and cartilage. Material is deposited in MCP, Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Brazil, and UFRJ, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil.

### *Simpsonichthys nielseni* new species
(Figs. 1–2)

*Simpsonichthys* sp. (Costa, in press).

**Holotype.** UFRJ 6060, male, 37.0 mm SL; Brazil: Estado de Minas Gerais, temporary pool in Pirapora, São Francisco River floodplains, 17º21'59.6"S 44º56'32.3"W, altitude 500 m; W. J. E. M. Costa & C. P. Bove, 22 January 2005.

**Paratypes.** UFRJ 6061, 3 males, 36.3-40.5 mm SL, 4 females, 29.1-31.1 mm SL; UFRJ 6062, 1 male, 32.8 mm SL, 4 females, 29.8-30.7 mm SL (c&s); MCP 37306, 1 male, 37.2 mm SL, 1 female, 30.9 mm SL; all collected with holotype.

  

**FIGURE 1.** *Simpsonichthys nielseni*, UFRJ 6060, male, holotype, 37.0 mm SL (one day after collection); Brazil: Minas Gerais: Pirapora: middle rio São Francisco basin.

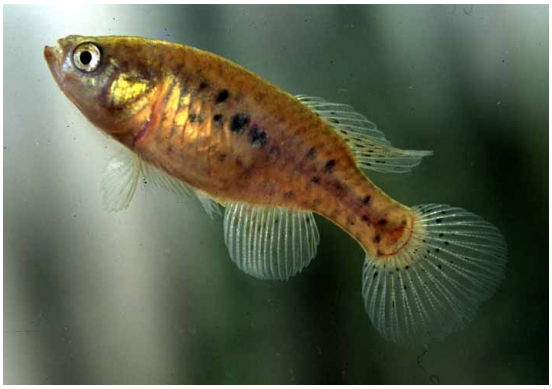

**FIGURE 2.** *Simpsonichthys nielseni*, UFRJ 6061, female, paratype, 31.1 mm SL (one day after collection); Brazil: Minas Gerais: Pirapora: middle rio São Francisco basin.

**FIGURE 3.** Brazil: Minas Gerais: Pirapora: temporary pool near rio São Francisco; type locality of *Simpsonichthys nielseni*.

  

**FIGURE 4.** Brazil: Minas Gerais: Pirapora: detailed view of the point where the type series of *Simpsonichthys nielseni* was collected.

**FIGURE 5.** *Simpsonichthys stellatus*, UFRJ 4769, male, 35.7 mm SL; Brazil: Minas Gerais: city of São Francisco: middle rio São Francisco basin.

**FIGURE 6.** *Simpsonichthys radiosus*, UFRJ 6017, male, holotype, 23.4 mm SL; Brazil: Goiás: Formosa: upper Rio Tocantins basin.

**Diagnosis:** Distinguished from all congeners in having six or seven light greenish yellow stripes on the caudal fin in males. Similar to *S. stellatus* and distinguished from all other species of the *S. notatus* group by possessing a row of elongated light spots alternating with black interspaces on the basal portion of the dorsal fin in males (vs. never a similar color pattern). Differs from *S. stellatus* in having caudal fin greenish yellow in males (vs. dark brownish red) and by the absence of a dark gray to black distal stripe on the anal fin in males (vs. presence).

**Description:** Morphometric data appear in Table 1. Males larger than females, the largest male examined 40.5 mm SL. Dorsal profile convex from snout to end of dorsal-fin base, approximately straight on caudal peduncle. Ventral profile convex from lower jaw to end of anal-fin base, nearly straight on caudal peduncle. Body moderately deep, compressed, depth about 1.8 times body width in larger males. Greatest body depth at level of pelvic-fin base. Caudal peduncle short, about two thirds length of head.

**TABLE 1.** Morphometric data of *Simpsonichthys nielseni*. H: holotype (UFRJ 6060).

| | males | | | | | females | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | H | paratypes | | | | | | | | |
| Standard length (mm) | 37.0 | 40.5 | 38.1 | 37.2 | 36.3 | 31.1 | 30.9 | 30.9 | 30.4 | 29.1 |
| **Percents of standard length** | | | | | | | | | | |
| Body depth | 37.2 | 35.6 | 36.4 | 37.9 | 34.7 | 35.3 | 33.9 | 34.5 | 34.3 | 34.5 |
| Caudal peduncle depth | 17.5 | 16.7 | 17.5 | 18.2 | 16.0 | 15.5 | 14.8 | 15.3 | 15.1 | 14.8 |
| Predorsal length | 44.8 | 46.6 | 44.9 | 44.1 | 45.9 | 59.5 | 59.9 | 61.4 | 60.7 | 59.3 |
| Prepelvic length | 47.8 | 47.0 | 46.7 | 46.6 | 47.5 | 55.0 | 53.9 | 54.5 | 54.0 | 52.7 |
| Length of dorsal-fin base | 40.7 | 38.6 | 39.3 | 41.4 | 38.8 | 26.0 | 23.3 | 23.1 | 24.6 | 25.9 |
| Length of anal-fin base | 34.6 | 35.0 | 35.4 | 35.4 | 33.9 | 22.9 | 20.8 | 21.4 | 21.8 | 23.0 |
| Caudal-fin length | 36.1 | 35.5 | 34.4 | 34.2 | 34.0 | 32.1 | 32.0 | 32.6 | 31.5 | 32.2 |
| Pectoral-fin length | 28.6 | 27.9 | 27.2 | 27.5 | 26.6 | 23.3 | 22.0 | 23.3 | 23.6 | 23.9 |
| Pelvic-fin length | 11.1 | 11.8 | 11.1 | 10.7 | 11.3 | 10.3 | 10.6 | 10.2 | 10.6 | 10.8 |
| Head length | 30.8 | 29.0 | 29.9 | 30.1 | 30.3 | 31.3 | 29.5 | 31.6 | 32.7 | 30.4 |
| **Percents of head length** | | | | | | | | | | |
| Head depth | 102.0 | 107.3 | 104.6 | 105.7 | 100.1 | 97.6 | 102.8 | 94.1 | 92.5 | 96.8 |
| Head width | 68.7 | 69.8 | 73.1 | 69.3 | 67.2 | 71.3 | 75.1 | 70.3 | 69.8 | 72.3 |
| Snout length | 14.8 | 14.4 | 14.1 | 14.5 | 14.4 | 13.5 | 14.8 | 14.0 | 12.7 | 14.6 |
| Lower jaw length | 21.2 | 20.9 | 20.2 | 21.4 | 18.5 | 17.8 | 19.5 | 16.9 | 16.8 | 18.1 |
| Eye diameter | 24.9 | 26.0 | 26.8 | 26.4 | 27.7 | 28.8 | 30.9 | 29.6 | 27.3 | 29.4 |

Tip of dorsal fin pointed. Tip of anal fin pointed in males, rounded in females. Short filamentous rays on tips of dorsal and anal fins in males, tip of filaments reaching vertical through caudal-fin base. Anterior and posterior rays of dorsal-fin rays, including rays on

  

tip of fin, unbranched; the median rays branched. Caudal fin subtruncate in males, rounded in females. Pectoral fin elliptical. Posterior margin of pectoral fin reaching vertical between base of 4th and 6th anal-fins ray in males, through pelvic-fin base in females. Tip of pelvic fin reaching between base of 3rd and 4th anal-fin rays in males, between urogenital papilla and base of 1st anal-fin ray in females. Pelvic-fin bases medially in contact. Dorsal-fin origin anterior to anal-fin origin in males, anal-fin origin on vertical between base of 2nd and 4th dorsal-fin rays; dorsal-fin origin slightly anterior to slightly posterior to anal-fin origin in females. Dorsal-fin origin between neural spines of vertebrae 8 and 9 in males, between neural spines of vertebrae 9 and 11 in females. Anal-fin origin between pleural ribs of vertebrae 8 and 9 in males, between pleural ribs of vertebrae 9 and 11 in females. Dorsal-fin rays 21–22 in males, 16–17 in females; anal-fin rays 19–21 in males, 17–18 in females; caudal-fin rays 25–27; pectoral-fin rays 12–13; pelvic-fin rays 6.

Scales large, cycloid. Body and head entirely scaled, except on ventral surface of head. Anal-fin base without scales. Frontal squamation A-patterned. Longitudinal series of scales 26-27; transverse series of scales 9-10; scale rows around caudal peduncle 12-13. Minute contact organ on each scale of anteroventral portion of flank in males. Small papillate contact organs on upper surface of dorsal-most ray of pectoral-fin in males. Supraorbital neuromasts 11-12, arranged in a continuous series.

Supraoccipital process short, reaching vertical through posterior portion of neurocranium. Basihyal triangular, longest width about 60 % of length; basihyal cartilage about 35 % of total length of basihyal. Six branchiostegal rays. Three teeth on second pharyngobranchial. Gill-rakers on first branchial arch 2 + 10. Vomerine teeth absent. Dermosphenotic absent. Ventral process of posttemporal long. Total vertebrae 27.

**Coloration:** Males: Side of body dark yellow ochre, with 9–11 dark purplish gray bars and light blue dots; venter yellowish white. Side of head yellow ochre to bright greenish blue on opercular and infraorbital region. Scales on posterodorsal side of head and anterodorsal portion of flank red. Iris light purplish yellow, with dark brown bar through center of eye. Dorsal fin greenish brown; 7–8 greenish yellow elongate spots forming short bars on basal region, alternating with dark gray to black elongate spots; row of greenish blue short lines along distal margin of fin. Anal fin greenish brown, with 6 light greenish yellow bars. Caudal fin greenish yellow, with greenish blue margin; 6–7 light greenish yellow stripes, parallel to fin rays, radially diverging from fin base to fin margin, each stripe distally terminating in sharp tip, and alternating with elongate spots of identical color on subdistal portion of fin. Pelvic fin purplish brown. Pectoral fin hyaline.

Females: Side of body light yellowish brown, with dark gray spots; spots above anal-fin base sometimes elongate, forming short bars; 2–3 spots on anterocentral portion of flank black; venter pale golden. Opercular region greenish golden. Iris light yellow, with gray bar through center of eye. Unpaired fins hyaline, with black small spots on basal region; small light blue spot on posterior margin of anal fin, just posterior to fin base. Paired fins hyaline.

  

**Distribution:** Known only from the type locality, the floodplains of the middle São Francisco River floodplains, Pirapora, Estado de Minas Gerais, Brazil.

**Habitat:** The new species was found in a temporary pool in the Cerrado, a typical savannah-like vegetation from central Brazil. The pool was shallow, about 1 m deep, densely covered by aquatic vegetation (Figs. 3–4). The water was dark gray, slightly turbid, and the pH 7.0 at the exact point where specimens were collected. No other annual fishes were found. Some specimens of *Synbranchus* sp. were also captured.

**Etymology:** Named in honor of Dalton Nielsen, the first collector of this new species, who sent me juvenile specimens which were not preserved for study.

## Discussion

*Simpsonichthys nielseni* is a member of the *S. notatus* species group, which also includes *S. notatus*, *S. radiosus*, *S. stellatus*, *S. rufus*, *S. trilineatus*, *S. auratus*, and *S. similis*. This group is diagnosed by a typical frontal squamation pattern, in which there is a central A-scale with all margins free (Costa & Brasil, 2004; Costa, in press). This derived pattern is not found in other cynolebiatins (i.e., *Simpsonichthys*, *Nematolebias* Costa, *Austrolebias* Costa, *Megalebias* Costa, and *Cynolebias* Steindachner) (Costa, 2001, 2002a, 2002b, in press), except in some specimens of *Simpsonichthys ocellatus* Costa, Nielsen & De Luca, from the Jequitinhonha River basin, Brazil. However, according to a recent phylogenetic study of the species of *Simpsonichthys*, *S. ocellatus* is not closely related to members of the *S. notatus* group (Costa, in press), which belong to a more inclusive clade exhibiting a typical spotted apomorphic color pattern in females (Fig. 2). This spotting does not occur in females of *S. ocellatus*.

*Simpsonichthys nielseni* is distinguished from all other species of the *S. notatus* group by the color pattern of the caudal fin in males, which comprises 6–7 light greenish yellow stripes parallel to fin rays (Fig. 1). This contrasts with the pattern consisting of bright dots scattered over the caudal fin, the plesiomorphic color pattern occurring in most other congeners (Costa, in press) (Fig. 5). However, *S. radiosus* also has similar caudal stripes, which however are reduced in number 3–5 (Costa & Brasil, 2004) (Fig. 6). *Simpsonichthys nielseni* may be easily distinguished from *S. radiosus* by having fewer dorsal-fin rays (21–22 vs. 23–26) and fewer anal-fin rays (19–21 vs. 21–23) in males, and by the presence of bright bars on caudal fin and elongated spots on dorsal-fin base, and absence of a black blotch on the flank in males.

Among species of the *S. notatus* group, only *S. nielseni* and *S. stellatus* possess a derived color pattern of elongated bright spots alternated by black zones on the basal portion of the dorsal fin in males (Figs. 1 and 5), which supports a hypothesis of sister group relationships (Costa, in press). Bright spots are longer in *S. nielseni*, and may be interpreted as short bars. In other species of this group, however, there is never a black zone on the dorsal-fin base (Fig. 6).

  

## Acknowledgments

Thanks are due to Claudia Bove and Bruno Costa for help in collecting. This study was supported by CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico - Ministério de Ciência e Tecnologia) and FAPERJ (Fundação de Amparo à Pesquisa do Estado do Rio de Janeiro). Material was collected with permits 049/2004 from IBAMA (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis - Ministério do Meio Ambiente, dos Recursos Hídricos e da Amazônia Legal).

## Literature Cited

Costa, W.J.E.M. (1995) *Pearl killifishes - the Cynolebiatinae: systematics and biogeography of the neotropical annual fish subfamily.* TFH, Neptune City, 128 pp.

Costa, W.J.E.M. (1996) Phylogenetic and biogeographic analysis of the Neotropical annual fish genus *Simpsonichthys* (Cyprinodontiformes: Rivulidae). *Journal of Comparative Biology*, 1, 129–140.

Costa, W.J.E.M. (2001) The neotropical annual fish genus *Cynolebias* (Cyprinodontiformes: Rivulidae): phylogenetic relationships, taxonomic revision and biogeography. *Ichthyological Exploration of Freshwaters*, 12, 333–383.

Costa, W.J.E.M. (2002a) Monophyly and phylogenetic relationships of the neotropical annual fish genera *Austrolebias* and *Megalebias* (Cyprinodontiformes: Rivulidae). *Copeia*, 2002(4), 916–927.

Costa, W.J.E.M. (2002b) The neotropical seasonal fish genus *Nematolebias* (Cyprinodontiformes: Rivulidae: Cynolebiatinae): taxonomic revision, with description of a new species. *Ichthyological Exploration of Freshwaters*, 13, 41–52.

Costa, W.J.E.M. (2003) The *Simpsonichthys flavicaudatus* species group (Cyprinodontiformes: Rivulidae: Cynolebiatinae): phylogenetic relationships, taxonomic revision and biogeography. *Ichthyological Exploration of Freshwaters*, 14, 31–60.

Costa, W.J.E.M. (in press). Descriptive morphology and phylogenetic relationships among species of the Neotropical annual killifish genera *Nematolebias* and *Simpsonichthys* (Cyprinodontiformes: Aplocheiloidei: Rivulidae). *Neotropical Ichthyology.*

Costa, W.J.E.M. & Brasil, G.C. (2004) *Simpsonichthys radiosus* sp. n. (Teleostei: Cyprinodontiformes: Rivulidae): a new annual killifish from the upper Rio Tocantins basin, central Brazil. *Zootaxa*, 737, 1–7.

Hoedeman, J.J. (1958) Rivulid fishes of the Antilles. *Studies on the Fauna of Curaçao and other Caribbean Islands*, 32, 112–127.

Taylor, W.R. & Van Dyke, G.C. (1985) Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study. *Cybium*, 9, 107–109.

  