



First record of Gammii Frog (*Nanorana gammii*) from the Kingdom of Bhutan

The amphibian fauna of the Himalayan Kingdom of Bhutan, sandwiched between India and China, is poorly known. Most data collected on this group of animals for the country comes from a few interested individuals or citizen scientists. Based on information provided by a citizen scientist (third author of this paper), we report for the first time on the occurrence of the Gammii Frog, *Nanorana gammii* (Anderson, 1871) in Zhemgang District of Central Bhutan. In this paper, we provide information on the newly discovered locality, habitat and conservation status of this species in Bhutan. We also report on the use of *N. gammii* by the local communities for food.

The amphibian fauna of Bhutan at present includes around 79 species (Wangyal & Gurung 2017, Tenzin & Wangyal 2019, Wangyal *et al.* 2020) out of which ten belong to the genus *Nanorana* Günther, 1896: *N. annandalii* (Boulenger), *N. arnoldi* (Dubois), *N. blanfordii* (Boulenger), *N. conaensis* (Fei & Huang), *N. ercepeae* (Dubois), *N. minica* (Dubois), *N. liebigii* (Günther), *N. parkeri* (Stejneger), *N. pleskei* Günther and *N. vicina* (Stoliczka). However, further verification for the records of *N. annandalii*, *N. arnoldi*, *N. conaensis* and *N. pleskei* is required since they have been listed for Bhutan based on the preliminary list of herpetofauna prepared by Wangyal & Das (2014) but without reliable voucher specimen information. It has been argued that the record of *N. conaensis* for Bhutan was likely based on a misidentification, since the type locality of this species in Tibet, China, is located approximately 1,510km from the locality reported by Wangyal (2013). In summary, further field surveys and taxonomic efforts including morphological and molecular analyses are needed to clarify the status and distribution of *Nanorana* species in Bhutan.

Here we report on the occurrence of *N. gammii* in the Himalayan Kingdom of Bhutan, which brings the total number of *Nanorana* species recorded for the country to eleven. The first information on the occurrence of *Nanorana* species in the Zhemgang District of Central Bhutan was reported by the third author on a Facebook social media group page <Amphibians and Reptiles of Bhutan> maintained by “Amphibians and Reptiles of Bhutan – Citizens Research Initiatives”; after which a thorough search of this species was conducted in the provided location (Figs. 1, 2). Garmin eTrex GPS (WGS 84) was used to collect location data of the habitat while information on whether the species is locally consumed was collected during the survey at the site by the second and the third authors. For species identification we relied on the available guidebooks and reviews of the genus *Nanorana*: Frost 1985, Schleich & Kästle 2002, Yang & Rao 2008, Ahmed *et al.* 2009, Fei *et al.* 2010, Vasudevan & Sondhi 2010, Subba *et al.* 2017, and Ohler *et al.* 2018. Our identification was also confirmed by Annemarie Ohler (MNHN, Paris) (pers. comm.).

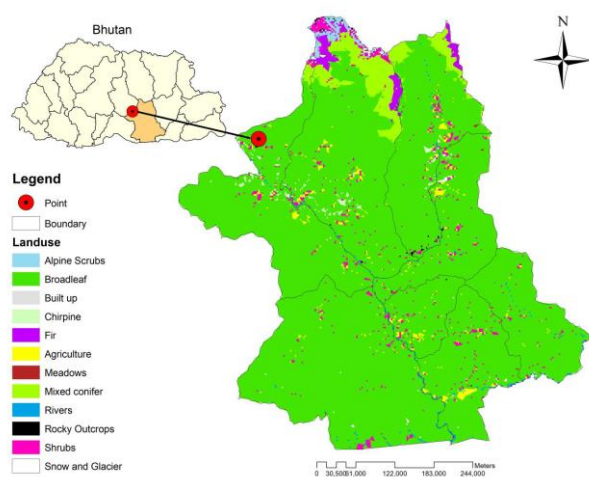


Figure 1. The locality of *Nanorana gammii* reported (red dot) in Zhemgang District, Central Bhutan.

A single specimen image was submitted on the Facebook social media page in September 2020 after which the area was scoured for the

presence of other individuals by the second and third authors who did not find any more that year as they may already have hibernated. A live specimen (Fig. 3A) was collected on 1 September 2020 at 16:00 h near a home garden in suburb of Zhemgang (27.215793°N, 90.658101°E, alt. 1,881 m a.s.l.; Fig. 2). Despite our efforts to find additional specimens, none were recorded likely due to the cold weather with the approach of winter in the area. The new locality is ~240 km air distance from the type locality of *N. gammii* in the Darjeeling Hills, West Bengal, India.



Figure 2. The exact locality where *Nanorana gammii* was observed, Zhemgang, Central Bhutan

Morphology. (Fig. 3A). Medium-sized frog with SVL 77.0 mm; snout short, moderately rounded; tympanum indistinct (but can be seen on closer look), comprising half of eye diameter, distinct supratympanic fold running from the eye to the shoulder; dorsal skin smooth with a few small tubercles on the sides and a skin fold between the posterior edges of the eyelids, dorsolateral folds prominent, running from the eye to the sacrum; hind limbs of moderate length compared to other frogs of this group; finger and toe tips slightly swollen with a lateral fold along the first and fifth toes; finger length formula: 1>3>4>2; toe length formula: 1>3>4>5>2; toes fully webbed with the web reaching the tips of all the toes. Dorsal surface of the body olive-grey marbled with blackish-brown patches or lines; a distinct black band running from the snout through eye and further along tympanic region toward the shoulder; inter-orbital space with a black band; dorsolateral fold yellowish posteriorly; fingers and dorsal surfaces of forelimbs with black spots, hind limbs with

brownish cross-bars; toes with black transverse bars and pale brown marbling.

Nanorana gammii is semi-aquatic and is mostly found in fast-flowing mountain streams (Subba *et al.* 2017). The locality of the specimen found is a hill station, the headquarters of Zhemgang District Administration (Fig. 3B), where the highest daily maximum temperature recorded in May 2020 was 24.5 °C while the lowest was 9 °C. The highest daily rainfall recorded at Zhemgang in May 2020 was 101.6 mm with a total rainfall for the month of 374.9 mm (NCHM 2021). Outside Bhutan, *N. gammii* is reported only from the Indian states of western Bengal specifically from the Darjeeling Hills (Ohler & Dubious 2006), Sikkim (Subba *et al.* 2017) and Arunachal Pradesh (Ohler *et al.* 2018). Anderson described *Nanorana gammii* as *Rana Gammii* in 1871 and noted its high similarity to *Rana sikimensis* Jerdon, 1870 (now *Ombrana sikimensis*). Jerdon (1870) did not provide a detailed description of his species which was described from the same type locality in the Darjeeling Hills, West Bengal, India. Therefore, some studies considered these two taxa as synonyms (Schleich & Kastle 2002). Ohler & Dubois (2006) demonstrated that *N. gammii* represents a valid species, which was allocated to the subgenus *Chaparana*; this taxonomy was followed by subsequent authors (Frost 2007, Dinesh *et al.* 2009).

Nanorana gammii is not evaluated by the International Union for Conservation of Nature (IUCN) Red List due to lack of information on this poorly known species. The species does not receive any legal protection in Bhutan like any other amphibian species in the country. However, the habitats of *N. gammii* are protected well. But our preliminary queries with the local community in Zhemgang revealed that the species is common in the area and is being consumed as medicine for stomach related complications. Being used by people for its medicinal properties, proper research is necessary before allocating the species to any conservation status. Facebook or other social media groups such as Amphibians and Reptiles of Bhutan play an important role as sources of the data for new herpetofaunal records in the Kingdom of Bhutan as well as globally. Our work further supports the importance of citizen science in research for assessing amphibian distribution and diversity in Bhutan and around the world (Cosquer *et al.* 2012, Theobald *et al.* 2015). We call for further field survey efforts

Plate 11

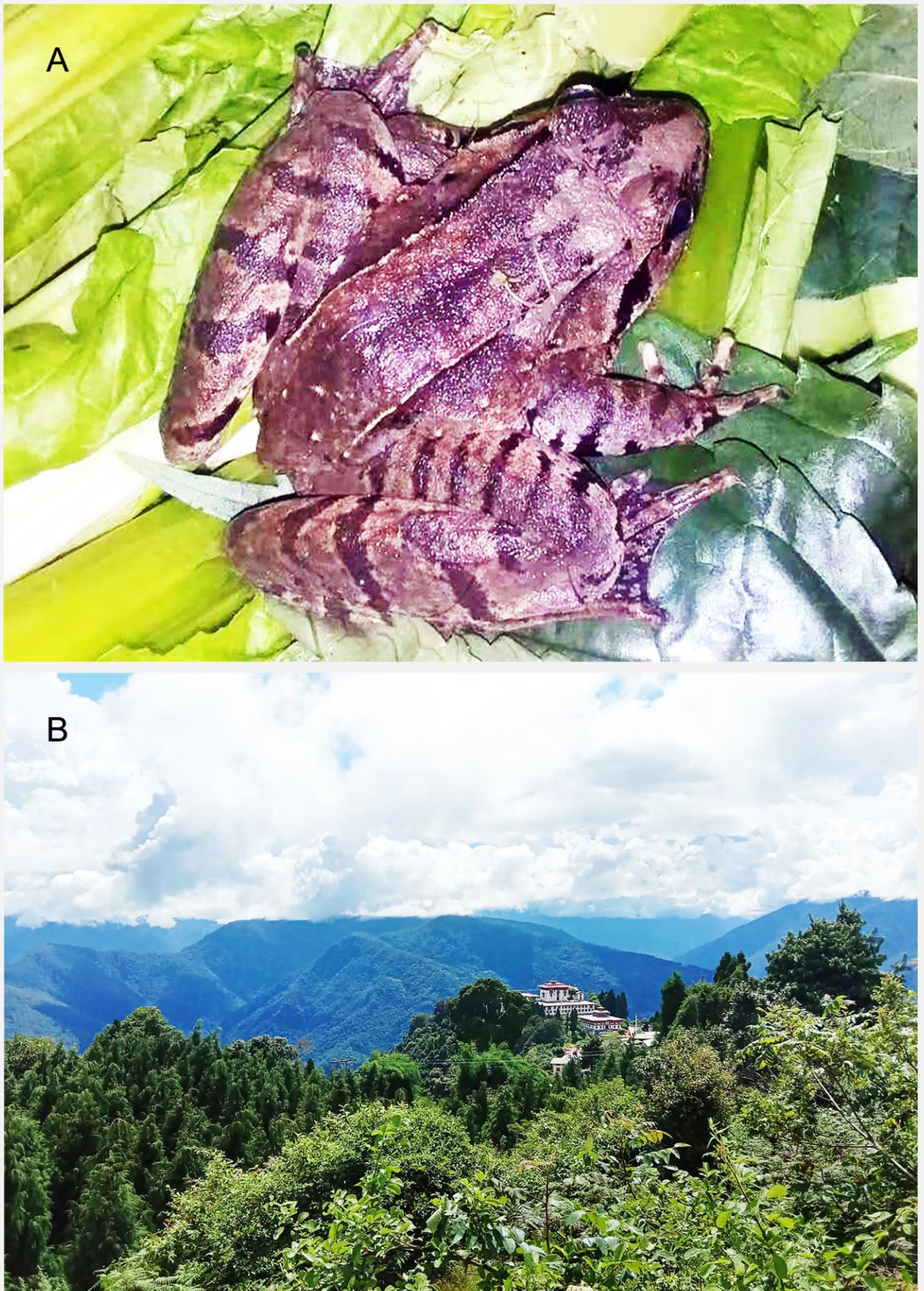


Figure 3. *Nanorana gammii*: (A) a live individual, © Photo: Kelzang Wangchuk and (B) the habitat in the hill stations of Zhemgang, Central Bhutan.

along with collaboration between researchers and citizen scientists, which is required for further progress in our knowledge on amphibians in Bhutan.

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