

2023, the authors walked a dirt road at the Kalinga Centre for Rainforest Ecology, a research station in the mid-elevation rainforest near Agumbe in the Western Ghats of Karnataka (13.574665°N, 75.106837°E, ca. 650 m a.s.l.). At 19:50 h, we observed an adult *A. farnsworthi* swallowing a significantly smaller *O. affinis* (Fig. 1a-c). The *A. farnsworthi* was positioned ~2 m above the ground, potentially having retreated to a higher perch after initially striking down to take the *O. affinis* off the forest floor. The observation is interesting in that it occurred an hour after sundown, unusually late for this diurnal *Ahaetulla*. We suspect it is most likely that the *A. farnsworthi* captured its prey in the fading light of dusk and had taken this long to progress in the feeding process. Photos of the encounter were deposited at the Lee Kong Chian Natural History Museum as ZRC(IMG) 2.682a-c.

The *A. farnsworthi* was identified via the Mallik et al. (2020) diagnostic of a green vine snake with short rostral appendage and presence in the Agumbe-Kodachadri range. The *O. affinis* was identified based on it being a small brown kukri snake with dark, broken crossbars and a yellow venter with rectangular black marks (Whitaker and Captain 2004). Both identifications were confirmed by Vivek Sharma (pers. comm.).

This incident elucidates how snakes can interact across the boundaries of their attributed diurnal/nocturnal and arboreal/terrestrial activity patterns, reminding us of the lack of hard boundaries. As is often said in the field, “snakes don’t read the guides.”

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References

KALKI, Y. & WEISS, M. (2020) Understanding the food habits of the green vine snake (*Ahaetulla nasuta*): a crowdsourced approach. *Herpetology Notes* 13, 835-843. <https://www.biotaxa.org/hn/article/view/57518>

MALLIK, A.K., SRIKANTHAN, A.N., PAL, S., D'SOUZA, P.M., SHANKER, K. & GANESH, S.R. (2020) Disentangling vines: a study of morphological cryptis and genetic divergence in vine snakes (*Squamata: Colubridae: Ahaetulla*) with the description of five new species from Peninsular India. *Zootaxa* 4874(1), 1-62. <https://www.biotaxa.org/Zootaxa/article/view/zootaxa.4874.1.1>

WHITAKER, R. & CAPTAIN, A. (2004) *Snakes of India. The Field Guide*. Draco Books, Chennai, India. 240 pp.

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Vocalization by the agamid lizard *Calotes emma* Gray, 1845 (Reptilia: Sauria)

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Acoustic communications are a means of passing information from one individual to another of the same species or another species. The information, for example, may be used to attract members of the same species as a means of sexual signalling, to warn off opponents or predators, or to exhibit distress under specific circumstances (Fletcher 1997; Russell and Bauer 2021). The ability to produce sound is widespread across the animal kingdom, spanning invertebrate and vertebrate groups. However, vertebrates, especially mammals, birds, and amphibians (Brudzynski 2009; Duellman and Trueb, 1994; Thorpe 1969), are prime examples of taxa that exhibit simple to extremely complex

Table 1. Summary of the attributes of the call by *Calotes emma*

	Range	Mean	±SD
Call duration (ms)	265–301	289	20.78
Low Freq (kHz)	0.34–0.55	0.48	0.12
High Freq (kHz)	15.8–16.21	16.03	0.21
Delta Freq (kHz)	15.3–15.9	15.57	0.3
Max Amp (U)	2007–5593	3042	2222.28
Max Freq (kHz)	8.61–13.8	11.77	2.77
Harmonics	18–23	20.33	2.52

vocalizations not only to communicate but also to imitate sounds produced by other distantly related species (Thorpe 1969). Conversely, only a few groups of reptiles have the ability to produce sound as a means of communication. Sounds produced by most reptiles, for example, large varanid lizards, chameleons, crocodylians and several species of snakes, can be classified as a hiss, grunt or a growl. Many of these sounds are produced by exhaling air from the lungs, which passes through the larynx and is extruded from the glottis (Russell and Bauer 2021). The sound produced through this process, if at all, is unstructured and cannot be termed as true vocalization. True structured vocalization in reptiles

is primarily attributed to lizards, especially gekkonid lizards and, to an extent, a few other lizard genera of other families (Vitt and Caldwell 2013). To produce true vocalization, modulated acoustic expulsions of air pass through a modified larynx or glottis, with vocal cords or similar structures that obstruct the airflow, thereby altering the pattern of airflow and producing tonal sound (Russell and Bauer 2021). Several examples of non-gekkonid lizards that vocalize are Dactyloidae (several species of *Anolis*) (Russell and Bauer 2021), Lacertidae (*Psammmodromus algirus*) (Baeckens et al. 2019), Liolaemidae (*Liolaemus chiliensis*) (Carothers et al. 2001), Scincidae (*Tribolonotus gracilis*) (Hartdegen et al. 2001), Pygopodidae (*Delma tincta* and *Lialis burtonis*) (Weber and Werner 1977) and a single species of the Agamidae (*Calotes minor*) (Cockburn 1882).

A recent observation has enabled us to add another species of agamid lizard of the genus *Calotes* to the list of species capable of vocalizing. An adult male *Calotes emma* Gray 1845, (snout to vent length 103 mm) was collected as part of an ongoing study of reptiles of Mizoram state. The individual was housed in a large plastic container with several holes punctured



Figure 1. Image of the male individual of *Calotes emma*. Photograph by Virender K. Bhardwaj

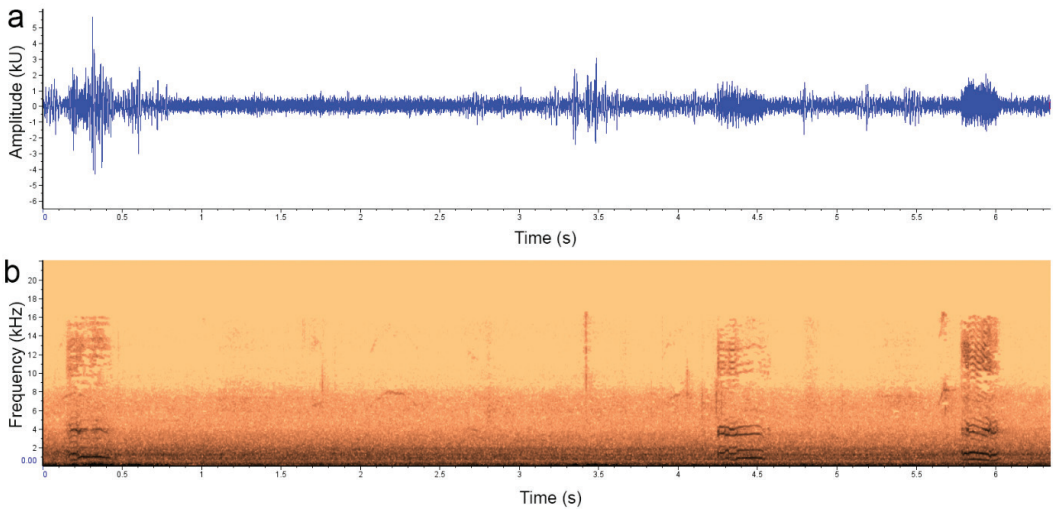


Figure 2. Call of male *Calotes emma* (a) Amplitude (b) spectrogram showing harmonics.

on the container for ventilation. The animal was retrieved from the container by one of us (VKB) for examination, upon which the animal produced an audible squeak. The animal was placed back in the container and was caught again by its trunk, and the animal produced the same squeak. Upon observing the consistent vocalization of the lizard upon handling, we decided to record and analyse its call. To do this, we stimulated the lizard to produce the sound by holding it by its trunk. We then recorded the call using an Apple iPhone 14 pro max in cinematic mode, extracted the audio in mp4 format, and analysed it using Raven Pro v.1.6.5 software. The call's attributes were recorded from the software, and the details are presented in Table 1. The recording was done on 6th April 2024 at 2350 hours.

The animal's call consists of short, tonal, low-pitched vocalization with several harmonics (Fig. 1, Table 1). The summary is based on three notes of the call. The call duration ranged from 265–301 ms with a low-frequency range of 0.34–0.55 kHz, whereas the high-frequency range was 15.8–16.10 kHz. The animal produced the sound every time it was caught, suggesting it might be a distress call. However, another juvenile of the species was captured to see if it, too, could vocalize, but interestingly, the juvenile did not produce any sound. It is likely that only adult individuals can call. However, further research is necessary to confirm if females can produce the sounds as well or if only

males are capable of vocalizing, in which case, the sound might be used as a means of sexual signalling.

The present observation constitutes the second record of vocalization by an agamid lizard and the first for *C. emma*. The first one is *Calotes minor*, which, too, was recorded to produce a squeak when captured (Cockburn 1882). However, further confirmation is required to assess the species' vocalization ability. The two *Calotes* species, *C. emma* and *C. minor* are members of different clades (Deepak et al. 2015), and the origin of the ability to vocalize could have evolved independently hinting at a convergent evolution of the trait. Further work on the vocalization by *C. emma* will be necessary to ascertain if the ability to vocalize is limited to adults or only the males. This information will help categorise if the call is a distress call or if it is also employed for other forms of communication, such as sexual signalling or intraspecific or interspecific interactions. The findings of the present work and the aforementioned investigations will open new avenues for future research.

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References

- BAECKENS, S., LLUSIA, D., GARCÍA-ROA, R. & MARTÍN, J. (2019)** Lizard calls convey honest information on body size and bite performance: a role in predator deterrence?. *Behavioral Ecology and Sociobiology* 73, 1–11.
- BRUDZYNSKI, S.M. (ED.) (2009)** *Handbook of mammalian vocalization: an integrative neuroscience approach*. Academic Press.
- CAROTHERS, J.H., GROTH, J.G. & JAKSIC, F.M. (2001)** Vocalization as a response to capture in the central Chilean lizard *Liolaemus chiliensis* (Tropiduridae). *Studies on Neotropical Fauna and Environment*, 36(2), 93–94.
- COCKBURN, J., 1882.** On the habits of a little known lizard, *Brachysaura ornata*. *Journal of the Asiatic Society of Bengal*, 51(2), 50–54.
- DEEPAK, V., VYAS, R., GIRI, V. & KARANATH, K. (2015)** A taxonomic mystery for more than 180 years: the identity and systematic position of *Brachysaura minor* (Hardwicke & Gray, 1827). *Vertebrate Zoology* 65, 371–381.
- DUPELLMAN, W.E. & TRUEB, L. (1994)** *Biology of amphibians*. JHU press. 670pp.
- FLETCHER, N. (1997)** Sound in the animal world. *Acoustics Australia* 25, 69–74.
- HARTDEGEN, R.W., RUSSELL, M.J. & YOUNG, B. (2001)** Vocalization of the crocodile skink, *Tribolonotus gracilis* (De Rooy, 1909), and evidence of parental care. *Contemporary Herpetology* 1, 1–6.
- RUSSELL, A.P. & BAUER, A.M. (2021)** Vocalization by extant nonavian reptiles: a synthetic overview of phonation and the vocal apparatus. *The Anatomical Record* 304(7), 1478–1528.
- THORPE, W.H. (1969)** The significance of vocal imitation in animals with special reference to birds. *Acta Biologica Experimentalis* 29(3–4), 251–269.
- VITT, L.J. & CALDWELL, J.P. (2013)** *Herpetology: an introductory biology of amphibians and reptiles*. Academic press.
- WEBER, E. & WERNER, Y.L. (1977)** Vocalizations of two snake-lizards (Reptilia: Sauria: Pygopodidae). *Herpetologica* 33(3), 353–363.

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A rapid assessment of herpetofaunal diversity and mortality along a railway track in Northern Western Ghats, India

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