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Nothobranchius seegersi (Cyprinodontiformes: Nothobranchiidae), a new annual killifish from the Malagarasi River drainage, Tanzania

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Abstract. A new annual killifish species, *Nothobranchius seegersi*, is described based on specimens collected in ephemeral water bodies in the Wulua River drainage system, Malagarasi River basin, central Tanzania. The new species belongs to the *N. neumanni* species group and is distinguished from *N. neumanni* by different male colouration and longer predorsal length in males and females.

Key words. *Nothobranchius neumanni*, new species, taxonomy, seasonal pool, Tanzania.

INTRODUCTION

The killifish genus *Nothobranchius* occurs in the subtropical and tropical parts of eastern Africa, from Sudan to South Africa, and from Chad to Zanzibar and Mafia islands in Tanzania. All known species are annual fishes, living in temporary pools and swamps formed during the rainy season (Wildekamp 2004). Six *Nothobranchius* species are currently known from central Tanzania: *N. neumanni* from the Great Ruaha, Bubu, Wembere, and Malagarasi River basins, and Lakes Manyara and Victoria drainage systems; *N. robustus* from the Lake Victoria drainage system; *N. taeniopygus* from the Wembere, Malagarasi, and Bubu River basins and the Lake Victoria drainage system; and at least three undescribed species: *N.* spec. aff. *neumanni* "Malagarasi Type", *N.* spec. aff. *neumanni* "Mbeya Type", and *N.* spec. "Lake Victoria" (De Vos et al. 2001; Seegers 1997; Shidlovsky 2010; Wildekamp 1990, 2004).

Nothobranchius spec. aff. *neumanni* "Malagarasi Type" and *N.* spec. aff. *neumanni* "Mbeya Type" share with N. neumanni a unique combination of characters in male colour pattern: the caudal fin is red or partially red, the pectoral fins are hyaline, the anal fin is yellow with red stripes, its proximal portion light bluish grey. These synapomorphic colour characters are diagnostic for the *N. neumanni* species group.

In May 2008, the second author and Iva Ivanova (Dupnitsa, Bulgaria) collected during a *Nothobranchius* species survey specimens of *N.* spec. aff. *neumanni* "Malagarasi Type" from small pools in the drainage system of the Wulua River, which flows into the Limba Limba River. Based on these specimens we herein describe *Nothobranchius seegersi*, new species.

MATERIAL AND METHODS

Measurements and counts were taken as described in Amiet (1987), Huber (1992), and Valdesalici (2010). Measurements were made with a digital calliper, partly under a dissecting microscope, and rounded to the nearest 0.1 mm. If not stated otherwise, measurements are presented as percentages of standard length (SL), except for eye diameter and snout length, which are given as percentage of head length (HL). Terminology for the cephalic neuromast series follows Scheel (1968), for the frontal squamation Hoedeman (1958). Osteological preparations (clearing and staining, below: C&S) were made according to Taylor and Van Dyke (1985), but not stained for cartilages. We consider as *Nothobranchius neumanni* only the populations from the type locality in the Bubu River drainage (see fig. A50201–4 in Seegers 1997) and the geographically close Bahi Swamp area (see figs 5 a–b in Wildekamp 1990), which were also studied by Wildekamp (1990) in the redescription of the species. Morphological data from Wildekamp (1990) were used here for comparisons. Numbers in brackets following counts indicate the frequency of occurrence. Type material is deposited in the following institutions: Zoologisches Forschungsmuseum Alexander Koenig (ZFMK), Bonn, Germany, Museo Civico di Storia Naturale "Giacomo Doria" (MSNG), Genova, Italy, and Royal Museum for Central Africa (MRAC), Tervuren, Belgium.

RESULTS

Nothobranchius seegersi, new species
(Figs 1–2, Table 1)

Nothobranchius spec. aff. *neumanni*: Seegers (1997), p. 75, figs A50205–4
Nothobranchius neumanni: Wildekamp (2004), p. 206, population from south-west of Ipole.

Holotype. ZFMK 41848, 1 male, 44.5 mm SL, seasonal pool on the right side of the main road T8 from Ipole to Rungwa, near Mabangwe village, close by the bridge over the Limba Limba River, altitude 1114 m, Malagarasi River drainage, Tanzania, 5°59'1" S, 32°48'5" E, 2 June 2008, Kiril Kardashev and Iva Ivanova.

Fig. 1. *Nothobranchius seegersi*, adult male, not preserved, Tanzania, seasonal pool on right side of the main road T8 from Ipole to Rungwa, near Mabangwe village. Photo: Iva Ivanova.

Paratypes. ZFMK 41849- 41850, 2 females, 49.5 & 54.7 mm SL, same data as holotype; ZFMK 41851, 1 male, 45.9 mm SL, same data as holotype; MRAC 2010-33-P-1, 1 male, 43.8 mm SL, same data as holotype; MSNG 56046, 1 male, 57.5 mm SL, C&S, same data as holotype; MRAC 2010-33-P-2-3, 2 males, 42.5 & 44.3 mm SL, flooded grasslands on the right side of the main road T8 from Ipole to Rungwa, Mkola area, altitude 1107 m, Tanzania, 5°54'54" S, 32°45'54" E, Kiril Kardashev and Iva Ivanova, 2 June 2008; MSNG 56045A-B, 2 males, 36.6 & 38.1 mm SL, large pool on left side of the main road T8 from Ipole to Rungwa, near Ngoywa village, altitude 1114 m, Tanzania, 5°57'49" S, 32°46'50" E, Kiril Kardashev and Iva Ivanova, 2 June 2008.

Non-type material. Private collection of the first author: 1 male, 62.00 mm SL, C&S, same data as holotype.

Diagnosis. *Nothobranchius seegersi* males share with the other members of the *N. neumanni* species group a combination of colouration characters, which distinguish them from all other species of the genus: caudal fin red or partially red; pectoral fin hyaline; anal fin yellow with red stripes, proximal portion light bluish grey. It is distinguished from *N. neumanni* by bright light blue scales (vs. pale bluish grey), an irregular pattern formed by red scale margins on lateral body and head (vs. uniform), and a single, blue male colour morph (vs. two colour morphs, blue and red). Male and female *N. seegersi* have a relatively higher predorsal length compared to *N. neumanni* (60.3–68.8 (7) vs. 54.8–61.0 % (13) SL in males, 68.0–68.4 (2) vs. 57.1–64.6 % (24) SL in females). In osteological characters, *Nothobranchius seegersi* differs from *N. neumanni* by having a conspicuously longer lateral process of the post-temporal, and by having short antero-dorsal process of the urohyal (examined in 2 C&S *N. seegersi* and 5 *N. neumanni*).

Fig. 2. *Nothobranchius seegersi*, adult female, not preserved, Tanzania, seasonal pool on right side of the main road T8 from Ipole to Rungwa, near Mabangwe village. Photo: Iva Ivanova.

Description. See Figs 1–2 for overall appearance and Table 1 for morphometric data of the type series. Robust *Nothobranchius* with rounded body, maximum length recorded in males 62.0 mm SL. Dorsal profile straight to slightly concave on head, convex from nape to end of dorsal fin base. Ventral profile convex, slightly concave on caudal peduncle posterior to dorsal and anal fin. Snout slightly pointed, mouth directed upwards, lower jaw longer than upper, posterior end of rictus at same level as or slightly above centre of eye. Branchiostegal membrane projecting posteriorly from opercle. Dorsal and anal fin located far posterior, tips rounded with short filamentous rays. Both fins with papillate contact organs on fin rays. Dorsal fin tip reaching caudal fin. Number of dorsal fin rays 16–17, anal fin rays 17–18. Pectoral fin approximately triangular; in some specimens pectoral fins reach pelvic fins, and pelvic fins reach the anal fin origin. Caudal fin rounded.

Scales cycloid, body and head entirely scaled, except for ventral surface of head. Scales in median lateral series 28–34 + 3–5 on caudal fin base. Cephalic squamation pattern variable. Anterior neuromast series of the 'open' type. Central supra-orbital series in shallow grooves, each with

Table 1. Morphometric data of *Nothobranchius seegersi.* Measurements except of standard length (in mm), eye diameter and head length (in percent of head length) are percentages of, standard length. Cleared and stained material is not included.

	Holotype	Males (n = 7)	Females (n = 2)
Standard length (mm)	44.5	36.6–45.9	49.5–54.7
Body depth at pelvic fin	29.2	28.9–33.8	29.2–29.2
Predorsal length	62.2	60.3–68.8	68.0–68.4
Preanal length	58.2	57.4–66.8	69.2–69.6
Prepelvic length	48.0	47.2–56.3	56.6–57.3
Caudal peduncle length	21.5	18.0–23.3	17.1–18.9
Caudal peduncle depth	13.2	13.2–16.2	13.7–13.9
Head length	30.7	30.7–36.0	34.7–35.7
Snout length	17.5	17.5–27.2	23.7–24.7
Eye diameter	27.0	22.2–27.0	18.9–22.0

two or three neuromasts. Posterior cephalic neuromast series curved with three or four neuromasts. One neuromast on each scale of median longitudinal series. Basihyal bone sub-triangular. Six branchiostegal rays. Vomerine teeth present in a large patch. Lateral process of post-temporal long. Single short antero-dorsal process of urohyal. Number of vertebrae 31–32. Premaxilla and dentary with many irregularly distributed unicuspid, slightly curved teeth of different size, a small number of larger ones on the outer row of upper and lower jaw. Females are smaller than males, maximum observed size 54.7 mm SL. In females, the dorsal fin is rounded, the anal fin is triangular with rounded tip. Branchiostegal membrane not projecting from opercle.

Colour in life. Males. (Fig. 1) Scales on body and head bright light blue with very thin and variable red margin, creating an irregular reticulated pattern on body and head. Branchiostegal membrane light blue with white margin. Dorsal fin grey greenish to grey bluish with with irregular rows of dark red spots proximally, which become elongate over fin rays distally. Anal fin bright yellow with light blue base, separated by a dark red narrow stripe or row of dark red irregular spots, and black margin. Some specimens with a median dark red narrow stripe or row of dark red irregular spots in anal fin. A sub-distal light blue narrow stripe present in anal fin of some specimens. Pelvic fins yellow with red spots. Pectoral fins hyaline with light blue margin. Caudal fin dark red, with black margin and light blue submargin. Iris golden, with faint black vertical bar through centre of eye.

Females. (Fig. 2) Scales on body and head pale greyish blue, with golden to light blue iridescence on scale centre. Opercular region silvery to golden. Abdomen silvery to golden. All fins hyaline. Iris golden, with faint black vertical bar through centre of eye.

Colour in ethanol. Males. Scales on body light brown to whitish, almost all scales on frontal and dorsal area with distinct dark red margin, ventral scales with irregular dark red spots. Dorsal fin whitish with dark red to brown spots. Anal fin pale yellowish with light brown to whitish base, separated by an irregular stripe formed by dark red to brown spots, black margin. Some specimens with a median dark red to brown narrow stripe or row of dark red irregular spots in anal fin. Pelvic fins yellowish with dark red proximal spots and distal black spots. Pectoral fins hyaline. Caudal fin dark red, with black margin and distinct yellowish submargin. Iris bluish.

Females. Body light brown to whitish. Opercular and ventral area yellowish. Unpaired and paired fins whitish. Iris bluish.

Etymology. The species is named in dedication to its first collector, the enthusiastic aquarist and ichthyologist Lothar Seegers, Germany.

Distribution and habitat. *Nothobranchius seegersi* is currently only known from seasonal pools in the drainage system of the Wulua and Mungu Rivers, Malagarasi River basin, central Tanzania (Fig. 3). The type locality was at the time of collection a small and very shallow pond, about 3 x 5 m wide and 0.25 m deep, without aquatic vegetation, in the open woodland (Fig. 4). The water was brown and very turbid. No other fish species was found in this pool.

DISCUSSION

Nothobranchius seegersi was collected for the first time in 1992 for aquaristic purposes, but apparently no material was deposited in public or institutional collections at

Fig. 3. Geographic distribution of *Nothobranchius seegersi* (black rhomboids, open black rhomboid: type locality), *N. neumanni* (red rhomboids, open red rhomboid: type locality *N. neumanni*), and *N.* spec. aff. *neumanni* "Mbeya Type" (blue rhomboids). Map prepared by Béla Nagy.

that time. Until the new collections in 2008, only pictures were available (Seegers 1997). *Nothobranchius neumanni* was diagnosed in Wildekamp (1990) by the straight dorsal profile and marked, angular transition between head and body along the dorsal profile. The dorsal profile is however variable within *N. neumanni*, so we did not use this character for diagnosing the species described here.

Nothobranchius neumanni appears to be restricted to the Bubu River drainage and the Bahi Swamps. There are indications that the remaining populations so far assigned to *N. neumanni* (namely from the areas of the Chipongola, Manyara, Tabora, and Lake Victoria) differ substantially in terms of colouration, osteology, and genetics from the Bubu drainage and Bahi Swamp material (preliminary data from A Dorn & A Cellerino, Jena, pers. comm.), and might be considered as valid species; this is however beyond the scope of the present paper. Tanzania is with 21 out of the 44 currently recognized species the hotspot of *Nothobranchius* diversity (Wildekamp 2004), and further species descriptions from this region are to be expected.

COMPARATIVE MATERIAL

Nothobranchius neumanni: MSNG 56051A–B, 2 males, 52.7 & 57.3 mm SL; Seneki, Tanzania, 5°11'S, 33°17' E; MSNG 56052A-B, Sukamahela, Tanzania, 5°8'25" S, 32°46'44" E; 2 males, 37.9 & 47.8 mm SL. MSNG 56053, 1 male, 49,3 mm SL, C&S, Bahi Swamp – Lusilile TZ 2008-19, Tanzania, 5°53'S, 35°12' E; first authors private collection: 1 male C&S, 49.7 mm SL, Manyara area, Tanzania, 3°35' S, 35°50' E; 1 male C&S, 44.2 mm SL Tabora area, Tanzania, 5°1' S, 32°48' E; 1 male, 54.1 mm SL, Magiri, Tanzania, 4°55' S, 33°1' E; 2 males C&S, 47.8 & 52.8 mm, Bahi Swamp – Itigi, Tanzania, 05°53' S, 35°12' E; 1 male, 43.9 mm SL, Bahi Swamp-Lusilile, Tanzania, 5° 53' S, 35°12' E.

Fig. 4. Type locality of *Nothobranchius seegersi*, seasonal pool on right side of the main road T8 from Ipole to Rungwa, near Mabangwe village, Tanzania.

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