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Nothobranchius taiti, a new species of annual killifish from the upper Nile drainage in Uganda (Teleostei: Nothobranchiidae)

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Nothobranchius taiti, new species, is described from seasonal habitats in the Apapi River system, forming part of the Lake Kyoga basin in the upper Nile drainage in eastern Uganda. *Nothobranchius taiti* is distinguished from all other members of the genus by the following characters in males: body coloration light blue with seven to ten irregular red-brown vertical stripes; anal and caudal fins light blue with brown spots proximally, with brown median band, followed by a light blue subdistal band and a black distal band; dorsal fin golden with brown spots and irregular brown stripes and with slender black distal band. Furthermore, it differs from *N. taeniopygus*, a species to which it has previously been tentatively ascribed, by having a greater head length of 35.0–38.6 % SL; smaller head width of 50–57 % HL; smaller head depth of 71–80 % HL; smaller interorbital width of 31–40 % HL; and smaller postorbital length of 44–51 % HL.

Introduction

The cyprinodontiform fish genus *Nothobranchius* is currently composed of 77 valid species. Species occur in river drainages of eastern and south-eastern Africa that are subject to seasonal rainfall (Seegers, 1997; Watters, 2009). They are recognised as annuals, with all known species having an annual or semi-annual life cycle (Peters, 1963) geared to the periodic drying up of their natural habitats, where they reproduce in the seasonally arid savannah biome (Nagy, 2015). They inhabit temporary pools and swamps during the rainy season (Skelton, 2001). The development of the fish is very rapid in order to reach sexual maturity within the shortest period of time during a rainy season. The adult fish deposits eggs into the muddy substrate of the habitat, where they survive the dry season, while undergoing development and intervening diapause in a vertisol-type substratum, characteristically rich in swelling clay minerals that are critical in maintaining the viability of the eggs through the dry season (Watters, 2009; Reichard, 2015). *Nothobranchius* species show marked sexual dimorphism being highly dichromatic; the typically robust and elaborately pigmented, colourful males contrast against the slightly smaller and dull coloured females (Jubb, 1981; Wildekamp, 2004). The distinctive colour pattern of the males provides important diagnostic characters (e. g. Wildekamp, 1978; Jubb, 1981; Nagy, 2018a). *Nothobranchius* species generally show little intra-specific morphological variation. They are small fishes, most species reaching 30–70 mm in standard length, with only a couple of species reaching 10 cm or more (Wildekamp,

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Literature cited

Abell, R., M. L. Thieme, C. Revenga, M. Bryer, M. Kottelat, N. Bogutskaya, B. Coad, N. Mandrak, S. Contreras-Balderas, W. Bussing, M. L. J. Stiassny, P. Skelton, G. R. Allen, P. Unmack, A. Naseka, R. Ng, N. Sindorf, J. Robertson, E. Armijo, J. V. Higgins, T. J. Heibel, E. Wikramanayake, D. Olson, H. L. López, R. E. Reis, J. G. Lundberg, M. H. Sabaj Pérez, & P. Petry. 2008. Freshwater ecoregions of the world: a new map of biogeographic units for freshwater biodiversity conservation. BioScience, 58: 403–414.

Blair, D. 1971. *Nothobranchius taeniopygus*. Killi-News, The Journal of the British Killifish Association, 87: 4–5.

Boulenger, G. A. 1902. List of the cold-blooded vertebrates, hitherto recorded from the Uganda protectorate. Pp. 445–449 in H. Johnston (ed.): The Uganda protectorate: an attempt to give some description of the physical geography, botany, zoology, anthropology, languages and history of the territories under British protection in East Central Africa, between the Congo Free State and the Rift Valley and between the first degree of South Latitude and the fifth degree of North Latitude. Volume 1. Hutchinson, London.

Burgis, M. J., J. J. Symoens & P. Compère. 1987. African wetlands and shallow water bodies. Office de la Recherche Scientifique et Technique Outre-Mer, Paris, 652 pp.

Cellerino, A., D. R. Valenzano & M. Reichard. 2016. From the bush to the bench: the annual *Nothobranchius* fishes as a new model system in biology. Biological Reviews, 91: 511–533.

Darwall, W., K. Smith, T. Lowe, & J.-C. Vié. 2005. The status and distribution of freshwater biodiversity in eastern Africa. IUCN SSC Freshwater Biodiversity Assessment Programme. IUCN, Gland, Switzerland & Cambridge, UK, 36 pp.

Dytham, C. 2011. Choosing and using statistics: a biologist's guide. Third Edition. Wiley-Blackwell, Oxford, Chichester & Hoboken, 320 pp.

Greenwood, P. H. 1958. The fishes of Uganda. Uganda Society, Kampala, 224 pp.

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

Hilgendorf, F. 1891. Eine Aufzählung der von Emin Pascha und Dr. Stuhlmann gesammelten Fische und Krebse. Sitzungs-Berichte der Gesellschaft Naturforschender Freunde zu Berlin, 1: 18–20.

Hughes, R. H. & J. S. Hughes. 1992. A directory of African wetlands. IUCN, Gland and Cambridge & UNEP, Nairobi, 820 pp.

IUCN. 2012. IUCN Red List Categories and Criteria: Version 3.1. Second edition. Gland, Switzerland & Cambridge, UK, 32 pp.

James, F. C. & C. E. McCulloch. 1990. Multivariate analysis in ecology and systematics: panacea or Pandora's box? Annual Review of Ecology and Systematics, 21: 129–166.

Jubb, R. A. 1981. *Nothobranchius*. T. F. H. Publication, Neptune, 61 pp.

Lowe-McConnell, R. H. 1987. Ecological studies in tropical fish communities. Cambridge University Press, Cambridge, 382 pp.

McDonald, J. H. 2008. Handbook of biological statistics. Sparky House, Baltimore, 287 pp.

Minitab. 2010. [Statistical computer software]. Version 16.2.1. State College, PA: Minitab, Inc.

Nagy, B. 2010. Collecting *Nothobranchius* in 'The pearl of Africa'. *Nothobranchius* Archives, 1: 14–30.

Nagy, B. 2014. *Nothobranchius milvertzi*, a new species of killifish from the Lushiba Marsh in the Lake Mweru drainage, Zambia (Teleostei: Cyprinodontiformes: Nothobranchiidae). Ichthyological Exploration of Freshwaters, 24: 347–360.

Nagy, B. 2015. Life history and reproduction of *Nothobranchius* fishes. Journal of the American Killifish Association, 47: 182–192.

Nagy, B. 2017a. Searching for a mystery *Nothobranchius* in Uganda. Journal of the American Killifish Association, 50: 162–174.

Nagy, B. 2017b. Nous cherchions un mystérieux killi en Ouganda. L'Aquarium à la maison, 125: 46–50.

Nagy, B. 2018a. *Nothobranchius ditte*, a new species of annual killifish from the Lake Mweru basin in Democratic Republic of Congo (Teleostei: Nothobranchiidae). Ichthyological Exploration of Freshwaters, 28: 115–134.

Nagy, B. 2018b. Searching for killifish in the Pearl of Africa. Practical Fishkeeping, 2018: 72–77.

Nagy, B. & B. R. Watters. 2018. Distribution and habitat conditions of *Nothobranchius* fishes in Uganda. Journal of the American Killifish Association, 51: 178–194.

Paepke, H.-J. & L. Seegers. 1986. Kritischer Katalog der Typen und Typoide der Fischsammlung des Zoologischen Museums Berlin. Teil 1: Atheriniformes. Mitteilungen aus dem Zoologischen Museum in Berlin, 62: 135–186.

Pellegrin, J. 1909. Mission scientifique de Ch. Alluaud en Afrique orientale (1908–09). Poissons. Mémoires de la Société Zoologique de France, 22: 281–298.

Peters, N. 1963. Zur Embryonalentwicklung bodenlaichender Zahnkarpfen. Die Aquarien und Terrarien Zeitschrift, 16: 201–204.

Quinn, G. P. & M. J. Keough. 2002. Experimental design and data analysis for biologists. University Press, Cambridge, 553 pp.

Reichard, M. 2015. The evolutionary ecology of African annual fishes. Pp. 133–158 in: N. Berois, G. García & R. de Sá (eds.), Annual fishes: life history strategy, diversity, and evolution. CRC Press, Boca Raton.

Rice, W. R. 1989. Analyzing tables of statistical tests. Evolution, 43: 223–225.

Sainthouse, I. 1985. A review of the problems associated with the identification of *Nothobranchius taeniopygus* (Hilgendorf 1891) from Central Tanzania. Killi-News, The Journal of the British Killifish Association, 235: 1–20.

Seegers, L. 1997. Killifishes of the world. Old world killis II. Aqualog, A.C.S., Mörfelden-Walldorf, 112 pp.

Skelton, P. H. 2001. A complete guide to the freshwater fishes of Southern Africa. Struik Publishers, Cape Town, xiv + 395 pp.

Sokal, R. R. & F. J. Rohlf. 1995. Biometry: the principles and practice of statistics in biological research. Third edition. Freeman, New York, 880 pp.

Sokal, R. R. & F. J. Rohlf. 2009. Introduction to biostatistics. Second edition. Dover Publications, Mineola, 382 pp.

Tait, C. C. 1965. Notes on the species *Nothobranchius brieni* Poll (Cyprinodontidae). The Puku, Occasional Papers of the Department of Game and Fisheries, Zambia, 3: 125–131.

Thieme, M. L., R. Abell, M. L. J. Stiassny, P. H. Skelton, B. Lehner, G. G. Teugels, E. Dinerstein, A. Kamdem-Toham, N. D. Burgess & D. Olson. 2005. Freshwater ecoregions of Africa and Madagascar: a conservation assessment. Island Press, Washington, Covelo & London. 483 pp.

Thomson, D. B. 2018. A fisherman's reflections on a beautiful but troubled world. https://www.electricscotland.com/thomson/reflections.htm. (accessed 9 Sep 2018).

Trewavas, E. 1983. Tilapiine fishes of the genera *Sarotherodon*, *Oreochromis*, and *Danakilia*. British Museum (Natural History), London, 583 pp.

Valdesalici, S. & A. Cellerino. 2003. Extremely short lifespan in the annual fish *Nothobranchius furzeri*. Proceedings of the Royal Society of London, Series B, 270: 189–191.

Watters, B. R. 2009. The ecology and distribution of *Nothobranchius* fishes. Journal of the American Killifish Association, 42: 37–76.

Wildekamp, R. H. 1978. Redescription of *Nothobranchius brieni* Poll, 1938 and the description of three new *Nothobranchius* species (Pisces, Cyprinodontidae) from the province of Shaba, Zaire. Revue de Zoologie Africaine, 92: 341–354.

Wildekamp, R. H. 1980. Investigations into the Identity of *Nothobranchius taeniopygus* Hilgendorf, 1891, with a reclassification of the subgenus *Zononothobranchius* Radda, 1969. Journal of the American Killifish Association, 13: 32–46.

Wildekamp, R. H. 1989. Fisch-Safari in Uganda. Die Aquarien und Terrarien Zeitschrift (DATZ), 42: 358–362.

Wildekamp, R. H. 1990. Redescription of two lesser known *Nothobranchius* from central Tanzania, *N. taeniopygus* and *N. neumanni* (Cyprinodontiformes: Aplocheilidae). Ichthyological Exploration of Freshwaters, 1: 193–206.

Wildekamp, R. H. 1994. The *Nothobranchius* species from Uganda, with description of a new polymorphic species (Cyprinodontiformes: Aplocheilidae). Ichthyological Exploration of Freshwaters, 5: 193–206.

Wildekamp, R. H. 2004. A world of killies. Atlas of the oviparous cyprinodontiform fishes of the world. Volume IV. American Killifish Association, Mishawaka, 368 pp.

Zar, J. H. 2010. Biostatistical analysis. Pearson Prentice-Hall, Upper Saddle River, 960 pp.

Zuur, A. F., E. N. Ieno & G. M. Smith. 2007. Analysing ecological data (statistics for biology and health). Springer, New York, 698 pp.

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