Nothobranchius krammeri n. sp. (Cyprinodontiformes: Nothobranchiidae): a new annual killifish from the Meronvi River basin, northeastern Mozambique

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Abstract

Nothobranchius krammeri n. sp., a small annual killifish collected from a seasonal pool in Meronvi River basin, northeastern Mozambique, is described. It differs from all congeners by the following combination of characters: 13-15 dorsal fin rays; 14-15 anal fin rays; 24-27 scales in median lateral series; pelvic fin tips not reaching anus; male body and head scales light blue with pale red or orange margin; snout reddish; throat orange to yellow; frontal and superior portion of head reddish; anal fin yellowish with a pattern of narrow pale brown lines; caudal fin pale red with a small black seam along its outer margin, and a sharply delineated hyaline submarginal band. Based on coloration of males and morphological aspects, this new species belongs to the *Nothobranchius melanospilus* species group.

Zusammenfassung

Beschrieben wird *Nothobranchius krammeri* n. sp., ein kleiner einjähriger Killifisch, der in einem zeitlich begrenzten Tümpel im Becken des Meronvi-Flusses in Nordost-Mosambik gefangen wurde. Er unterscheidet sich von allen anderen Angehörigen der Gattung durch die Kombination folgender Merkmale: 13-15 Rückenflossenstrahlen; 14-15 Afterflossenstrahlen; 24-27 Schuppen in der mittleren seitlichen Reihe; Bauchflossenspitzen erreichen nicht den After; Rumpf- und Kopfschuppen der Männchen hellblau mit blassrotem oder orangefarbenem Rand; rötliche Schnauze; Kehle orangefarben bis gelb; vorderer und oberer Teil des Kopfes rötlich; Afterflosse gelblich mit einem Muster schmaler blassbrauner Linien; Schwanzflosse blassrot mit einem schmalen schwarzen Saum am äußeren Rand; ein scharf umrissenes durchscheinendes submarginales Band. Aufgrund der Farben der Männchen und der Morphologie wird die neue Art zur *Nothobranchius-melanospilus*-Gruppe gezählt.

Résumé

Nothobranchius krammeri n. sp., un petit Killi annuel collecté dans une mare temporaire de la rivière Meronvi, au nord-est du Mozambique, est décrit. Il se distingue de tous ses congénères par la série de caractères suivants: 13-15 rayons dorsaux; 14-15 rayons à l'anale; 24-27 écailles le long de la ligne latérale; les extrémités des pelviennes n'atteignant pas l'anus; le corps du mâle et les écailles de la tête bleu clair avec une marge rouge pâle ou orange; rostre rougeâtre; gorge orange à jaune; la partie frontale et supérieure de la tête rougeâtre; anale jaunâtre avec un patron de fines lignes brunes; caudale rouge pâle avec un fin liseré noir sur son bord extérieur et une bande hyaline submarginale fortement marquée. Sur base de la coloration des mâles et des aspetcts morphologiques, cette nouvelle espèce fait partie du groupe d'espèces *Nothobranchius melanospilus.*

Sommario

In questo articolo è descritto *Nothobranchius krammeri* n. sp., un piccolo killifish annuale raccolto presso un acquitrino stagionale nel bacino del fiume Meronvi, Mozambico nordorientale. Esso differisce dai congeneri per la seguente combinazione di caratteri: 13-15 raggi dorsali; 14-15 raggi anali; 24-27 scaglie lungo la linea laterale mediana; pinna pelvica non prolungata fino all'ano; corpo e capo del maschio ricoperti da scaglie blu chiaro con margine rosso pallido o arancio; muso rossastro; gola dall'arancio al giallo; aree frontali e superiori del capo rossastre; pinna anale giallastra decorata da un motivo di sottili linee marrone chiaro; pinna caudale rosso pallido con una sottile linea nera lungo il margine esterno e una netta banda submarginale ialina. Sulla base della colorazione dei maschi e degli aspetti morfologici, la nuova specie appartiene al gruppo di specie *Nothobranchius melanospilus.*

INTRODUCTION

The freshwater fish fauna of north Mozambique is poorly known to date (Valdesalici 2007). In the family Nothobranchiidae, *Nothobranchius hengstleri* Valdesalici, 2007 was the first species to be described from northern Mozambique, in the "East Coast" province (sensu Skelton 1994). Also known from this province is the closely related, but undescribed, *N.* cf. *melanospilus,* that has a wide

distribution from the Melela River northwards to the Rovuma River basin (Wildekamp 2004, Valdesalici 2007). The remaining *Nothobranchius* species seem to be restricted to the south-central part of Mozambique, in the "Zambesi" province (sensu Skelton 1994): *N. orthonotus* (Peters, 1844) known from Montepuez, Luala, lower Zambezi, lower Limpopo, Pungwe and Incomiti River systems, *N. rachovii* Ahl, 1926 (including *N.* aff. *rachovii* sensu Wildekamp 2004) known from drainage systems of the lower Zambezi, lower Limpopo as well as the eastward flowing rivers in the intervening area and *N. furzeri* Jubb, 1972 known from the lower Limpopo River drainage basin (Wildekamp 2004).

Recent ichthyological surveys of Mozambique have been limited to the southern and central parts of the country (Valdesalici 2007), except for Rosenstock (2003). In spring 2005, an extensive survey was conducted (H. H.), which aimed to investigate the diversity and distribution of *Nothobranchius* in the whole of Mozambique. In northern Mozambique, phenotypically different populations were observed and specimens collected during our field work (Hengstler & Valdesalici 2006).

On 15 May 2005, an unidentified *Nothobranchius* species was collected from an ephemeral pool, which is situated within the Meronvi River basin. This new annual killifish is herein described as *Nothobranchius krammeri* n. sp.

MATERIALS AND METHODS

Measurements and counts were taken as described in Amiet (1987), except for the eye diameter, which is measured between the anterior and posterior orbital walls, and snout length which is measured from the anterior tip of the lower jaw to the anterior edge of the orbital wall.

Measurements were made to the nearest 0.1 mm with digital callipers, partly under a dissecting microscope. All visible rays of the dorsal and anal fins were counted. The counts of scales on the longitudinal median lateral series are the number of scales between the superior junction of the opercular membrane and the hypural plate. The scales on the base of the caudal fin were counted separately. All measurements are presented as percentages of standard length (SL), except for interorbital width, eye diameter and snout length which are given as percentage of head length (HL). Terminology for the cephalic neuromast series follows Scheel (1968), the frontal squamation is as given in Hoedeman (1958).

Type material is deposited in the following institutions: Zoologische Staatssammlung München (ZSM), Germany; Musée Royal de l'Afrique Centrale (MRAC), Tervuren, Belgium; South African Institute for Aquatic Biodiversity (SAIAB), Grahamstown, South Africa.

Nothobranchius krammeri n. sp.

(Figs 1-5)

Nothobranchius sp. "Cabo Delgado", Hengstler & Valdesalici 2006

Holotype: ZSM 35101, male, 27.0 mm SL (upper part of caudal fin removed for DNA extraction), Mozambique, Cabo Delgado, temporary pool about 35 km north of Mocimboa da Praia village, within the Meronvi River basin, 11°09.405'S 40°19.441'E, altitude 10 m, Holger Hengstler and Silverio Vendo, 15 May 2005; collected with large hand nets and preserved while in the field.

Paratypes: ZSM 35102, female, 26.6 mm SL, same data as Holotype; MRAC 2006-41-P-1, male, 32.8 mm SL, aquarium stock (F1 generation, six months old; parents collected at the type location together with the holotype); SAIAB 78304, male, 32.9 mm SL, aquarium stock (F1 generation, six months old, parents collected at the type location together with the holotype); MRAC 2007-29-P-6, male, 33.2 mm SL, aquarium stock (F1 generation, four months old, parents collected at the type location together with the holotype); MRAC 2007-29-P-7, female, 22.2 mm SL, aquarium stock (F1 generation, four months old, parents collected at the type location together with the holotype).

Additional material, non type: ZSM 35103,

Fig. 1. Adult wild male of *Nothobranchius krammeri* n. sp. about one month after collection (not preserved). Photo by W. Krammer.

Table I. Morphometric characters of *Nothobranchius krammeri* n. sp.

		Holotype	Males (n=3)	Females (n=2)
SL (mm)		27.0	32.8-33.2	22.2-26.6
Depth of caudal peduncle	In percent of standard length	15.5	13.0-14.6	12.0-13.5
Depth at the pelvic fins		33.8	32.2-34.4	28.8-34.3
Preanal length		59.2	58.5-62.0	61.7-62.0
Predorsal length		56.3	54.5-60.2	55.2-55.8
Prepelvic length		48.8	46.0-48.4	48.1-49.6
Head length		33.2	30.1-33.4	32.7-34.6
Interobital width	In percents of head length	43.6	34.6-38.0	37.6-42.5
Snouth length		22.9	26.1-28.0	19.4-19.5
Eye diameter		35.6	26.1-27.0	31.0-35.0

male, 32.1 mm SL, aquarium stock (F1 generation, six months old, parents collected at the type location together with the holotype).

Diagnosis: *Nothobranchius krammeri* can be distinguished from all other species of the genus by the following combination of unique characters: 13-15 dorsal fin rays; 14-15 anal fin rays; 24-27 scales in median lateral series; frontal squamation pattern variable; pelvic fin tips not reaching the anus; male body and head scales light blue with pale red to pale orange margin, outer rim of ventral body scales towards the belly yellow; snout reddish; throat orange to yellow; frontal and superior portion of head reddish; anal fin yellowish with a pattern of narrow pale brown lines extending to fin rays; caudal fin pale red with a small black seam along its outer margin, larger on upper and lower angle, sharply delineated hyaline submarginal band.

Description: Morphometric measurements are given in Table I. Small, robust, deep bodied *Nothobranchius* species with a pointed snout, and upward mouth position; dorsal fin rays 13-15 ; anal fin rays 14-16; longitudinal median lateral series of scales 24-27 + 3-4 on caudal fin base; cephalic squamation pattern variable; cephalic neuromast series reduced, "open type" anterior neuromast series; central series in two small shallow grooves, lined with low lobes or with two, or rarely three, single neuromasts; posterior cephalic neuromast series curved with shallow pits on each side or with a single, or up to four neuromasts; preopercular neuromast system with 10-14 neuromasts in open grooves, distal ridges slightly overlaps the bony opercle; one neuromast on each scale of median longitudinal series.

Maximum male size observed 33.2 mm SL; body deep and compressed; dorsal body profile convex towards the dorsal fin and ventrally towards the belly, slightly concave towards the caudal peduncle; maximum body height measured at the base of the pelvic fins; dorsal and anal fins rounded, tips with rudimentary filamentous rays; minute papillate contact organs present above the middle of the dorsal fin towards its distal part, and on the anal fin

Fig. 2. Adult male of *Nothobranchius krammeri* n. sp. F1 about six months old (not preserved). Photo by W. Krammer.

Fig. 3. Adult wild female of *Nothobranchius krammeri* n. sp. about one month after collection (not preserved). Photo by W. Krammer.

which is densely covered over fin rays; membranes of pelvic fins fusing near the fin base; tips of pelvic fins not reaching the anus; caudal fin subtruncate; branchiostegal membrane projecting from opercle, distal edge slightly wrinkled.

Female smaller than male; maximum observed size 26.6 mm SL; body deep and compressed; dorsal fin rounded; anal fin triangular with rounded tip; branchiostegal membrane not projecting from the opercle.

Colour in live specimens: For general appearance of males see Figs 1-2. Body and head scales light blue with pale red to pale orange margin, creating a reticulated pattern on the body and the head; outer rim of ventral body scales towards the belly yellow; snout reddish; throat orange to yellow; frontal and superior portion of head reddish; dorsal fin yellowish with red brown spots, getting smaller towards distal fin part; dorsal fin seamed with an iridescent light blue to white rim; anal fin yellowish with a pattern of narrow pale brown lines extending to fin rays, fin margin white to light blue; caudal fin pale red with a small black seam along its outer margin, larger on upper and lower angle, sharply delineated hyaline submarginal band; the pale red on the caudal fin extends partially into caudal peduncle; pelvic fins yellowish to hyaline with light blue margin; pectoral fins hyaline with a light blue margin; iris golden, with a black vertical bar through the centre of the eye.

Female coloration (Fig. 3): Body pale olive-brown; darker grey-brown dorsally; lighter brown to silver ventrally; unpaired and paired fins hyaline; iris golden, with a black vertical bar through the centre of the eye.

Male coloration in alcohol (Fig. 4): Body scales light brown to whitish; scales on opercular and ventral area yellowish to light orange; almost all scales with distinct dark brown margin; dorsal fin light brown with a pattern of dark brown spots; anal fin light brown with a faint pattern, dark brown spots extending on fin rays; caudal fin brown with a fine dark brown to black seam along its outer margin, larger on upper and lower angle and a light brown submarginal band; pelvic fins light brown; pectoral fins light brown to whitish; iris bluish.

Female coloration in alcohol (Fig. 5): Body scales brown; opercular and ventral area brown yellowish; unpaired and paired fins pale brown; iris bluish.

Distribution and habitat: *Nothobranchius krammeri* is only known from the type locality (Figs 6-7).This species was caught in an ephemeral pool which measures only approximately 350 m in diameter and is no more than about 0.75 m deep at its centre. The banks were densely covered with water lilies *(Nymphaea* spp.). The water was brown, slightly turbid with a neutral pH (measured in the morning). In the late morning (around 11:00) the surface water temperature was 27°C, and at a depth of 0.30 m it was 25°C. In the afternoon (around 16:30) near the banks the temperature increased to 30°C at a depth of 0.2 m; the surface temperature was not measured. A second species of *Nothobranchius* (see Hengstler & Valdesalici 2006) was collected in the same pool near the banks, called here *Nothobranchiu* sp. "Macimboa da Praia" (see Discussion).

Etymology: The new species is described in honour of Werner Krammer, Pöttmes, Germany, a well known German aquarist, who first successfully bred this species.

Discussion: The *N. melanospilus* species group was defined in Wildekamp et al. (1998) and modified in Valdesalici (2007). This clade includes *N. melanospilus* (Pfeffer, 1896), *N. vosseleri* Ahl, 1924,

Fig. 4. *Nothobranchius krammeri* n. sp., Holotype, ZSM 35101, 27.0 mm SL, male. Photo by S. Valdesalici.

Fig. 5. *Nothobranchius krammeri* n. sp., ZSM 35102, Paratype, 26.6 mm SL, female. Photo by S. Valdesalici.

N. interruptus Wildekamp & Berkenkamp, 1979, *N. jubbi* Wildekamp & Berkenkamp, 1979, *N. elongatus* Wildekamp, 1982, and *N. hengstleri* Valdesalici, 2007. *Nothobranchius krammeri* is a member of this group, presenting all the diagnostic features of this complex. This result was also confirmed by a preliminary phylogenetic analysis of COI gene (M. Benedetti, P. Roncaglia and A. Cellerino, pers. comm.).

Within this group, *N. krammeri* is similar to *N. hengstleri* in general appearance. Male *N. krammeri* differ from male *N. hengstleri* in maximum observed length (33.2 mm *vs* 41.3 mm SL), greater body depth (32.2-33.8 *vs* 30.4-31.8% SL) and shorter predorsal length (54.5-60.2 *vs* 60.8-60.9% SL). Male *N. krammeri* also differ from male *N. hengstleri* by body and head colour (pale red-yellowish *vs* deeper red), throat colour (orange to yellow *vs* deep red), more intensely yellow dorsal and anal fins, the anal fin spot pattern (arranged in pale brown narrow lines extending to fin rays *vs* well defined brown spots that form transverse arc-like stripes); caudal fin shape (subtuncated *vs* perfectly rounded). Male eye colour differs: Iris golden with a well defined black vertical bar *vs* iris golden, with light blue iridescences and faint dark vertical bar. Female *N. krammeri* differ from female *N. hengstleri* in its greater body depth (28.8- 34.3 *vs* 24.1-27.3% SL), a comparatively deeper caudal peduncle (12.0-13.5 *vs* 10.5-11.4% SL), shorter preanal length (61.7-62.0 *vs* 65.4-67.4% SL), shorter predorsal length (55.2-55.8 *vs* 60.8-63.3% SL) and by the shape of the caudal fin (subtruncate *vs* perfectly rounded). Males and females have a reduced pelvic fin length (tips not reaching the anus *vs* tips reaching urogenital papilla).

Nothobranchius krammeri is easly distinguished from all others member of the *N. melanospilus* species group. It differs from male *Nothobranchius* sp. "Macimboa da Praia", found in the same habitat, which belongs to the same group but is as yet undescribed, in the following features: maximum observed length (33.2 mm *vs* 38.5 mm SL), greater body depth (32.2-33.4 *vs* 22.9-32.9% SL) and shorter prepelvic length (46.0-48.8 *vs* 49.1-52.2% SL). Female *Nothobranchius krammeri* differs from females of *N.* sp. "Macimboa da Praia" in maximum observed length (26.6 *vs* 27.1 mm SL), longer head (32.7-34.6 *vs* 27.3-29.8% SL), deeper caudal peduncle (12.0-13.5 *vs* 9.4-11.0% SL), shorter preanal length (61.7-62.0 *vs* 62.7-68.9% SL) and shorter predorsal length (55.2-55.8 *vs* 60.5-62.8% SL). Males and females have reduced numbers of scales in the longitudinal series (24-27 *vs* 29-30), reduced length of pelvic fins (tips not reaching the anus *vs* tips overpassing the anus). Male *N. krammeri* differ from male *Nothobranchius* sp. "Machimboa da Praia" in their contact organs (papillate contact organs limited to anal and dorsal fins *vs* distributed on dorsal fin, anal fin, lower preoperculum and operculum, post otic area and on supraanal area), in the ctenoid spines on distal margins of scales (absent *vs* present), in head and body colour (pale red-yellowish *vs* deeper red), perctoral fin colour (hyaline *vs* deeper red) and anal fin colour (yellowish with pale brown narrow lines extending to fin rays *vs* plain yellow with few red spots near the base).

Nothobranchius krammeri differs from *N. melanospilus* in having a different maximum observed length (32.2 mm SL [largest male] and 26.6 mm SL [largest female] vs. 57.4 mm SL [largest male] and 50.6 mm SL [largest female]). Males also differ in having a greater body depth (32.2-33.8 *vs* 29.3-30.3% SL), a longer head (30.3-33.4 *vs* 26.8-28.3% SL), males and females with reduced number of scales in longitudinal series (24-27 *vs* 31-32) and anal fin rays (14-16 *vs* 16-18). Pelvic fins shorter (tips not reaching the anus *vs* tips overpassing the anus). *Nothobranchius krammeri* differs from *N.* cf. *melanospilus* in having a different observed maximum length (33.2 mm SL [largest male] and 26.6 mm SL [largest female] *vs* 50.5 mm SL [largest male] and 43.7 mm SL [largest female]). Male *N. krammeri* also have a greater body depth (32.2-33.8 *vs* 25.6-28.2% SL); males and females have reduced

Fig. 6. Mozambique, Cabo Delgado, about 35 km north of Mocimboa da Praia, left of the main road, temporary pool on Meronvi River basin, type locality of *Nothobranchius krammeri* n. sp. Photo by H. Hengstler.

number of scales in the longitudinal series (24-27 *vs* 29-30). Pelvic shorter (tips not reaching the anus *vs* tips overpassing the anus).

Male *N. krammeri* differ from male *N. melanospilus* and *N.* cf. *melanospilus* in anal fin spot pattern (arranged in pale red-brown narrow lines extending to the fin rays *vs* few red spots limited at base and on rear part). Female *N. krammeri* differ from female *N. melanospilus* by the spots on body and fins (absent *vs* present) and by the caudal fin shape, as described here above. They also differ from female *N.* cf. *melanospilus* by the spots on body and fins (absent *vs* present but rudimentary) (Seegers 1986, 1997 and 2003, Rosenstock 2003).

Male *N. krammeri* differ from male *N. vosseleri* in maximum observed length (33.2 *vs* 44.6 mm SL), a longer head (30.3-33.4 *vs* 25.1-31.5% SL), a moderately greater body depth (32.2-33.8 *vs* 27.8-32.6% SL), male body colour (body and head scales light blue with pale red to pale orange margin vs. body and head scales blue-green to iridescent blue with grey-brown to red-brown border), dorsal fin colour (yellowish *vs* pale blue to grey-yellow), anal fin colour (yellowish with pale red-brown narrow

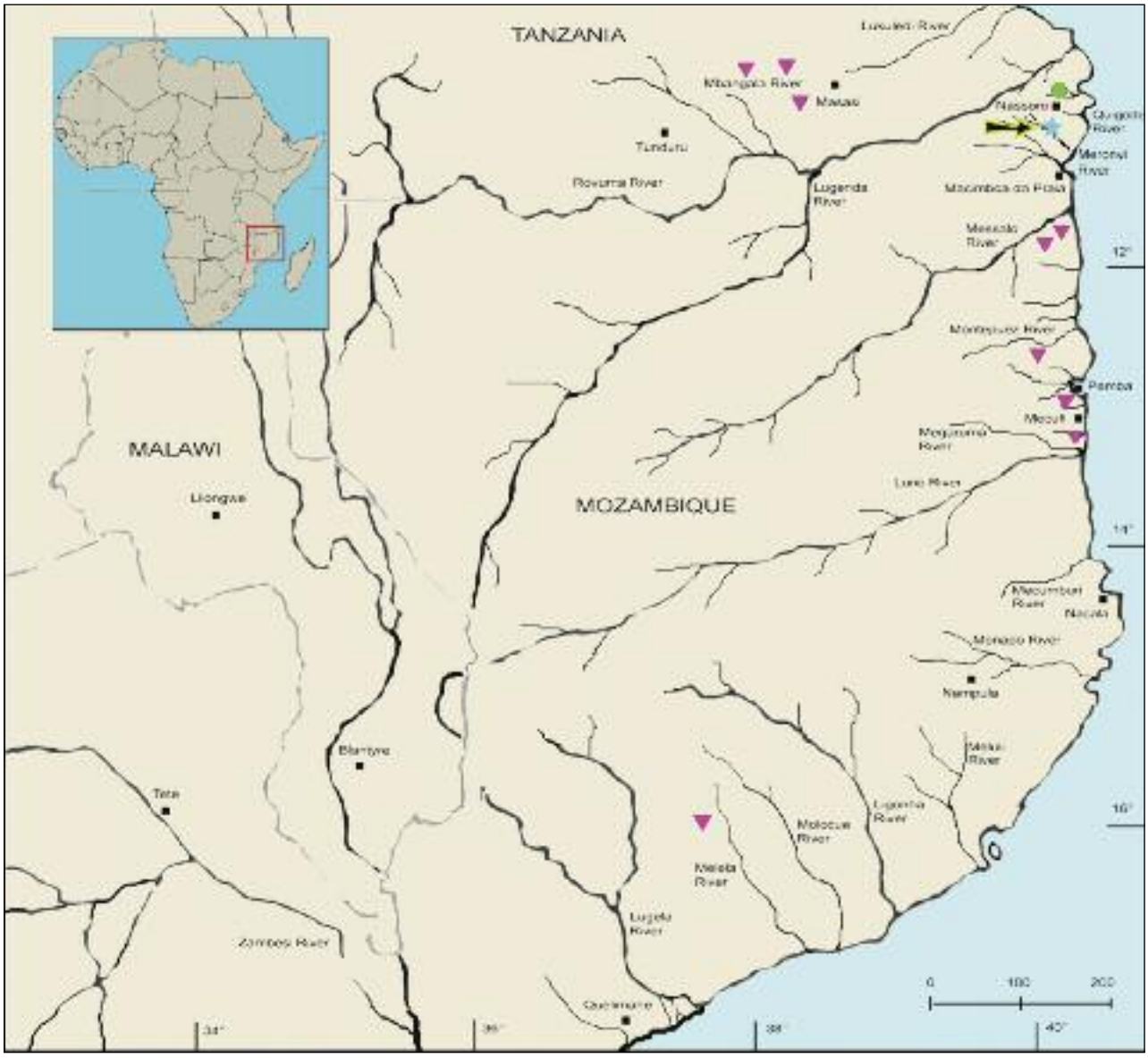

Fig. 7. Geographic distribution of *Nothobranchius krammeri* n. sp. (star, type locality), *N. hengstleri* (dot) and *N.* cf. *melanospilus* (inverted triangle). Drawing by S. Valdesalici.

lines extending to fin rays and with a light blue to white margin *vs* yellow-grey to pale blue with a dense pattern of red-brown spots and stripes and without any coloured margin), males and females with moderately reduced number of scales in longitudinal series (24-27 *vs* 25-31) and less anal fin rays (14-16 *vs* 15-18).

Male *N. krammeri* differ from male *N. interruptus* in its dorsal fin colour (yellowish with red-brown spots *vs* blue-grey to olive with dark grey spots), anal fin colour (yellowish with pale red-brown narrow lines extending to fin rays *vs* olive-yellow to pale blue with some grey spots near fin base) and maximum observed size (33.2 *vs* 56.8 mm SL). Male and female *N. krammeri* have reduced numbers of scales in longitudinal series (24-27 *vs* 27-32) and different eye colour (iris golden with a black vertical bar *vs* iris golden without any marking).

Male *N. krammeri* differ from male *N. jubbi* in dorsal fin colour (yellowish with red-brown spots *vs* blue-grey to olive with red brown spots), anal fin colour (yellowish with pale red-brown narrow lines extending to fin rays *vs* olive-yellow to pale blue with some grey spots near fin base), maximum observed size (33.2 *vs* 67.9 mm SL), males and females with reduced number of scales in longitudinal series (24-27 *vs* 29-32), less dorsal (13-15 *vs* 15-20) and anal fin rays (14-16 *vs* 15-19).

Female *N. krammeri* differ from female *N. jubbi* in body colour pattern and colour of unpaired fins (not marked *vs* dark border on body scales and small dark grey marking at base of fins). Male and female *N. krammeri* have different eye colour (iris golden with a black vertical bar *vs* iris golden without any marking).

Male *N. krammeri* differ from male *N. elongatus* in its anal fin colour (yellowish with pale red-brown narrow lines extending to fin rays *vs* yellow-grey with few red spots near fin base), maximum observed length (33.2 *vs* 44.1 mm SL), greater body depth (32.2-33.8 *vs* 22.1-27.9% SL) and a longer head (30.3-33.4 *vs* 28.1-30.8% SL). Male and female *N. krammeri* have a reduced number of scales in longitudinal series (24-27 *vs* 30-32) and fewer anal fin rays (14-16 *vs* 16-18).

Northern Mozambique, including the area north of Rovuma River (Seegers 1986, 1997 and 2003, Wildekamp 2004, Watters et al. 2008), seems to be richer in species than previously expected (Hengsteler & Valdesalici 2006, Valdesalici 2007, this work).

Comparative material: *Nothobranchius hengstleri*, ZSM 34483-34486, Mozambique, Cabo Delgado, about 5 km north of Nassoro village, 10°53.222'S, 40°22.094'E, Holger Hengstler & Silverio Vendo, 18 May 2005. *Nothobranchius* sp. "Macimboa da Praia", MRAC 2007-29-P-1-5, aquarium stock, F1 generation, six months old, parents collected in Mozambique, Cabo Delgado, temporary pool about 35 km north of Mocimboa da Praia village, within the Meronvi River basin, 11°09.405'S, 40°19.441'E, altitude 10 m, Holger Hengstler & Silverio Vendo, 15 May 2005. *Nothobranchius melanospilus,* MRAC P 98008.0013-0017, Tanzania, 2 km north of Kidete, 06°23'S, 37°16'E, R. Wildekamp and others, 6 June 1995, MRAC P 98008.0001-0002, Tanzania, 1 km north of Ndundu, 08°01'S, 39°01'E, R. Wildekamp et al., 6 November 1995. *Nothobranchius* cf. *melanospilus*, MRAC AO-071-P-0227-0229, Tanzania, 36 km southwest of Masasi, 10°53.85'S, 38°33.02'E, R. Wildekamp and others, 6 April 1997, MRAC AO-071-P-0234-0237, Tanzania, 69 km west of Masasi, 10°55.73'S, 38°17.05'E, R. Wildekamp and others, 6 April 1997, MRAC AO-071-P-0249-0256, Tanzania, 124 km west of Masasi, 10°55.28'S, 37°52.19'E, R.Wildekamp and others, 6 April 1997.

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REFERENCES

AMIET, J. L. 1987. *Faune du Cameroun. Fauna of Cameroon*. Vol. 2. Le genre *Aphyosemion* Myers (Pisces, Teleostei, Cyprinodontiformes). Sciences Naturales, Compiègne, 262 pp.

HENGSTLER, H. & VALDESALICI, S. 2006. Un incredibile viaggio in Mozambico. Associazione Italiana Killifish. *Notizie Killi* **5**: 3-8.

HOEDEMAN, J. J. 1958. The frontal scalation pattern in some groups of tooth carps (Pisces, Cyprinodontiformes). *Bulletin of Aquatic Biology* **1**: 23-28.

ROSENSTOCK, J. 2003. *Nothobranchius* I det nordlige Mocambique. Skandinaviska Killisallskapet. *Killibladet* **2**: 24-30.

SCHEEL, J. J. 1968. *Rivulins of the Old Word*. Tropical Fish Hobbyist Publication, Neptune City, 480 pp.

SEEGERS, L. 1986. Farbtupfer aus Ostafrika: Prachtgrundkärpflinge. Neue Nothobranchius-Arten aus Süd-Tansania. *Aquarienmagazin* **20**: 420-426.

SEEGERS, L. 1997. *Killifishes of the World. Old World Killis II*. Verlag A.C.S. Mörfelden-Walldorf, Germany, 112 pp.

SEEGERS, L. 2003. Die Fische des Ruvuma Rivers, Ostafrika. *Aquaristik Fachmagazin & Aquarium Heute* **35**: 46-53.

SKELTON, P. H. 1994. Diversity and Distribution of Freshwater Fishes. *In:* East and Southern Africa, in Biological Diversity of African Fresh- and Brackish Water Fishes. Geographical Overviews - Paradi. (Eds. G. G. Teugels, J.-F. Guegan and J.-J. Albaret). *Annales du Musée Royael de l'Afrique Centrale, Sciences Zoologiques* **275**: 95-131.

VALDESALICI, S. 2007. A new species of the genus *Nothobranchius* (Cyprinodontiformes: Nothobranchiidae) from the coastal area of northeastern Mozambique. *Zootaxa* **1587**: 61-68.

WATTERS, B. R., COOPER, B. J. & WILDEKAMP, R. H. 2008. Description of *Nothobranchius cardinalis* spec. nov. (Cyprinodontiformes: Aplocheilidae), an annual fish from the Mbwemkuru River basin, Tanzania. *Journal of the American Killifish Association* **40**: 129-145.

WILDEKAMP, R. H. 2004. *A world of killies. Atlas of the oviparous cyprinodontiform fishes of the world*. Volume 4. Mishawaka, Indiana, 398 pp.

WILDEKAMP, R. H., WATTERS, R. B. & SAINTHOUSE, I. . 1998. Redescription of *Nothobranchius vosseleri* (Cyprinodontiformes: Aplocheilidae) an annual fish from the Tanzanian coastal plains. *Ichthyological Exploration of Freshwaters* **8**: 289-298.