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Comment on "Scaling new heights: first record of Boulenger's Lazy Toad *Scutiger boulengeri* (Amphibia: Anura: Megophryidae) from high altitude lake in Sikkim Himalaya, India" by Barkha Subba, G. Ravikanth & N.A. Aravind (2015)

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Global high-altitude limits for amphibians

Much research over the past decade has been dedicated to understanding the elevation limits of species in the context of climatic change. Due to their heightened environmental sensitivities, amphibians represent especially good indicator species for observing how climate change can shift species distributions (Raxworthy et al. 2008). In the paper published recently by Subba et al. (2015), the authors reference an assertion by Hock (1964) that frogs in the genus *Scutiger* are the highest altitude frogs. They report the presence of *Scutiger boulengeri* at an elevation of 5,270m, which, according to the authors represents a new elevational record for the highest altitude frog documented worldwide.

We welcome the efforts by Subba et al., to study amphibian taxa in high alpine Himalayan environments. Such data provide critical baseline data for continued monitoring of amphibians in these high elevations in the Himalaya range. However, we would like to place their findings in context of elevation limits of other amphibian species around the world, notably amphibian species already reported to meet and exceed the record elevation claimed for *Scutiger boulengeri.*

Records of elevation limits at which organisms are known to exist are widely dispersed throughout the literature, and often times these records can be anecdotal, discovered merely by chance, or buried deep in publications dealing with larger issues. In a previous article we discussed how a new finding of an altitude record is subject to a threefold problem: (1) At any one time, a record is only due to the chance combination of observer, recorded organism, and the chance that the record will actually be published and reach the eyes of other researchers; (2) Vertical range expansions, both upward and downward in response to changing environmental conditions cause absolute limits to species distributions that can change over time; and (3) Precision of altitudinal records (especially those from previous decades) can be erroneous by tens or hundreds of meters (Seimon et al. 2007a). New records require careful screening for consistency and precision.

Examples of high altitude amphibians that did not come under the attention of Subba et al. is a record of 5,200m purported for *Scutiger alticola* (*boulengeri*) in Tibet (Swan 1990), and several other species in the genera *Scutiger* that have been found up to 5,000m (The IUCN Red List of Threatened Species. Version 2015.2. www.iucnredlist.org). Another species found in the Himalaya, *Nanorana parkeri*, the spiny frog has a range up to 5,000m (Hu et al. 2011). In the Andes of South America, a unique and biodiverse ecosystem also vulnerable to climate change, records of up to 5,400m for *Pleurodema marmoratum* (Seimon et al. 2007b), up to 5,244m for *Rhinella spinulosa* (Seimon et al. 2007b), and between 4,000–5,244 m, for several species in the genera *Telmatobus* (Péfaur & Duellman 1980; Seimon et al. 2005, 2007b; Catenazzi & von May 2014) have been published. These and other high Andean species

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are also discussed in recent reviews on herpetological diversity along Andean elevation gradients (Navas 2002; von May et al. 2008; Catenazzi & von May 2014).

As the climate changes over the next century, shifts in species distributions will cause range expansions that will inevitably change elevation limits for many species around the world. At our field site in the tropical Andes, we have documented a 150–200 m upward expansion of amphibians to 5,400m in response to rapid deglaciation that has been occurring over the past century (Seimon et al. 2007b). On Madagascar's highest mountain, the Tsaratanana massif, a mean upslope shift of 65m has been documented for amphibians over the past decade in response to climatic warming (Raxworthy et al. 2008). In the title of their manuscript, Subba et al. (2015) declare that *S. boulengeri* is "scaling new heights" and present some discussion on species migration to climate change, yet provide insufficient evidence to place their data in a historical context or prove that this species is now found in an area where it was not historically present. Should Subba et al. (2015) obtain historical information on the distribution of *S. boulengari* in future studies, then perhaps they may also discover that this species is indeed "scaling new heights".

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