ZSL
LET'S WORK FOR WILDLIFE

EDGE

EVOLUTIONARILLY DISTINCT & GLOBALLY ENDANGERED

Survival Blueprint

Botsford's leaf-litter frog, *Leptobrachella botsfordi*

Compiler: Luan Thanh Nguyen

Contributors: Luan Thanh Nguyen, Benjamin Tapley, Chung Thanh Nguyen, Hao Van Luong, and Jodi J.L Rowley

Suggested citation: Nguyen et al. (2020). A survival blueprint for the Botsford's leaf-litter frog, *Leptobrachella botsfordi*, in Mount Fansipan, Northwest Vietnam, an output from the EDGE of Existence fellowship, Zoological Society of London, London, UK.

1. STATUS REVIEW

1.1 Taxonomy:

Class: Amphibia
Order: Anura
Family: Megophryidae
Genus: *Leptobrachella*
Species: *Leptobrachella botsordi*
Species name author: *Leptobrachella botsfordi* (Rowley, Dau & Nguyen, 2013)
Common name: Botsford's leaf-litter frog (English); Cóc mày Botsford (Vietnamese)
Taxonomic source:
http://research.amnh.org/vz/herpetology/amphibia/Amphibia/Anura/Megophryidae/Leptobrachella/Leptobrachella-botsfordi (access on 01 August 2020).

1.2 Distribution and population status:

1.2.1 Global distribution:

Country	Population estimate (plus references)	Distribution	Population trend (plus references)	Notes
Vietnam	Unknown	Mount Fansipan, Hoang Lien Range, Northwest Vietnam	Decreasing (IUCN SSC, 2015)	Three fieldworks in of the species' type locality on Mount Pu Ta Leng (surveyed at 2200-2800 m) and Mount Ky Quan San (surveyed at 1900 – 2900m) have been conducted and no individual of this species have been detected yet.

1.2.2 Local distribution:

Leptpbrachella botsfordi is only known from Mount Fansipan, Hoang Lien National Park, Lao Cai Province. The known Extent of Occurrence for the species is 36 km^2 (Fig. 1). The species is now known to occur between 2500–2815 m asl.

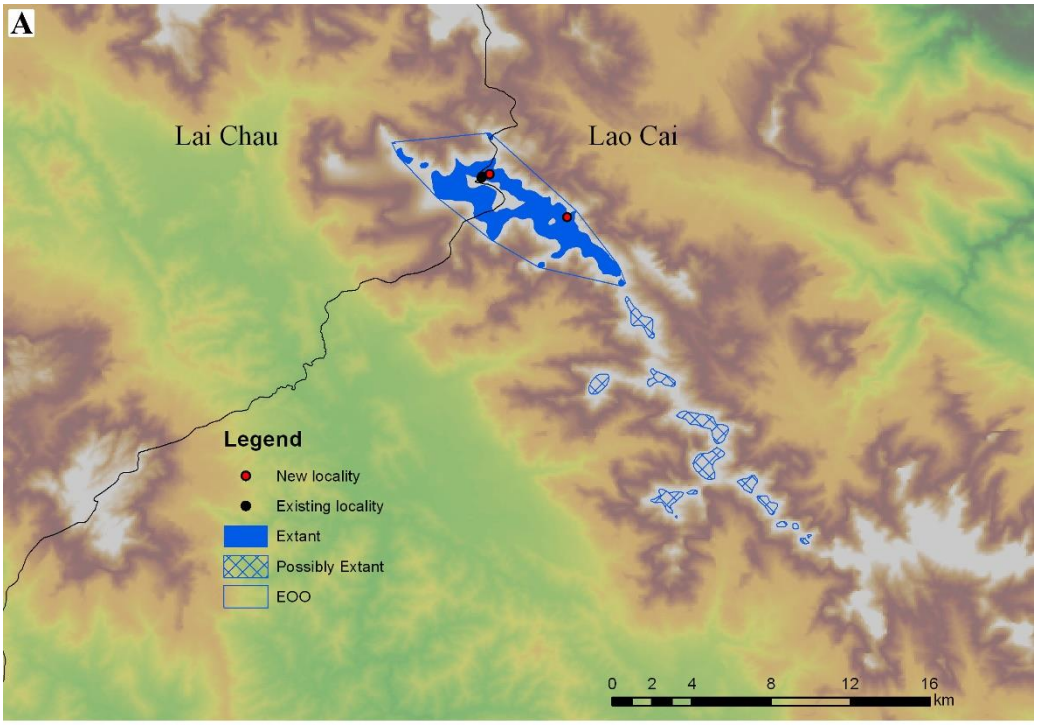

Figure 1. The distribution range of *Leptobrachella botsfordi* in the Hoang Lien Range, northeast Vietnam. Solid blue area represents presumed range and cross-hatched blue area denotes areas where this species may be possibly extant. Blue outline denotes species' Extent of Occurrence

Country	Region / province	Site	Level of Protection	Population size	Reference(s)	Notes
Vietnam	Sapa District, Lao Cai Province	Tram Ton Site: Type locality, a slope stream on Mount Fansipan, from 2600 m – 2830 m.	National Park, the highest protection level site in Vietnam	- Currently unknown, A number of 9 type specimens (7 males, 2 females) have been report in 2013 in single stream in the type locality. - In June 2018, September	Rowley et al. 2013; this project	Except type specimens, other individuals were captured and released without any making or tagging.

				2018, March 2019, and June and October 2019, 29 individuals have been observed in this stream		
Vietnam	Sapa District, Lao Cai Province	Cat Cat Site: A highly covered, mossy stream on different part on Mount Fansipan (3.5 km from type locality); 2500 – 2600 m asl.	National Park, the highest protection level site in Vietnam	Currently unknown. Total 11 individuals have been observed in June 2018, September 2018, March 2019, and June and October 2019.	This study	These individuals were captured and released without making or tagging.

1.3 Protection status:

The Botsford's leaf-litter frog is assessed as Critically Endangered by IUCN (2015). This species has not been assessed by the local (Vietnamese) Law or Decree; and is listed in the CITES yet.

This species continues to assess as Critically Endangered by IUCN Red List authority in 2020 (un-published report).

The known living sizes (two sites) of this species is located within Hoang Lien National Park, Sapa District, Lao Cai Province. The National Park is highest protected level area in Vietnam.

Both two sites are also within Mount Fansipan, about 3.5 km in straight distance, which had been confirmed as one of the Global Alliance for Zero Extinction (AZE) sites in 2018 (AZE, 2018)

1.4 Ecology, behaviour and habitat requirements:

This species is known only from the highest peak in Indochina, Mount Fansipan, occupying higher altitudes than any other species of *Leptobrachella* in Indochina. It is associated with upper montane forest with a temperature range of -3°C to 20°C, heavy rainfall, and occasional snow in December (Rowley *et al*. 2013). Males have been observed calling from under leaf litter next to small streams and females have been found nearby on the leaf or in holes at grass roots (Rowley *et al*. 2013), in one case, three males have been found calling next to one female under the rock at middle of stream. The quality of habitat used by this species is currently in decline due to tourism (Rowley *et al*. 2013, Nguyen *et al*. in press).

Very little is known about the size and trends of this species' population except that seven adult males and two adult females were found during surveys in 2012 (Rowley *et al*. 2013).The species was detected again during surveys in 2015 (J. Rowley, pers. comm.), and again between 2017 and 2019 (40 males and females without using making and re-capture method) have been counted in total in 8 survey trips in 2017–2019, when three tadpoles and a metamorphose were observed (Nguyen *et al.* in press). The species is difficult to detect, even when calling (Rowley *et al*. 2013). The population is very likely to be in decline due to past and present habitat loss and disturbance, and pollution, which are ongoing in its range and specifically at known one of its known localities (Rowley *et al*. 2013, Nguyen *et al.* in press).

The species breeds in rocky streams by larval development. Its tadpoles have only been observed under submerged rocks in pools beneath small waterfalls. Tadpoles of this species were found in steep, fast-flowing streams at elevations between 2500–2600 m asl (Nguyen *et al*. in press). It is unclear whether breeding is truly restricted waterfall microhabitats, however tadpoles of stream-breeding frogs are often microhabitat specialists (Inger 1986), and many congeneric larvae are thought to depend of a rocky or gravel substrate (Ohler *et al*. 2011)

Tadpoles (at Gosner Stage 25 and 26, Gosner 1960) have elongate body, rounded snout, nares anterodorsally positioned, closer to the tip than eyes; body laterally depressed; tail length twice the body length; rounded tail tip; cup-like oral disc, oral disc fringed with short pointed conical papillae; labial tooth row formula: 3(1–3)/4(1–3), jaw sheaths black, robust; upper jaw and lower jaw sheaths developed with distinctly serrated edges. An unvouchered specimen (observed at Site 2 on 23 June 2019) at Gosner Stage 44 had a total length 32.4 mm, four limbs fully developed, snout rounded, tympanum rounded, dorsum smooth with numerous tubercles, ventral surfaces smooth. Thickened tail 15.1 mm in length (Nguyen et al. In press).

In life, tadpoles with whitish-brown to grey body with obvious, whitish neuromasts arranged in lines concentrated around nares and eyes, two lines of neuromasts present, running dorsolaterally along the body before continuing along lateral surfaces of tail muscle; iris black; internal gills distinctly reddish; tail muscle dark grey to whitish brown, tail fin whitish-brown; translucent skin on ventral surface of body, gut coil clearly visible (Nguyen et al. in press.)

1.5 Threat analysis:

The most immediate threat to this species' persistence is habitat degradation associated with tourism. Pollution by garbage and runoff from toilets is affecting the habitat of the species (Rowley *et al.* 2013, IUCN, 2015) and the construction of a cable car from Sa Pa to the summit of Mount Fansipan is likely to affect it although no confirm the presence of this species at the base of cable car station (IUCN, 2015). Vegetation adjacent to the stream is being cut for use as fuel (J. Rowley pers. comm. January 2016).

In addition, rocks and gravel that make up the species' larval microhabitat are being mined directly from streams for the construction and lining of tourist walking paths. This was observed in the same stream and only several hundred metres from where a tadpole was observed, and the rate gravel removal was observed to increase over surveys from 2017 to 2019 (Nguyen *et al*. in press). Historic burning and subsequent ecosystem conversion of the summit of Mount Fansipan and adjacent areas, which are thought to have been previously covered in forest (Nguyen and Harder 1996), are also likely to have disturbed this species.

The species' restriction to high altitudes near the mountain peaks will probably present an issue as tropical montane forests are expected to be particularly prone to alteration by climate change (Rowley *et al*. 2013, Foster 2001; IUCN 2015).

Threat	**Description of how this threat impacts the species**	**Intensity of threat** *(low, medium, high, critical or unknown)*
Knowledge	Lack of knowledge impact to action plan of the species. This may happen when local partner member has been changed. This problem will affect to current plan/schedule and future plan due to lacking trained member to work with species	Medium
Habitat loss	Habitat loss due to collecting bamboo for cooking effecting to species survival special in non-breeding season where frogs were not found nearby stream	High
Tourism impact/Littering	Littering by tourist out of control impacting to water quality special in the dry season when tadpole living under water	High
Tourism impact/Construction	Building the tourist trek might happen again and the collection of sand on the headquarter of stream (type locality of this species) impact to breeding habitat and gravel mining is also impacting to the tadpole life	Medium
Diseases	Extremely of temperature change (temperature increasing) impacting to chytrid development	Unknown

Change of National Park management broad member	This will change the conservation plan in the National Park and old established plan will have been changed	Medium
Change of local people behaviours	Change of gravel mining (increasing or decreasing) will impact (good or bad) to the species habitat	High

1.6 Stakeholder analysis:

Country	**Stakeholder**	**Stakeholder's interest in the species' conservation**	**Current activities**	**Impact** *(positive, negative or both)*	**Intensity of impact** *(low,medium, high, critical)*
Vietnam	Mr. La Van Toi, Hoang Lien National Park	Highly interested, new director of	He supports for project design as well as getting permission and develops fieldwork schedule; Facilitate the execution of practical components and dissemination of findings and outcomes to the conservation community in the project area	Positive	High
Vietnam	Hoang Truong Giang (CRCO)	Highly interested	Giang is a member of staff at CRCO and he has been working with me in the field in Fansipan.	Positive	High
Vietnam	Asian Turtle Program of Indo-Myanmar Conservation Organization (Timothy McCormack and Hoang Van Ha)	Highly interested as support to me work with the project and ensure to project come to the end on time.	They will support to development project plan, activities, and manage time for me to work with the EDGE project.	Positive	High
	Vietnam National Museum of Nature	Highly interested as the type specimen of the new species (if found) will be deposited there	Specimens of new species (if found) will be deposited in the VNNM after paper published; The VNNM able to	Positive	Medium

			guarantee long-term care and maintenance of the collection		
	Hoang Lien Ecological tourism centre – Hoang Lien NP	Medium interest as tourist activity is now affecting target species	The centre will help connect to local porters who work within Hoang Lien NP under their control (almost porters) so that support team to work with local porters/tourists to giving questionnaire, interview, and/or training	Positive and negative	Medium
	Lao Cai Peoples Committee	Low interest as only support for paperwork	Support permission for field work in Hoang Lien NP and Hoang Lien Range	Positive and negative	High
	Porters	Low interest as they have to spend more time for our activity than normal and bring the trash back to the mountain	Transfer equipment to the mountain and assists in the field as camp making, coking.	Positive and negative	High
	Trekking companies	Low interest	Support to work with local porter under their management	Positive and negative	High
	Manager of tourist camp	Medium interest	Manager accommodation during survey in place under their control. Control trash colleting activities on the site 2200 and 2800 tourist camp	Positive and negative	Medium
	Cable car operator	Low interest, but recommendations may impact how they are able to operate on the mountain.	Transferring team to the peak of mountain if needed	Negative	High

1.7 Context and background information that will affect the success of any conservation action for this species:

	Description	Barriers to conservation	Opportunities for conservation
Socio-cultural effects and cultural attitudes	The main ethnic people live around Mount Fansipan is H'mong, they have a larger population in northern Vietnam and close group that is not open to strange people	Their behaviours including living in high mountain, planning cardamom forest, collecting frog for food are main barrier to working with them in order to conserve frog the species.	The most important opportunity is that team member must become a friendly member of their community. When you work with them in a long time (e. g. during this project, 2017–2019), you will understand their behaviour much more than when you started. It will be helpful to develop a better plan to raising their conservation awareness.
Economic implications	The presence of caber-car on the peak of Mount Fansipan since April 2018 has changed (reduced) the economic value of tourism activity (trekking from the town to Fansipan peak).	The major problem when cable car built on the peak of Mount Fansipan is about sewage treatment system. There is still unclear how the cable car company has done with this.	Decreasing in number of tourists in type locality of this species also reducing the amount of trash here. This bring a change to stop littering in the stream where is type of this species.
Existing conservation measures	An action plan has been published for amphibian in Hoang Lien Range in 2017 (Tapley et al. 2017)	No barriers	This work gives a good guide on amphibian conservation activities need for amphibian in Hoang Lien Range.

Administrative/political set-up	**Na**		
Local expertise and interest	Local research has been working in other project thought Hoang Lien Range and potential conflict/collaborate	Sometime local research has conflict of interested as they will be published same data at the same site	Collaborate to have better understanding on amphibian conservation in Hoang Lien Range
Resources	**NA**		

2. ACTION PROGRAMME

Vision (30-50 years): To improve knowledge of and develop conservation strategies for Botsford's leaf-litter frog and other amphibian species in Hoang Lien Range, northwest Vietnam	
Goal(s) (5-10 years): To improve scientific understanding of Botsford's leaf-litter frog and other amphibian species in Hoang Lien Range and enabling local people to understand their impact on the target species' habitat	
Objectives	**Prioritisation** *(low, medium, high or critical)*
Continue to monitor the Botsford's leaf-litter frog (BLLF) and other amphibian species on Hoang Lien Range	**Critical**
Continue to assess the specific threats impacting BLLF focusing on emerging infectious disease and how it impacts frog survival	**High**
Raising local understanding about the Botsford's leaf-litter frog (BLLF) and other amphibian species on Hoang Lien Range	**High**
Updating the conservation status of the species as included this species in the Local national Red List Data Book and legally protection Degree	**Medium**

Activities	Country / region	Priority *(low, medium, high or critical)*	Associated costs (currency)	Time scale	Responsible stakeholders	Indicators	Risks	Activity type
Objective 1: Continue to monitor the Botsford's leaf-litter frog (BLLF) and other amphibian species on Hoang Lien Range								
Establish the species population size	Vietnam	Critical	$10,000	15 months	Hoang Lien National Park team (Mr. Nguyen Huu Hanh-Director); ZSL London Zoo (Benjamin Tapley - advisor); Australian Museum (Jodi Rowley - advisor); Asian Turtle Program of Indo-Myanmar Conservation	Breeding population size estimates allowing researcher or/and conservation biologist to assess the populations of this species and monitoring the effect of habitat protection initiatives	Cannot estimate the population site using Photo ID program; Field survey unable to detect enough number of animals for estimate population site due to bad weather.	Improving Knowledge
Study on the species population genetics	Vietnam	Critical	$10,000	15 months	Hoang Lien National Park team (Mr. Nguyen Huu Hanh-Director); ZSL London Zoo (Benjamin Tapley - advisor); Australian Museum (Jodi Rowley - advisor); Asian Turtle Program of Indo-Myanmar Conservation	Understanding the variation of population genetic within the species in different sites (three sites at present)	Unable to collect enough sample due to bad weather during field survey; lacking funding for analysis DNA sample	Improving Knowledge
Monitoring breeding behaviour though years	Vietnam	High	$20,000	36 months	Hoang Lien National Park team (Mr. Nguyen Huu Hanh-Director); ZSL London Zoo (Benjamin Tapley - advisor); Australian Museum (Jodi Rowley - advisor); Asian Turtle Program of Indo-Myanmar Conservation	Data/understand the breeding period of the species based on call monitoring using Song Meter Acoustic Recorder through a year	Lack of fund to by equipment because of the price; lost of equipment during tracking/recording sound in a long time	Improving Knowledge/ Species Management

Updating the amphibian species diversity in Hoang Lien Range	Vietnam	Critical	$30,000	36 months	Hoang Lien National Park team (Mr. Nguyen Huu Hanh-Director); ZSL London Zoo (Benjamin Tapley - advisor); Australian Museum (Jodi Rowley - advisor); Asian Turtle Program of Indo-Myanmar Conservation	Data on other amphibians in Hoang Lien Range publish (including new ecology data of known species, and describe new species)	Lack of fund for survey, unable to discovery new species	Improving Knowledge
Objective 2: Continue to assess the specific threats impacting BLLF focusing on emerging infectious disease and how it impacts frog survival								
Annual monitoring species habitat	Vietnam	High	$5,000/year	5 years	Hoang Lien National Park team (Mr. Nguyen Huu Hanh-Director); ZSL London Zoo (Benjamin Tapley - advisor); Australian Museum (Jodi Rowley - advisor); Asian Turtle Program of Indo-Myanmar Conservation	Quartile survey completed at least in breeding and non-breeding season, data on species habitat, threat update regularly	Lack of fund for survey, unable to conduct long-term surveys due to the change of team member of project plan change through time	Improving Knowledge/ Species Management
Monitoring disease on amphibian in Hoang Lien Range including target species	Vietnam	Critical	$5,000/year	5 years	Hoang Lien National Park team (Mr. Nguyen Huu Hanh-Director); ZSL London Zoo (Benjamin Tapley - advisor); Australian Museum (Jodi Rowley - advisor); Asian Turtle Program of Indo-Myanmar Conservation	Sab sample collected, analysis and data on disease provide by years to monitoring the disease infection of Chytrid fungi to amphibian population in the Hoang Lien Range including the target species	Lack of fund to survey and collect and analysis swab sample. Unable to survey regularly by time and different elevation sites	Improving Knowledge/ Species Management
Objective 3: Raising local understanding about the Botsford's leaf-litter frog (BLLF) and other amphibian species on Hoang Lien Range								
Conduct education school program in local area	Vietnam	Critical	$1,500/year	5 years	Hoang Lien National Park team (Mr. Nguyen Huu Hanh-Director); ZSL London Zoo (Benjamin Tapley - advisor); Australian Museum (Jodi	School program conducted in Secondary and High Schools around project side (Sapa District, Lao Cai	Students have not interested in amphibian conservation; knowledge will not change	Education & Awareness

					Rowley - advisor); Asian Turtle Program of Indo-Myanmar Conservation	Province; Tam Duong and Tan Uyen District, Lai Chau Province); student increasing knowledge on amphibian conservation		
Publish education textbook about the life of amphibian in Hoang Lien Range for secondary and high schools	Vietnam	High	$10,000/year	2 years	Hoang Lien National Park team (Mr. Nguyen Huu Hanh-Director); ZSL London Zoo (Benjamin Tapley - advisor); Australian Museum (Jodi Rowley - advisor); Asian Turtle Program of Indo-Myanmar Conservation	At least 1000 textbooks published and release to around 30 secondary school, secondary school and high school in three districts around project sites (Mount Fansipan)	Textbook cannot design and publish; the information in the textbook is not interested reader/students.	Education & Awareness
Annual training for local guide to improve their knowledge on amphibian in Mount Fansipan and tourism area	Vietnam	High	$2,000/year	5 years	Hoang Lien National Park team (Mr. Nguyen Huu Hanh-Director); ZSL London Zoo (Benjamin Tapley - advisor); Australian Museum (Jodi Rowley - advisor); Asian Turtle Program of Indo-Myanmar Conservation	Tourist guide and local ranger trained annually. Knowledge on amphibian conservation increasing by time/ in each training.	Local tourist guide will not change their behaviour/knowledge on amphibian.	Education & Awareness
Continue training for local ranger/the National Park staff in order to raising local capacity in amphibian conservation	Vietnam	Critical	$2,000/year	5 years	Hoang Lien National Park team (Mr. Nguyen Huu Hanh-Director); ZSL London Zoo (Benjamin Tapley - advisor); Australian Museum (Jodi Rowley - advisor); Asian Turtle Program of Indo-Myanmar Conservation	Local ranger trained annually. Knowledge on amphibian conservation increasing by time/ in each training.	Rangers of National Park and Nature Reserve will not change their behaviour/knowledge on amphibian.	Capacity Building

Objective 4: Updating the conservation status of the species as included this species in the Local national Red List Data Book and legally protection Degree								
Providing species data (distribution range; ecology and biology, threats) to IUCN Red List authority in order to update conservation status of the species	Vietnam	High	NA; data will be collected base on above activities	Annual, in the next 48 months	ZSL London Zoo (Benjamin Tapley - advisor); Australian Museum (Jodi Rowley - advisor); Asian Turtle Program of Indo-Myanmar Conservation	Species data (of amphibians in Hoang Lien Range) will be provided to IUCN Red List authority.	No more update data provide	Law & Policy
Providing species information and suggestion to Vietnamese authority in order to update species into Vietnamese protection Degree.	Vietnam	High	$10,000	36 months	Ministry of Natural Resources and Environment; Hoang Lien National Park	Species data (of amphibians in Hoang Lien Range) will be provided to Vietnamese National authority team	Species will not update/list to Vietnamese protection Degree;	Law & Policy

3. LITERATURE CITED

Alliance for Zero Extinction (AZE) sites 2018: Fan Si Pan. https://zeroextinction.org/site-identification/2018-global-aze-map/

Foster, P. 2001. The potential negative impacts of global climate change on tropical montane cloud forests. *Earth-Science Reviews* 55: 73-106.

Gosner, K.L. (1960) A simplified table for staging anuran embryos and larvae with notes on identification. *Herpetologica,* 16, 183–190.

Inger, R.F., Voris, H.K. & Frogner, K.J. (1986) Organization of a community of tadpoles in rain forest streams in Borneo. *Journal of Tropical Ecology,* 2, 193−205.

IUCN SSC. 2015. *Leptolalax botsfordi*. The IUCN Red List of Threatened Species 2015: e.T73727195A73727483. http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T73727195A73727483.en. Downloaded on 25 February 2019.Ohler, A., Wollenberg, K.C., Grosjean, S., Hendrix, R., Vences, M., Ziegler, T. & Dubois, A. (2011) Sorting out *Lalos*: description of new species and additional taxonomic data on megophryid frogs from northern Indochina (genus *Leptolalax,* Megophryidae, Anura). *Zootaxa,* 3147, 1–83.

Nguyen, L. T., Tapley, B., Cutajar, T., Nguyen, C. T., Portway, C., Harding, L., Luong, V. H. & Rowley, J. J. A description of the tadpole of the Critically Endangered Botsford's leaf-litter frog (*Leptobrachella botsfordi*) with comments on the distribution and conservation status of the species. Zootaxa. In Press.

Nguyen, N. T. and Harder, D. K. 1996. Diversity of the flora of Fan Si Pan, the highest mountain in Vietnam. *Annals of the Missouri Botanical Garden* 83: 404-408.

Rowley JJ, Dau VQ, Nguyen TT. 2013. A new species of *Leptolalax* (Anura: Megophryidae) from the highest mountain in Indochina. Zootaxa, **3737**: 415–428.

Tapley, B., Rowley, J.J., Chung, N.T. & Hao, L.V. (2017). An action plan for the amphibians of the Hoang Lien Range 2017–2021. *Amphibian Survival Alliance*, 44 pp.