## Range Expansion of *Tylototriton shanorum* (Salamandridae, Urodela) in Shan State, Myanmar, with Reference to its Relict and Circum-Highland Lake Distribution

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*Tylototriton shanorum* Nishikawa, Matsui and Rao, 2014 is a newt endemic to the Shan State, central Myanmar. The species was only known from Taunggyi and Nyaungshwe townships when it was described (NISHIKAWA *ET AL.*, 2014). However, PE (2018) later found the species in Kalaw (Baw Hseng in He Hoe, La-mine Village and Thar-mine-khem Dam in Aungpan) and Pindaya (Taung Paw Gyi Village and Lindley Inn Village) townships located north of Inle Lake (Fig. 1). In this article, we report on a new population south of Inle Lake, at the western side of Moebyel Lake, an artificial lake with a dam.

We conducted fieldwork in Pinluang Township, Shan State, Myanmar (20°00' N, 96°46' E, ca. 1395 m a.s.l.) on 7 August 2019 (Figs. 1 and 2). The air temperature was 22.4 °C and water temperature of the surveyed paddy field was 23.2 °C at 1310 h in the rain when we collected the newts. The fieldwork was conducted in terraced rice fields, and we found the newts walking in the paddies filled with water. We collected 24 individuals of *T. shanorum* and preserved five adult males and five adult females as voucher specimens. The remaining 14 individuals were released at the original collection site. The specimens were euthanized using a solution of chloretone, fixed in 10% formalin, conserved in 70% ethanol, and deposited in the University of Taunggyi. The specimens were collected with permission from the Ministry of Natural Resources and Environmental Conservation, Forestry Department of Myanmar.

The snout-vent length of five adult males and five adult females ranged from 77.5 to 95.6 mm (mean 87.3 mm), and from 70.5 to 93.0 mm (mean 84.7 mm), respectively. Descriptions of the newts are as follows: middorsal ridge on head very weak; vertebral ridge narrow and slightly segmented from neck to base of tail, separated from middorsal ridge on head by a small gap; rib nodules distinct, forming knob-like warts, 12 to 15 (median 14) on both sides of body from axilla to base of tail; dorsal ground color dark brown to black; anterior head, parotoid, vertebral ridge, rib nodules, limbs, vent region, and tail reddish brown (Fig. 3A). The body markings were much brighter and the warts were much larger than those in the other populations (Fig. 3B) including type locality (Taunggyi) that we observed in the same survey. However, the specimens from Pinlaung were certainly identified as *T. shanorum* 

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by the combinations of the characters noted above, especially by the weak middorsal ridge on the head. Our preliminary genetic survey also supports this identification (ONISHI *ET AL.*, in preparation).

Geographic intraspecific variation in body color is great in some species of *Tylototriton* (in *T. yangi*: NISHIKAWA *ET AL.*, 2015). The variation may relate to the aposematic behavior and volume of toxins stored in newt skin (in *Cynops pyrrhogaster*: MOCHIDA, 2009). Further studies are needed to clarify the reason why the species has the color variation within its small range.

The new record of this species is the first from south of Inle Lake and near Moebyel Lake. By this record, the range of the species has expanded nearly two times in area. Including the present record, all populations are located near and around Inle and/or Moebyel lakes, suggesting that the species favors the wetlands near these highland lakes. The present report has expanded the distribution of the species; however, the previous distribution of the species must have been larger, and shrunk to the present relict area, which idea must be tested by future examination of intraspecific genetic variation.

It is probable that we will find other populations of this species on the eastern and southern sides of the lakes by surveying similar wetlands or paddies. Unfortunately, a population in Baw Hseng, Kalaw Township, has nearly become extirpated due to habitat destruction caused by past mining (PE, 2018). Further, the present new population in rice fields may be degraded by the use of pesticides in the near future. At present, pesticides are rarely applied because they cost more than labor expenses. Urgent conservation action is needed to protect this small-ranged species in this rapidly developing country.

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Figure 1. Distribution map of *Tylototriton shanorum* in Shan State, Myanmar: 1, Pindaya Township (from PE [2018]); 2, Heho, Kalaw (from PE [2018]); 3, Aungpan, Kalaw (from PE [2018]); 4, Taunggyi Township (from NISHIKAWA *ET AL* [2014]); and the new record (open circle; Pinlaung Township) from the present study. Closed triangle shows the type locality of *T. ngarsuensis* which is a sister species of *T. shanorum* (from GRISMER *ET AL*. [2018]).



Figure 2. Habitat of Tylototriton shanorum in Pinluang Township.



Figure 3. Live female of *Tylototriton shanorum* in Pinluang Township (A) and Lindley Inn Village (B).