

Two new species of seasonal killifishes of the *Nothobranchius melanospilus* species complex from the East Africa biodiversity hotspot (Cyprinodontiformes: Aplocheilidae*)

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Abstract

During a revision of material identified in museum collections as *Nothobranchius melanospilus*, two new species were recognised: *N. kwalensis*, new species, from the Ramisi River basin, southeastern Kenya, and *N. prognathus*, new species, from the upper Wami River basin, eastern Tanzania. Both new species are distinguished from *N. melanospilus* by the relative position of the dorsal-fin origin in females, presence of dark dots on the whole flank in females, the two sections of the anterior supraorbital series of neuromasts well-separated, and presence of fewer mandibular neuromasts. *Nothobranchius prognathus* is distinguished from other species of the *N. melanospilus* complex by the shape of the snout and eye, frontal squamation, and basal portion of the pelvic fins medially united in males. Additional morphometric characters were found informative to diagnose species of the *N. melanospilus* complex.

Key words

Kenya, Mkata River, Ramisi River, Tanzania, Tendigo Swamp, Systematics.

Introduction

The African genus *Nothobranchius* Peters, 1868 is among the most diversified genera of the killifish sub-order Aplocheiloidei, exhibiting interesting trophic specializations (COSTA, 2011, 2018). All the about 60 species included in this genus inhabit temporary pools formed during rainy seasons that are alternated by intensively dry periods, when pools disappear and resistant eggs survive within the bottom substrate (e.g., JUBB, 1969; BAILEY, 1972; WOURMS, 1972). Its greatest diversity is found in the East African region comprising south-eastern Kenya and eastern Tanzania, recognised as a biodiversity hotspot (East Africa biodiversity hotspot, hereafter EABH;

MYERS *et al.*, 2000), to where about one half of all species of *Nothobranchius* are endemic (e.g., COSTA, 2008, 2017a).

Nothobranchius melanospilus (Pfeffer, 1896) has been considered a geographically widespread species, occurring in the coastal forests of eastern Tanzania and south-eastern Kenya, commonly diagnosed by the presence of black dots on the flank in females (WILDEKAMP *et al.*, 2009). However, the study of aplocheilid collections deposited in Musée Royal de l'Afrique Central, Tervuren (MRAC), revealed that *N. melanospilus* *sensu* WILDEKAMP *et al.* (2009) is a species complex. Recently,

(*) Aplocheilidae is here adopted as a single Aplocheiloidei family following COSTA (2016).

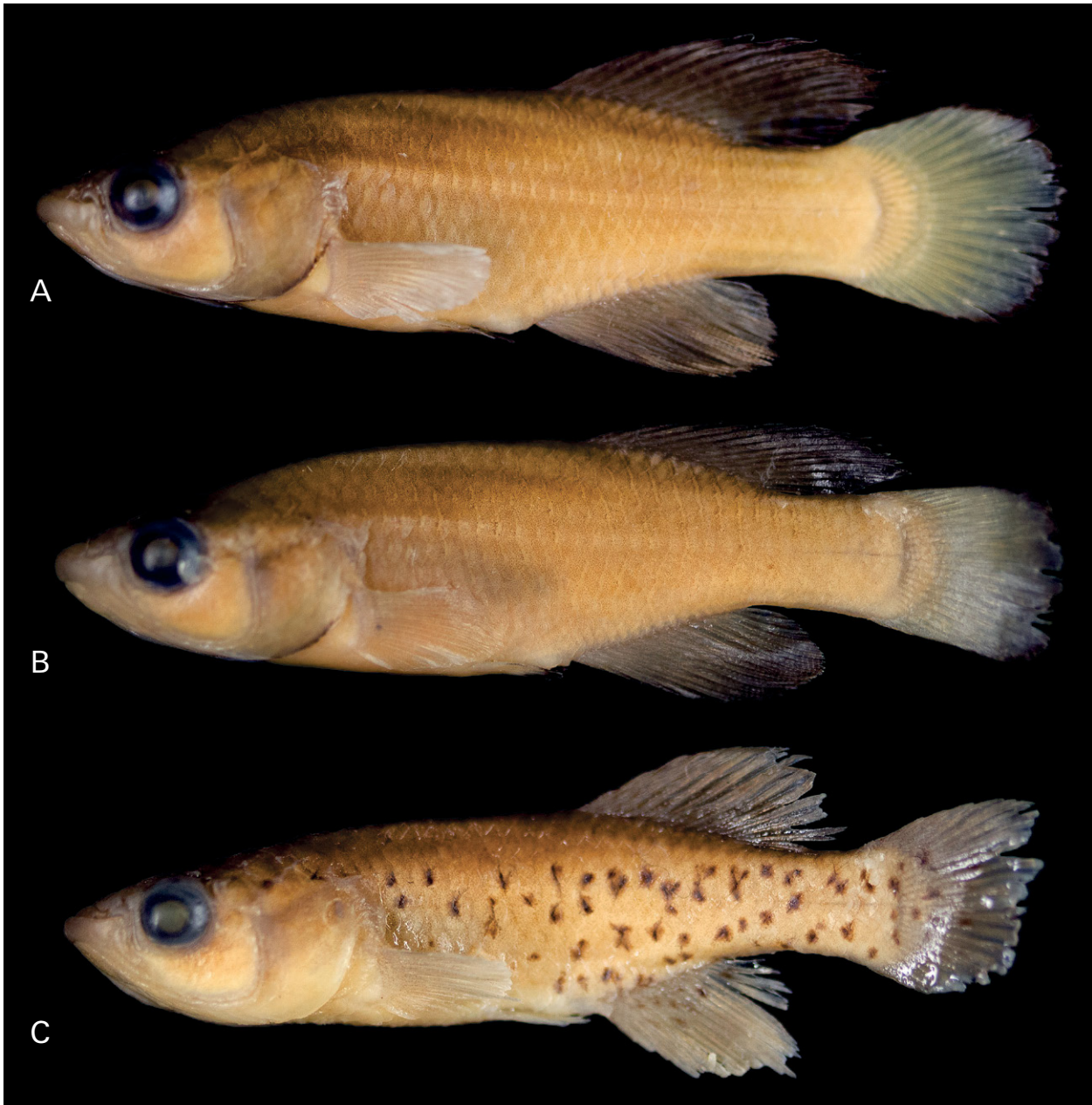


Fig. 1. *Nothobranchius kwalensis*: **A**, MRAC 79-007-P-172, holotype, male, 41.5 mm SL; **B**, MRAC 79-007-P-173-180, paratype, male, 38.6 mm SL; **C**, MRAC 79-007-P-173-180, paratype, female, 35.3 mm SL: Kenya: Kwale: Kikoneni-Mrima road.

N. melanospilus was redescribed and geographically restricted to Zanzibar Island and adjacent continental river basins of Tanzania (COSTA, 2017b). The populations occurring in the northern and northwestern part of the distribution of this complex correspond to two new species that are herein described.

Material and methods

Material examined is deposited in the Natural History Museum, formerly British Museum, Natural History, London (BMNH); Musée Royal de l'Afrique Central,

Tervuren (MRAC); Instituto de Biologia, Universidade Federal do Rio de Janeiro, Rio de Janeiro (UFRJ); and Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin (ZMB). List of comparative material is listed in Appendix 1. Morphometric and meristic data were taken following COSTA (1988), except for the snout length, measured between the anterior margin of the orbit and the anterior extremity of the middle portion of the upper jaw; measurements are presented as percent of standard length (SL), except for those related to head morphology, which are expressed as percent of head length. Specimens with deformed body were not measured to avoid unnecessary error. Fin-ray counts include all elements. Terminology for frontal squamation follows HOEDEMAN (1958) and for

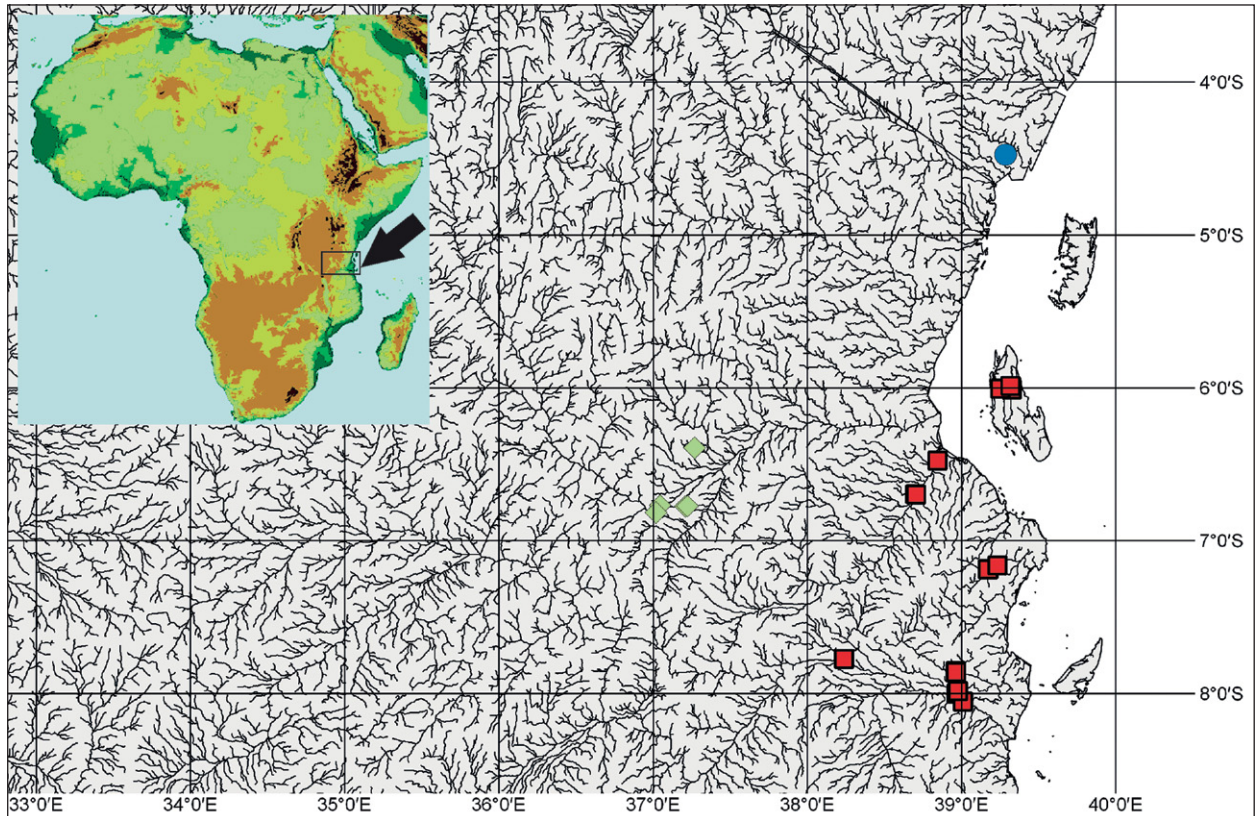


Fig. 2. Geographical distribution of *Nothobranchius kwalensis*, blue circle, *N. prognathus*, green lozenges, and *N. melanospilus*, red squares.

cephalic neuromast series COSTA (2001). Species were diagnosed using unique combination of character states (diagnosability criterion; e.g., DAVIS & NIXON, 1992).

***Nothobranchius kwalensis*, spec. nov.**

urn:lsid:zoobank.org:act:62464E7C-AD18-407E-9655-5F3415CE2E73

Fig. 1, Table 1

Holotype: MRAC 79-007-P-172, male, 41.5 mm SL; Kenya: Kwale: Kikoneni-Mrima road, Ramisi River basin, 4°28'26"S 39°17'05"E, about 35 m asl; E. HOLLER, Aug. 1978.

Paratypes: MRAC 79-007-P-173-180, 7 males, 29.2–40.6 mm SL, 1 female, 35.3 mm SL; collected with holotype.

Diagnosis. *Nothobranchius kwalensis* is distinguished from all other congeners of the *N. melanospilus* complex by the combination of the following morphological character states: lower jaw not anteriorly projecting beyond upper jaw (vs. anteriorly projecting in *N. prognathus*); dorsal-fin origin anterior to anal fin origin in females (vs. posterior in both sexes, in *N. melanospilus*); pelvic fins medially in contact (vs. bases medially united in males of *N. prognathus*); presence of two longitudinal series of scales on frontal region (vs. three in *N. prognathus*); anterior supraorbital series of neuromasts divided in two sections (vs. arranged in a single continuous row in *N. melanospilus*); mandibular neuromasts 14–16 (vs. 17–21 in *N. melanospilus*); in females, few rounded

black dots on anterior portion of flank (vs. dots absent on anterior portion of flank in *N. melanospilus*); body depth 28.7–30.9 % SL in males, 25.8 % SL in female (vs. 32.7–35.5 and 32.1–33.4 % SL, respectively, in *N. prognathus*); dorsal-fin base length 24.1–27.3 % SL in males (vs. 27.9–29.9 % SL in *N. prognathus*); head depth 79.0–82.9 % of head length in males, 69.5 % in female (vs. 90.4–99.2 and 85.6–90.3 % of head length, respectively, in *N. prognathus*); eye diameter 26.8–28.4 % of head length in males, 27.1 % in female (vs. 20.9–25.9 % and 21.1–24.4 %, respectively, in *N. prognathus*).

Description. Morphometric data appear in Table 1. Dorsal and ventral profiles slightly convex from snout to posterior end of dorsal and anal-fin bases, about straight on caudal peduncle. Body slender, compressed. Greatest body depth at vertical just in front of pelvic-fin base. Jaws short, snout weakly pointed in lateral view. Jaw teeth canine, numerous, irregularly arranged, outer teeth greater than internal teeth. Gill-rakers of first branchial arch 4 + 5 + 15 + 16. Six branchiostegal rays.

Dorsal and anal fins broad in males, extremity rounded, with short filamentous rays along distal margin, dorsal fin longer than anal fin; in females, dorsal fin rounded, anal fin sub-triangular and slightly longer than dorsal fin. Caudal fin subtruncate. Pectoral fin rounded, posterior extremity between pelvic-fin base and anus. Pelvic fin small, tip reaching between anus and urogenital papilla; pelvic-fin bases medially in contact. Dorsal-fin

Table 1. Morphometric data of *Nothobranchius kwalensis*.

	Holotype	paratypes	
	male	males (5)	female (1)
Standard length (mm)	41.5	35.4–40.6	35.3
Percent of standard length			
Body depth	30.9	28.7–30.9	25.8
Caudal peduncle depth	16.1	14.1–14.8	12.7
Pre-dorsal length	60.8	61.2–63.0	62.3
Pre-pelvic length	50.9	51.3–53.7	53.8
Length of dorsal-fin base	25.1	24.1–27.3	22.9
Length of anal-fin base	23.1	22.4–23.5	17.3
Caudal-fin length	29.2	26.4–29.2	30.0
Pectoral-fin length	19.9	18.8–21.4	22.3
Pelvic-fin length	11.0	10.8–12.0	12.3
Head length	32.9	32.9–33.9	33.3
Percent of head length			
Head depth	81.7	79.0–82.9	69.5
Head width	70.4	66.2–70.9	70.3
Snout length	35.3	31.4–34.9	34.2
Lower jaw length	29.8	26.7–29.9	26.5
Eye diameter	26.5	26.8–28.4	27.1

origin on vertical between base of first and third anal-fin rays in males, just anterior to anal-fin origin in females. Dorsal-fin rays 14–16; anal-fin rays 16–18; caudal-fin rays 30–32; pectoral-fin rays 19–20; pelvic-fin rays 6. Minute contact organs on first and second pectoral-fin rays in males; rows of papillate contact organs along two distal thirds of most rays of anal fin in males.

Scales small, cycloid; body and head entirely scaled, except ventral surface of head. Minute filamentous contact organs along posterior margin of scales on middle portion of flank and latero-ventral portion of head in males. Body squamation extending over anterior 35 % of caudal-fin base; no scales on dorsal and anal-fin bases. Frontal squamation irregularly arranged in two longitudinal rows. Longitudinal series of scales 29–30; transverse series of scales 9; scale rows around caudal peduncle 16.

Anterior supraorbital series of neuromasts arranged in two separate sections, each placed in shallow depression, the anterior section with two neuromasts, the posterior one with three; sometimes minute neuromast between depressions. Posterior supraorbital series with four neuromasts placed in shallow depression. Infraorbital series with 18–24 neuromasts, pre-opercular series 15–16, mandibular 14–16. One neuromast per scale of lateral line.

Colouration in alcohol. Males. Trunk and head light brown, slightly darker on dorsum and lighter on venter; branchiostegal membrane dark grey. Dorsal fin hyaline with transverse series of grey spots, anal fin hyaline. Caudal fin yellowish hyaline with narrow black line along whole fin margin, slightly broader on posterior dorsal corner. Pectoral fin hyaline, pelvic fin greyish hyaline with black tip.

Females. Trunk and head light brown, slightly darker on dorsum and lighter on venter; small dark brown spots irregularly arranged on whole flank, less concentrated in front vertical through pelvic-fin base. Unpaired fins hyaline with small dark grey spots on basal portion. Paired fins hyaline.

Etymology. The name *kwalensis* is an allusion to the occurrence of the new species in the County of Kwala, Coastal Province of Kenya.

Distribution. Known only from the Ramisi River basin, in the coastal plain of south-eastern Kenya (Fig. 2).

Remarks. Photographs of live individuals from the type locality area, south-eastern Kenya, have been published in the aquarium fish literature (e.g., SEEGER, 1997; NAGY, 2007; NEUMANN, 2008). These photographs show that the colour pattern of live males in this species is similar to that commonly reported for *N. melanospilus*, differing by the red pigmentation of the anal fin being restricted to a few pale dots on the posterior portion of the fin (*vs.* red bars and dots on the whole basal half of the fin in *N. melanospilus*) and the caudal fin being pale red or pink (*vs.* dense vivid red).

***Nothobranchius prognathus*, spec. nov.**

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Fig. 3, Table 2

Holotype: MRAC 76-49-P-55, 1 male, 42.9 mm SL; Tanzania: Morogoro district: swamp pool about 7 km from Kimamba in the to Kilosa, 6°46'30"S 37°12'30"E, about 425 m asl; R. H. WILDEKAMP, 11 Jun. 1976.

Paratypes: MRAC 76-49-P-56-64, 5 males, 33.9–42.2 mm SL, 3 females, 35.6–41.8 mm SL; collected with holotype. – MRAC 76-49-P-43-54, 6 males, 30.2–35.4 mm SL, 6 females, 28.6–36.3 mm SL; Tanzania: swamp pool about 8 km before Kimamba in the road Morogoro-Kilosa, 6°46'24"S 37°13'18"E, about 425 m asl; R. WILDEKAMP, 11 Jun. 1976.

Additional material (non types): MRAC 76-49-P-27, 1; MRAC 77-16-P-45, 1; collected with holotype. – MRAC 98-008-P-0013-0017, 5; Tanzania: 2 km north of Kidete in Nkundi/Wami drainage system, approximately 65 km northwest of Morogoro, 6°23'31"S 37°16'05"E, about 490 m asl; R. WILDEKAMP *et al.*, 6 Jun, 1995. – MRAC 76-49-P-81-82, 2; Tanzania: ditch along road from Ilonga to Kilosa, 6°46'08"S 37°02'39"E, about 495 m asl; R. WILDEKAMP *et al.*, 11 Jun. 1976. – MRAC 76-49-P-65-75, 11; near Chanzuru, road Morogoro-Kilosa, 6°48'57"S 37°01'03"E, about 490 m asl; R. WILDEKAMP, 11 Jun. 1976.

Diagnosis. *Nothobranchius prognathus* differs from all other species of the *N. melanospilus* complex in possessing lower jaw anteriorly projecting beyond upper jaw (*vs.* not projecting), pelvic fins medially united in males (*vs.* bases just in contact, but not united), and presence of three longitudinal series of scales on frontal region (*vs.* two). Also distinguished from all other species of the *N. melanospilus* complex by the combination of



Fig. 3. *Nothobranchius prognathus*: **A**, MRAC 76-49-P-55, holotype, male, 42.9 mm SL; **B**, MRAC 76-49-P-56-64, paratype, male, 40.7 mm SL; **C**, MRAC 76-49-P-56-64, paratype, female, 40.8 mm SL; Tanzania: Morogoro: Kimamba.

the following morphological character states: dorsal-fin origin anterior to anal fin origin in both sexes (vs. posterior in *N. melanospilus*); anterior supraorbital series of neuromasts divided in two sections (vs. arranged in a single continuous row in *N. melanospilus*); mandibular neuromasts 14–16 (vs. 17–21 in *N. melanospilus*); in females, few dark dots on anterior part of flank (vs. dots absent on anterior part in *N. melanospilus*); body depth 32.7–35.5 % SL in males, 32.1–33.4 % SL in females (vs. 27.5–32.2 and 27.1–30.9 % SL, respectively, in *N. melanospilus*, and 28.7–30.9 and 25.8 % SL, re-

spectively, in *N. kwalensis*); dorsal-fin base length 27.9–29.9 % SL in males, 23.5–25.0 % SL in females (vs. 24.6–27.9 and 19.9–23.4 % SL, respectively, in *N. melanospilus*, and 24.1–27.3 and 22.9 % SL, respectively, in *N. kwalensis*); head depth 90.4–99.2 % of head length in males, 85.6–90.3 % in females (vs. 78.0–87.8 and 74.6–80.7 % of head length, respectively, in *N. melanospilus*, and 79.0–82.9 and 69.5 % of head length, respectively, in *N. kwalensis*); eye diameter 20.9–25.9 % of head length in males, 21.1–24.4 % in females (vs. 26.8–28.4 % and 27.1 %, respectively, in *N. kwalensis*).

Table 2. Morphometric data of *Nothobranchius prognathus*.

	Holotype	paratypes	
	male	males (6)	females (4)
Standard length (mm)	42.9	35.4–42.2	35.6–44.1
Percent of standard length			
Body depth	33.4	32.7–35.5	32.1–33.4
Caudal peduncle depth	17.6	15.7–17.4	13.3–14.8
Pre-dorsal length	60.0	61.3–63.0	64.6–65.9
Pre-pelvic length	52.1	51.4–52.7	55.2–56.8
Length of dorsal-fin base	28.9	27.9–29.9	23.5–25.0
Length of anal-fin base	25.2	23.2–26.0	15.5–17.3
Caudal-fin length	29.6	29.0–31.3	28.3–29.9
Pectoral-fin length	21.8	23.1–24.0	21.0–22.7
Pelvic-fin length	12.1	12.3–13.3	12.2–12.9
Head length	33.1	32.3–33.7	32.1–34.1
Percent of head length			
Head depth	97.9	90.4–99.2	85.6–90.3
Head width	76.7	73.0–76.8	73.4–79.5
Snout length	36.3	33.3–38.5	33.6–35.8
Lower jaw length	31.6	28.9–32.9	27.2–29.7
Eye diameter	20.9	21.4–25.9	21.1–24.4

Description. Morphometric data appear in Table 2. Dorsal and ventral profiles slightly convex from snout to posterior end of dorsal and anal-fin bases, about straight on caudal peduncle. Body moderately deep, compressed. Greatest body depth at vertical just in front of pelvic-fin base. Jaws short, snout weakly pointed in lateral view; mouth superior, lower jaw anteriorly projecting beyond upper jaw. Jaw teeth canine, numerous, irregularly arranged, outer teeth greater than internal teeth. Gill-rakers of first branchial arch 4 + 15. Six branchiostegal rays.

Dorsal and anal fins broad in males, extremity rounded, with short filamentous rays along distal margin, dorsal fin longer than anal fin; in females, dorsal fin rounded, anal fin sub-triangular and slightly longer than dorsal fin. Caudal fin subtruncate. Pectoral fin rounded, posterior extremity between pelvic-fin base and anus. Pelvic fin small, tip reaching between urogenital papilla and base of second anal fin rays in males, reaching anus in females; pelvic-fin bases united in males, separated by minute interspace in females. Dorsal-fin origin on vertical between base of first and second anal-fin rays in males, just anterior to anal-fin origin in females. Dorsal-fin rays 15–16; anal-fin rays 17–18; caudal-fin rays 29; pectoral-fin rays 20; pelvic-fin rays 6. In males, minute papillate contact organs on first and second pectoral-fin rays and distal portion of middle dorsal-fin rays, and rows of well-developed papillate contact organs along two thirds of most rays of anal fin.

Scales small, cycloid; body and head entirely scaled, except ventral surface of head. Minute filamentous contact organs along posterior margin of scales on middle portion of flank and latero-ventral portion of head in males. Body squamation extending over anterior 30 % of caudal-fin base; no scales on dorsal and anal-fin bases. Frontal squamation irregularly arranged in three longitu-

dinal rows. Longitudinal series of scales 29–30; transverse series of scales 10–12; scale rows around caudal peduncle 16.

Anterior supraorbital series of neuromasts arranged in two separate sections, each placed in shallow depression, the anterior section with two neuromasts, the posterior one with three; sometimes minute neuromast between depressions. Posterior supraorbital series with four neuromasts placed in shallow depression. Infraorbital series with 18–22 neuromasts, pre-opercular series 15–16, mandibular 14–16. One neuromast per scale of lateral line.

Colouration in alcohol. Males. Trunk and head light brown, slightly darker on dorsum and lighter on venter; branchiostegal membrane dark grey. Dorsal and anal fins hyaline; pale transverse series of grey spots on dorsal fin. Caudal fin yellowish hyaline; sometimes narrow black line along whole fin margin, slightly broader on posterior dorsal corner. Pectoral fin hyaline, pelvic fin greyish hyaline with black tip.

Females. Trunk and head light brown, slightly darker on dorsum and lighter on venter. Small dark brown to black dots irregularly arranged on whole flank, often coalesced to form inverted V or Y-shaped spots, more concentrated on posterior half of flank; few similar dots on head side. Unpaired fins hyaline; small dark grey dots arranged in five transverse rows on dorsal fin, and arranged in two irregular rows on basal portion of anal and caudal fins. Paired fins hyaline.

Etymology. From the Latin *prognathus* (= prognathous), referring to the distinctive lower jaw of the new species that is anteriorly projected slightly beyond the upper jaw. An adjective.

Distribution. Tendigo Swamp area, Mkata River floodplains, upper Wami River basin, altitude about 425–490 m asl, eastern Tanzania.

Remarks. The colouration in life of *N. prognathus* is documented in the aquarium fish literature, in photographs taken from live individuals collected in the type locality region (e.g., SEEGER, 1997).

Discussion

WILDEKAMP *et al.* (2009) provided a short redescription of *N. melanospilus*, which was considered to occur in a vast region of southeastern Kenya and eastern Tanzania. The distribution area attributed to *N. melanospilus* overlaps the geographical range of all other congeners found in the EABH, which are always endemic of smaller areas as occurring with most seasonal killifishes (e.g., COSTA, 2010). On the other hand, the colour pattern found in all



Fig. 4. *Nothobranchius melanospilus*: **A**, UFRJ 6758, male, 36.7 mm SL; **B**, UFRJ 6758, female, 29.0 mm SL: Tanzania: Pwani: Mbezi River floodplains.

populations present in this huge region is very constant, inducing taxonomists to consider them as a single species, since most congeners are mainly diagnosed by their colour patterns (e.g., SEEGER, 1997; WILDEKAMP, 2004; DORN *et al.*, 2014). In all species of this complex, in males (Fig. 4A) the flank is pale blue with red scale margins forming a striking red reticulation and the caudal fin is red, with a thin posterior black margin, sometimes restricted to the fin corners. Females are mostly recognised by the great concentration of dark grey to black dots on the posterior part of the flank (Fig. 4B).

All the material listed by WILDEKAMP *et al.* (2009) is deposited in MRAC and was examined in the present study, which also includes material from other collections (see Appendix 1). This study consistently indicated that the new two species, *N. kwalensis* and *N. melanospilus*, differ from all other populations identified as belonging to *N. melanospilus*, including topotypes, by both sharing some distinct morphological features. In the two new species, the dorsal-fin origin is slightly anterior to the anal-fin origin in females (Figs. 1C, 3C); there are dark dots on the whole flank in females, although more concentrated in its posterior portion (Figs. 1C, 3C); and the two sections of the anterior supraorbital series of

neuromasts are well-separated (Fig. 5A). In *N. melanospilus*, the dorsal-fin origin is always slightly posterior to the anal-fin origin (Fig. 4B); dark dots are restricted to the posterior portion of the flank, usually lacking dark pigmentation on the anterior portion, sometimes with rudimentary marks (Fig. 4B); and the two anterior supraorbital neuromast sections are nearly continuous (Fig. 5B). The two new species also differ from *N. melanospilus* by having fewer mandibular neuromasts (14–16 *vs.* 17–21). *Nothobranchius prognathus* is distinguished from *N. kwalensis* and *N. melanospilus* by having a moderately long snout with the lower jaw projecting beyond the upper jaw, besides having a proportionally smaller eye (*vs.* not projecting; Fig. 7); the frontal squamation, although irregular as in other species of the complex, comprises smaller scales that are arranged in three irregular longitudinal rows (*vs.* two; Fig. 5); and the pelvic fins are medially united in males (*vs.* just in contact; Fig. 6). In addition, the three species of the complex are distinguished by some morphometric data (see diagnoses above).

WILDEKAMP (1981) considered Ilonga, Tanzania, as the type locality of *N. melanospilus*, which was followed in subsequent studies (WILDEKAMP, 2004; WILDEKAMP *et al.*,

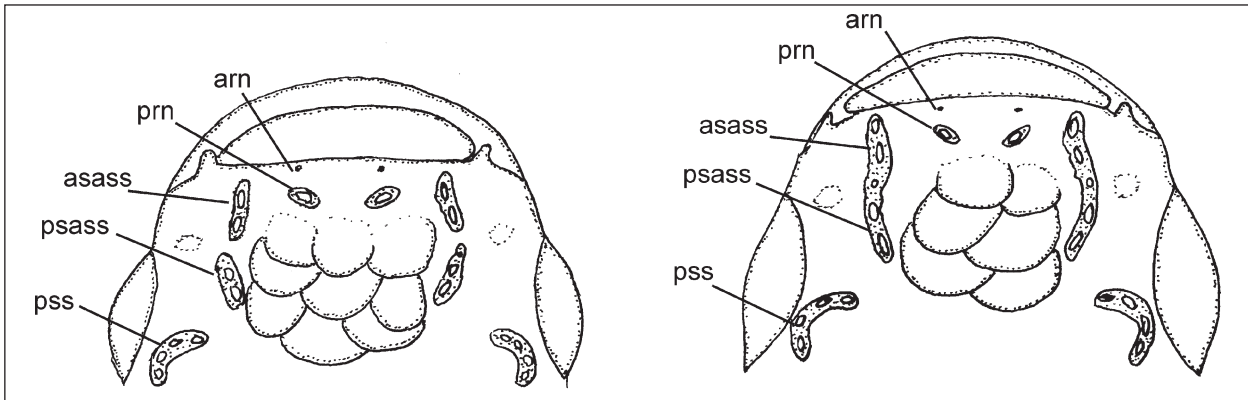


Fig. 5. Diagrammatic representation of the latero-sensory system on the dorsal surface of the head in: **A**, *Nothobranchius prognathus* sp. n., MRAC 76-49-P-56-64, male, paratype, 40.6 mm SL; **B**, *Nothobranchius melanospilus*, MRAC 76-49-P-101-113, male, 40.1 mm SL. arn – anterior rostral neuromast; asass – anterior section of the anterior supraorbital series; prn – posterior rostral neuromast; psass – posterior section of the anterior supraorbital series; pss – posterior supraorbital series.

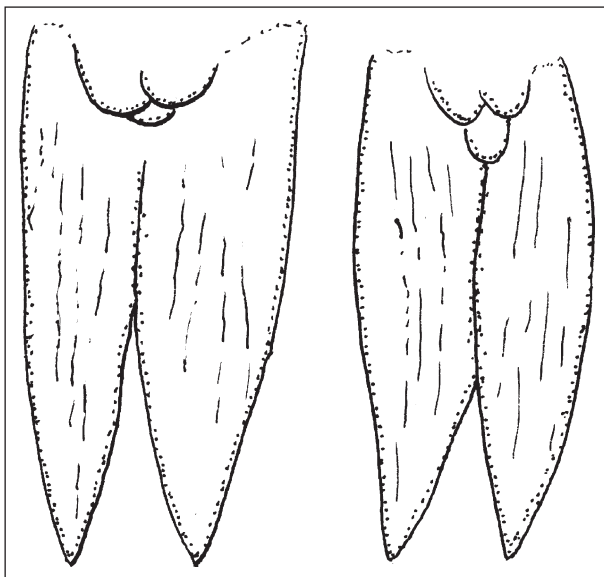


Fig. 6. Diagrammatic representation of the pelvic fins, ventral view of: **A**, *Nothobranchius prognathus* sp. n., MRAC 76-49-P-56-64, male, paratype, 40.6 mm SL; **B**, *Nothobranchius melanospilus*, MRAC 76-49-P-101-113, male, 40.1 mm SL.



Fig. 7. Head, lateral view of: **A**, holotype of *Nothobranchius kwalensis*, MRAC 79-007-P-172, male, 41.5 mm SL; **B**, holotype of *Nothobranchius prognathus*, MRAC 76-49-P-55, male, 42.9 mm SL.

2009), but COSTA (2017b) provided a historical review of the taxonomy of *N. melanospilus*, showing that the Zanzibar island should be considered as its type locality. In fact, PFEFFER (1896) based its original description of *N. melanospilus* on four female specimens collected in Longo-Bay (possibly present Ilonga) by PASHA and STUHLMANN in 1890 and specimens reported in PLAYFAIR & GÜNTHER (1866) collected in Zanzibar (COSTA, 2012, 2017b). The only illustration of *N. melanospilus* appearing in PFEFFER (1896) was a reproduction of a figure of a female specimen from Zanzibar first illustrated in PLAYFAIR & GÜNTHER (1866). However, no individual type specimen was then designated. BOULENGER (1915) attributed type status for those specimens collected in Zanzibar, using the same illustration published in PLAYFAIR & GÜNTHER (1866) and PFEFFER (1896) of a

female from Zanzibar. Based on recommendation 74B of the International Code of Zoological Nomenclature (1999) referring to lectotype selection (i.e. preference to a syntype of which an illustration has been published), COSTA (2017b) designated that specimen from Zanzibar illustrated in PLAYFAIR & GÜNTHER (1866), PFEFFER (1896)

and BOULENGER (1915) as the lectotype of *N. melanospilus*. Recent taxonomical analyses (COSTA, 2017b; the present study) have consistently indicated that *N. melanospilus* is restricted to Zanzibar and adjacent continental river basins of Tanzania south of the Wami River (Fig. 2) as well as specimens collected in the upper Wami River basin, including a population found in the road between Ilonga and Kilosa, are here identified as belonging to *N. prognathus*, not *N. melanospilus*.

Key for identification of species of the *N. melanospilus* complex

- 1 Lower jaw not anteriorly projecting beyond upper jaw (Fig. 7A); pelvic fins never medially united (Fig. 6A); two longitudinal series of scales on frontal region (Fig. 5B) **2**
- 1' Lower jaw anteriorly projecting beyond upper jaw (Fig. 7B); pelvic fins medially united in males (Fig. 6B); three longitudinal series of scales on frontal region (Fig. 5A) ***N. prognathus***
- 2 Dorsal-fin origin anterior to anal-fin origin in females (Fig. 1C); anterior supraorbital series of neuromasts divided in two sections (Fig. 5A); mandibular neuromasts 14–16; few rounded black dots on anterior portion of flank in females (Fig. 1C) ***N. kwalensis***
- 2' Dorsal-fin origin posterior to anal-fin origin in females (Fig. 4B); anterior supraorbital series of neuromasts arranged in a single continuous row (Fig. 5B); mandibular neuromasts 17–21; dots absent on anterior portion of flank in females (Fig. 4B) ***N. melanospilus***

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Appendix 1

Comparative material of *N. melanospilus*: all from eastern Tanzania. **Zanzibar Island.** BMNH 2016.12.2.1, lectotype; BMNH 1865.3.18.98-99, 4 paralectotypes; Zanzibar; Playfair. – MRAC 81-59-P-12-16, 5; MRAC 81-59P-17-19, 3; about 1.5 km south of Kinyasini, 5°59'32" S 39°19'08" E, about 45 m asl; L. Seegers *et al.*, Dec. 1980. – MRAC A0-017-P-0391-0399, 9; MRAC A0-071-P-128, 1; 5 km S of Kinyasini, 6°00'40" S 39°19'28" E, about 50 m asl; R. Wildekamp, 29 May 1997. – MRAC A0-017-P-0129-0130, 2; fast flowing stream with nearly still pools, 2 km S of Mahonda, 6°00'20" S 39°15'02" E, about 40 m asl; R. Wildekamp, 29 May 1997. – UFRJ 6874, 1; temporary channel about 500 m S of Kinyasini, 5°59'13" S 39°18'59" E, about 45 m asl; W. J. E. M. Costa & C. P. Bove, 29 Dec. 2011. **Ruvu River basin and adjacent areas.** – ZMB 21392, holotype of *Fundulus emini* Ahl, 1935; Kongoran Botto; F. Stuhlmann. – MRAC 75-72-P-1-2, 2; road A7, Ruvu River floodplains; Jan Pap, 1975. – MRAC 76-49-P-101-113, 13; road A7, about 40 km W of Dar es Salaam; R. Wildekamp, 12 Jun. 1976. – MRAC 87-38-P-38-39, 2; small pool near the Ruvu river at Nguhi; J. Lourens, 13 Jun. 1976. – MRAC A0-071-P-0410-0411, 2; pools on the floodplain of the Ruvu River, a few kilometres from ferry terminal west of Bagamoyo; R. Wildekamp *et al.*, 10 Jun 1997. – MRAC 76-49-P-83-84, 2; road A7, about 750 m from the bridge over Ruvu River, 6°41'44" S 38°41'58" E, about 25 m asl; R. H. Wildekamp, 12 Jun. 1976. – MRAC 96-045-P-28, 1; a few kilometres from ferry terminal west of Bagamoyo, roadside pools and flooded grassy areas on the Ruvu River floodplain; R. Wildekamp, 12 Jun. 1995. – UFRJ 6515, 13; UFRJ 6591, 4 (C&S); Ruvu river floodplains near Bagamoyo, 6°28'33" S 38°50'35" E, about 25 m asl; W. J. E. M. Costa *et al.*, 13 Jun. 2007. – UFRJ 6757, 9; UFRJ 6753, 2; *idem*;

W. J. E. M. Costa *et al.*, 9 Jan. 2009. – UFRJ 6651, 11; UFRJ 6652, 3 (C&S); Ruvu river floodplains near Mlandizi, 6°41'53" S 38°42'15" E, about 30 m asl; W. J. E. M. Costa *et al.*, 13 Jan. 2009. **Mbezi River basin.** MRAC A0-071-P-124-127, 4; MRAC A0-071-P-131-139, 10; road B2, Mbezi River floodplains, 7°11'10" S 39°10'11" E, about 65 m asl; R. Wildekamp *et al.*, 31 May 1997. UFRJ 6758, 13; UFRJ 6759, 4 (C&S); UFRJ 6765, 2; Mbezi River floodplains, near Kitonga, road B2, 7°11'14" S 39°10'18" E, about 80 m asl; W. J. E. M. Costa *et al.*, 10 Jan. 2009. – UFRJ 6760, 5; Mbezi river floodplains, between Mkuranga and Binga, 7°09'44" S 39°13'54" E, about 65 m asl; W. J. E. M. Costa *et al.*, 10 Jan. 2009. **Rufiji river basin.** MRAC 81-39-P-6-7, 2; left bank of Ruhoi River next to the bridge on the road Kibiti-Ndundu, road B2, 7°51'06" S 38°57'43" E, about 30 m asl; L. Seegers *et al.*, 29 Dec 1980. – MRAC 81-59-P-08-11, 4; Mtanza, close to the northern entrance of the Selous Game Reserve, 7°46'25" S 38°14'13" E, about 60 m asl; L. Seegers *et al.*, 31 Dec 1980. – MRAC 98-008-P-0001-0002, 2; pools 1 km north of Ndundu, ferry terminal on Rufiji River, road B2, 7°59'59" S 38°57'57" E, about 25 m asl; R. Wildekamp *et al.*, 11 Jun 1995. – MRAC 98-008-P-0003-0006, 4; 21 km south of Kibiti, 21 km north of Ndundu, on main road to Dar es Salaam, pools adjacent to Ruhoi River, southwest of the bridge; 7°51'33" S 38°57'42" E, about 35 m asl; R. Wildekamp *et al.*, 11 Jun 1995. – MRAC A0-071-P-140-148, 9; MRAC A0-071-P-149-151, 3; pool 2 km S of Kitonga ferry terminal on south bank of Rufiji river, 8°03'08" S 39°00'32" E, about 20 m asl; R. Wildekamp, 31 May 1997. – UFRJ 6761, 29; UFRJ 6762, 4 (C&S); floodplains of left bank of Rufiji River, 7°59'02" S 38°58'32" E, about 20 m asl; W. J. E. M. Costa *et al.*, 14 Jan. 2009.

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