

SHORT COMMUNICATION

A novel cave habitat use and range extension for the cryptic snake *Stegonotus muelleri* (Serpentes: Colubridae)

Curt H. Barnes and Tyler K. Knierim

Department of Biology, Institute of Science, Suranaree University of Technology, Thailand. E-mails: chradbarnes@gmail.com, tyler.k.knierim@gmail.com.

Keywords: distribution, endemic, Muller's Wolf Snake, Philippines.

Palavras-chave: distribuição, espécie endêmica, Filipinas, serpente-lobo-de-muller.

Comprising more than 7,100 islands, and housing 20% of earth's species, the Philippine archipelago is considered a global biodiversity hotspot (Myers *et al.* 2000). At least 270 reptile and 111 amphibian species (BREO 2015) have previously been observed in the Philippines. Of the reptile species recorded, as many as 66% may be endemic to the archipelago (Diesmos *et al.* 2002). As many as 32 Philippine reptile and amphibian species are additionally listed by the IUCN as threatened, and seven as critically endangered (Diesmos *et al.* 2002). Habitat destruction is perhaps the most clear and immediate threat to Philippine herpetofauna as vast tracts of forest have been converted to agriculture (Diesmos *et al.* 2002).

The Philippines house nine distinct faunal regions, defined as Pleistocene aggregate island complexes by Diesmos *et al.* (2002). The island of Bohol is part of the Mindanao faunal region and is the 10th largest island in the Philippines (3,269 km²). Bohol is topographically charac-

terized by rolling hills and limestone karsts. The island's primary forest cover has been completely cleared in recent decades (DENR-UNEP 1997). Currently, only beach forest, mangrove forest, plantations, grassland, secondary forest with moderate-high levels of disturbance, and lowland evergreen forest habitats remain.

The genus *Stegonotus* is known from the Philippines, Indonesia, Malaysia, Papua New Guinea, and Australia, with its greatest species diversity on the island of New Guinea (Ruane *et al.* 2018). Taxonomy of *Stegonotus* remains unclear, and despite its presumably close relationship to the genus *Lycodon*, *Stegonotus* has not been included in any large molecular phylogenetic study of snakes (Ruane *et al.* 2018). Basic biological information remains scarce from all representative species in the genus. However, frogs, lizards, mammals, and eggs have previously been recorded in the diets of *Stegonotus* (summarized in Ruane *et al.* 2018).

Muller's Wolf Snake (*Stegonotus muelleri* Duméril, Bibron and Duméril, 1854) is a large (1.5–2.0 m) snake endemic to Samar, Leyte, Mindanao, and Dinagat islands in the Philippines (Diesmos *et al.* 2009, Sanguila *et al.* 2016) between sea level and 1,000 m a.s.l. The latest

Received 09 May 2018

Accepted 29 August 2018

Distributed December 2018

IUCN assessment for *S. muelleri* listed it as Near Threatened (close to qualifying to Vulnerable) due to significant habitat loss (Diesmos *et al.* 2009). However, Sanguila *et al.* (2016) suggested *S. muelleri* may be more common and widely distributed than previously reported, and subsequently proposed downgrading the species to Least Concern status. Habitat preference of this species is thought to include primary and secondary moist forests, wooded swamps, and possibly disturbed forests (Diesmos *et al.* 2009).

Herein, we provide two novel troglobitic observations of *Stegonotus muelleri* from a cavern at 397 m elevation on the eastern end of the Philippine island of Bohol near the town of Candijay (09°49'0.85" N, 124°30'0.09" E). Our observations also document the first records of *S. muelleri* from the island of Bohol. Our initial

observation occurred at 08:10 h on 06 December 2016 when TKK found a presumably adult *S. muelleri*, measuring approximately 1.7 m in total length (visually estimated, Figure 1A) inside the cave. The individual was coiled within a cavity in the cave wall, approximately 1 m above the ground and 20 m from the cave entrance. The dorsum of this *S. muelleri* was solid iridescent black from head to tail. The ventral scales were white with pale yellow patches on their outer edges, forming stripes which extended from the neck to at least mid-body (Figure 1A). We were unable to determine the entire extent of ventral coloration without handling the snake. The supralabial scales were bright yellow, as were the outer ventrals and adjacent lower dorsal scales on much of the head and neck region (Figure 1A, B).

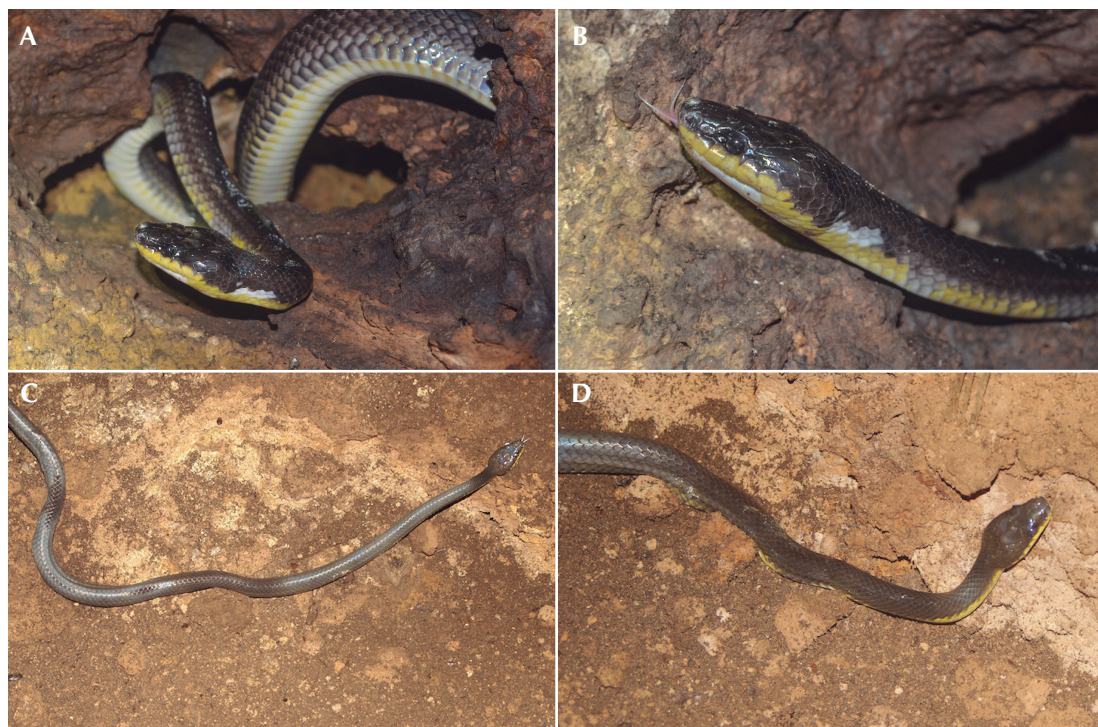


Figure 1. The two *Stegonotus muelleri* in a Bohol cave system. First *S. muelleri*, in its shelter location, with exposed ventral and dorsal surfaces (A), close-up of same individual's head and neck region (B), the second individual from in the cave system (C), and close-up of its head and neck region, showing similar colorations (D). Photos by TKK, (A, B) and CHB (C, D).

On 20 April 2018 at 15:50 h CHB found the second adult *S. muelleri*, measuring approximately 1.1 m in total length (visually estimated) in the same cave system (Figure 1C, D). This individual was crawling on the ground approximately 20 m from the cave's mouth. This individual was similar in coloration to the first, with bright yellow supralabial, anterior ventral, and adjacent dorsal scales (Figure 1D). Time spent in the cave was approximately 1.5 h during each observation visit (or approximately 6 man hours each visit). Photographs of the first and second snake are inventoried at the University of Kansas Herpetology Division Digital Archive (KUDA), accession numbers KUDA 012165, KUDA 012166, and KUDA 012167, KUDA 012168 respectively.

The genus *Stegonotus* remains poorly understood, with significant gaps present in basic biology. Although previously recorded from the Mindanao faunal region, we present a new record of *S. muelleri* from the island of Bohol, expanding its known distribution in the region. Both of our observations were in a cave system, which is novel for the genus and may partially explain why it had remained previously unreported from Bohol.

Further study of *S. muelleri* is required on Bohol to determine population status as well as cave use by the species, including prey and seasonal or temporal habitat use. Genetic and morphological investigation of troglobitic *Stegonotus* on the island of Bohol would reveal the phylogenetic and ecological relationship of the individuals we observed with those previously recorded in the Mindanao faunal region.

Acknowledgments.—We thank our guides, Samshie Nairo and Pasag Raku of Bohol Herping, for sharing with us their local knowledge and providing the special opportunities in which we made our observations. We also thank Dr. Rafe Brown for species ID confirmation and the University of Kansas

Herpetology Division Digital Archive (KUDA) for cataloging our photographs. We are grateful for the two anonymous reviews and constructive criticism provided by the editor and associate editor of PHYLLOMEDUSA.

References

- BREO. 2015. Biodiversity Research and Education Outreach, Philippines. Electronic Database accessible at <http://www.philbreo.org>. Captured on 28 April 2018.
- DENR-UNEP. 1997. *Philippine Biodiversity: an Assessment and Action Plan*. Makati City. Department of Environment and Natural Resources and the United Nations Environment Programme, Bookmark Inc. 298 pp.
- Diesmos, A., J. C. Gonzalez, and R. Brown. 2009. *Stegonotus muelleri*. The IUCN Red List of Threatened Species 2009. Electronic Database accessible at <http://www.iucnredlist.org/details/169872/0>. Captured on 02 May 2018.
- Diesmos, A. C., R. M. Brown, A. C. Acala, R. V. Sison, L. E. Afuang, and G. V. A. Gee. 2002. Philippine amphibians and reptiles. Pp 26–44 in P. S. Ong, L. E. Afuang, and R. G. Rosell-Ambal (eds.), *Philippine Biodiversity Conservation Priorities: a Second Iteration of the National Biodiversity Strategy and Action Plan*. Quezon City. Department of the Environment and Natural Resources.
- Myers, N., R. A. Mittermeier, C. G. Mittermeier, G. A. B. Fonseca, and J. Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403: 853–858.
- Ruane, S., S. J. Richards, J. D. McVay, B. Tijaturadi, K. Krey, and C. C. Austin. 2018. Cryptic and non-cryptic diversity in New Guinea ground snakes of the genus *Stegonotus* Duméril, Bibron and Duméril, 1854: a description of four new species (Squamata: Colubridae). *Journal of Natural History* 52: 917–944.
- Sanguila, M. B., K. A. Cobb, C. D. Siler, A. C. Diesmos, A. C. Alcala, and R. M. Brown. 2016. The amphibians and reptiles of Mindanao Island, southern Philippines, II: the herpetofauna of northeast Mindanao and adjacent islands. *Zookeys* 624: 1–132.

Editor: Ross D. MacCulloch