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COMMUNICATION

The herpetofauna of Jigme Singye Wangchuck National Park in central Bhutan: status, distribution and new records

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Abstract: A checklist of herpetofauna in Jigme Singye Wangchuck National Park in central Bhutan based on field surveys and photographic records is presented. Twelve families, 30 genera, and 42 species of herpetofauna were recorded; 33 species from 24 genera and eight families were reptiles and nine species belonging to six genera and four families were amphibians. Two ophidians, *Bungarus caerulus* and *B. lividus*, and one anuran, *Amolops formosus*, are new records for Bhutan. The compiled record also includes three threatened species. We recommend enhanced monitoring and herpetofauna-oriented conservation and research for Jigme Singye Wangchuck National Park.

Keywords: Amphibians, Bhutan, herpetofauna, lizards, protected area, reptiles, snakes, turtles.

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Author Details: Sangay Tshewang serves as Park Ranger of Adha Deputy Park Park Range Office under Jigme Singye Wangchuck National Park and is also the park focal for SMART patrolling. He is an active field biologists with deep taxonomical knowledge in flora and fauna. Limited experts in the herpetological field in Bhutan made Tshewang put special interests in herpetofauna. Letro Letro serves as a Forestry Officer at Jigme Singye Wangchuck National Park and coordinates various conservation research works in the park. Currently he is a graduate student at the University of Greifswald, studying Landscape Ecology and Nature Conservation. His research focuses on landscape approach conservation of wildlife.

Author Contribution: ST organized the field survey works, collected the data, identified the species, and drafted the paper. LL conceptualized the research work, analysed the data, and wrote the paper.

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INTRODUCTION

Humans frequently depend on diverse sources for essentials such as food, refuge, medicine, combustibles, and industrial products (Dirzo & Raven 2003). Amphibians and reptiles are an essential component of the earth's biodiversity (Urbina-Cardona 2008) and play a key role in most ecosystems, both terrestrial and aquatic, as prey and predators (Schneider et al. 2001). Herpetofauna are excellent ecological indicators owing to their high sensitivity to environmental change (Roy 2002), and are also among the most threatened taxa (Böhm et al. 2013) with more than 30% of amphibians and 19% of reptile species listed under threatened categories in the IUCN Red List (Stuart 2004; Böhm et al. 2013). While many taxa are still data deficient, known amphibian and reptile species are reported to be declining on a global scale due to factors such as deforestation, draining of wetlands, and pollution from agricultural runoff (Alford & Richards 1999; Gibbon et al. 2000; Kiesecker et al. 2001; Becker et al. 2007).

Bhutan's biodiversity database is strong for vertebrates like mammals and birds, but herpetofauna is less well studied (Wangyal 2013). A recent review by Wangyal (2014) recorded 183 species of reptiles and amphibians; 84 species of snakes, 23 species of lizards, 20 species of tortoises and turtles, and 56 species of frogs. Currently, none of these are listed under Schedule I of the Forests and Nature Conservation Act (FNCA) 1995 (RGoB 1995), and without any specific conservation plan, these diverse species are likely to face considerable threats from habitat destruction and degradation (Wangyal 2014). Most existing records are based on opportunistic encounters by enthusiasts (Wangyal 2012), and for protected areas the limited reports describe the herpetofauna of Royal Manas National Park (RMNP) (Das et al. 2016), the diversity and distribution of snakes in Jigme Dorji National Park (JDNP) (Koirala et al. 2016), and snakes and lizards from Bumdeling Wildlife Sanctuary (BWS) (Wangyal & Tenzin 2009). Two decades after its gazettement in 1995 (JSWNP 2014), Jigme Singye Wangchuck National Park (JSWNP) still does not have a checklist of its herpetofauna. In this paper, we provide the first checklist of reptiles and amphibians from the biologically diverse JSWNP, thereby filling the information gap and establishing baseline information for future conservation measures.

MATERIAL & METHODS

Study Area

The study was conducted in JSWNP, located in the central part of Bhutan (27.022–27.488 ^{0}N & 90.069–90.693 ^{0}E; Figs. 1 & 2). With an area of 1,730km^2, JSWNP is the third largest protected area in Bhutan, spread across 10 'gewogs' (sub-district administrative blocks) in five districts (JSWNP 2014). For effective conservation and sustainable management of resources, the park is divided into four park ranges: Langthel park range, Nabji park range, Taksha park range, and Tingtibi park range. JSWNP connects with JDNP and Wangchuck Centennial National Park (WCNP) in the north and with RMNP and Phibsoo Wildlife Sanctuary (PWS) in the south through biological corridors. Thus, JSWNP forms a vital link between the northern and southern protected areas network of Bhutan. JSWNP has a diverse habitat representation from sub-tropical forests at 464m to alpine scrubs with the centrally located Black Moutain (Jowo Durshing) going up as high as 4925m. This wide altitudinal variation has bestowed the park with six major forest types: (i) subtropical forests, (ii) chirpine forests, (iii) warm temperate broadleaf forest, (iv) cool temperate broadleaf forests, (v) subalpine conifer forests, and (vi) alpine meadows (JSWNP 2014). The national park has a good biodiversity database (Letro 2015) with a recording of 39 mammal species including the endangered tiger and Red Panda, 218 birds including the critically endangered White-bellied Heron, and 139 butterflies. These diverse ecological habitats, together with well-drained catchments and wetlands, prominent geophysical features, and agricultural farmlands, provide varied habitats for diverse herpetofauna.

Methods

The survey was conducted in all park range jurisdictions from May 2016 to June 2017. Searches were intensified in spring and summer months when reptiles and amphibians are most active. Data for reptiles were collected by randomly walking along opportunistic footpaths and trails between 9:00am and 3.30pm employing visual encounter surveys (Campbell & Christman 1982). For amphibians, the potential wetland habitats like marshes, ponds, streams, and riversides (Becker et al. 2007) were scanned by employing visual encounter searches between 7:00pm and 8:00pm. These areas were searched for all morphological stages of herpetofauna. Additional survey techniques to optimize detection success included night spot-light search, aural identification of species calls, recording road kills, and species killed by villagers. No voucher samples were collected during the survey, but all

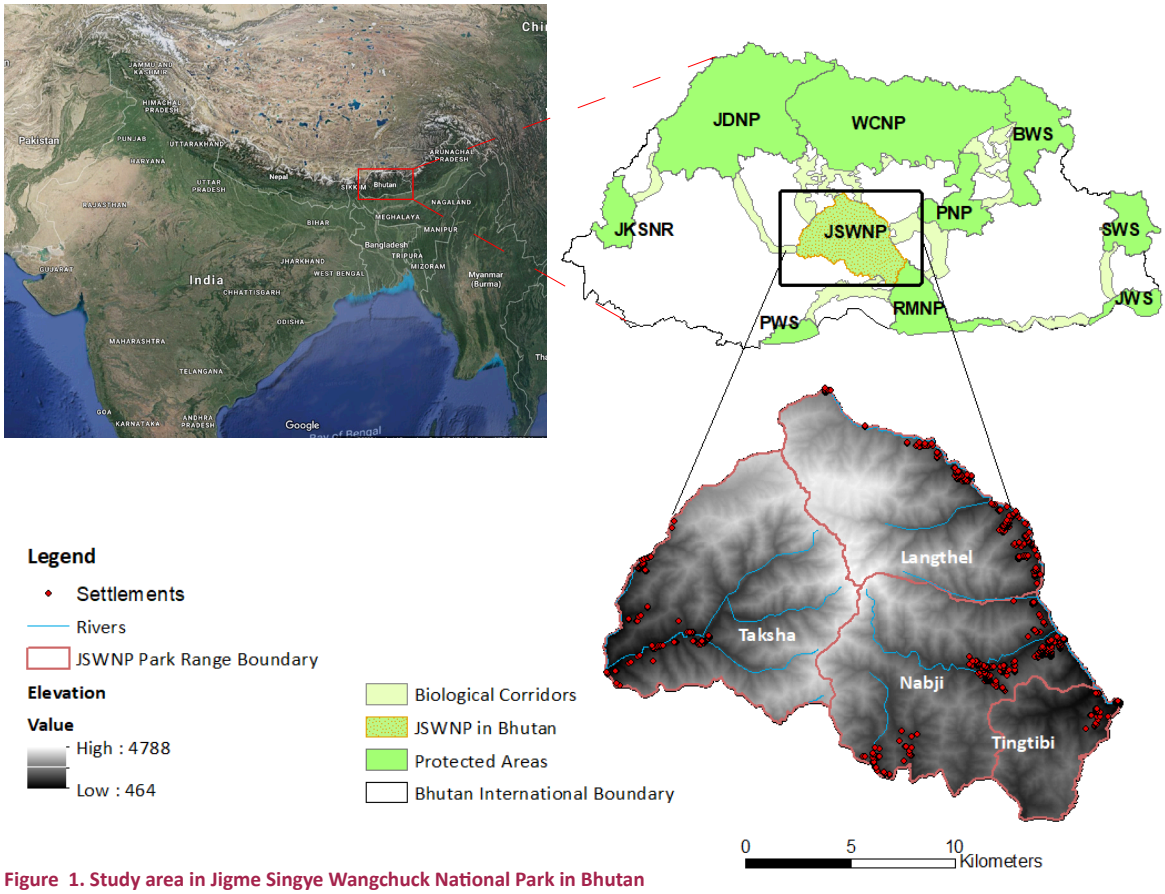

Figure 1. Study area in Jigme Singye Wangchuck National Park in Bhutan

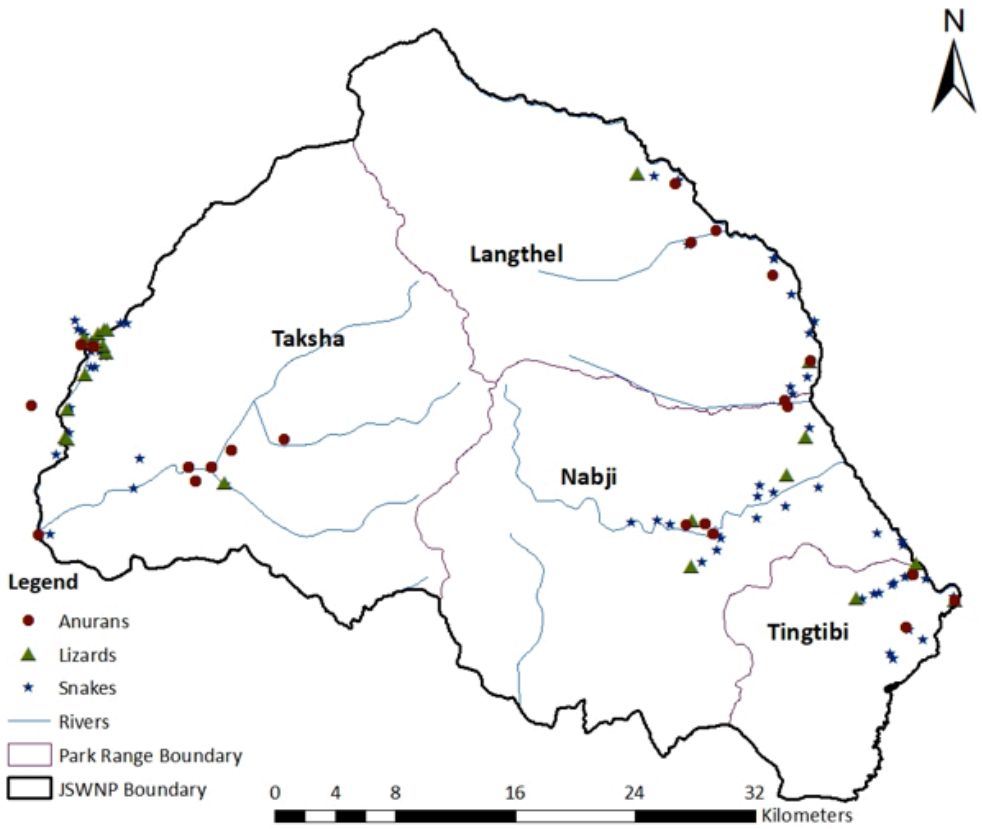

Figure 2. Sampled localities in JSWNP

the species encountered were identified either in the field or were photographed for identification and released back to their natural habitat. For every individual encountered, details such as species name, number of individuals, sex, and habitat inhabited were recorded along with the GPS coordinates. Garmin eTrex 30 was used to record geographic coordinates of the sites. The field guides on reptiles and amphibians by authors Purkayastha (2013) , Ahmed et al. (2009), and Daniel (2002) were referred for species identification in the field.

RESULTS

A total of 42 species were recorded from the national park, belonging to 30 genera and 12 families. Of these, 32 species belonging to 24 genera and eight families were reptiles and nine species from six genera and four families were amphibians.

Snakes

We observed 24 species of snakes from 18 genera belonging to four families (Table 1; Images 1–23). The family Colubridae was the most diverse with 16 species belonging to 12 genera, whereas Pythonidae appeared to be the least diverse with only one species. In terms of relative abundance based on individuals sighted, Colubridae was the most abundant, accounting for 75% (n=56) of all snakes, followed by Elapidae with 18%. Individual counts were least for Pythonidae and Viperidae, at 3% each (Fig. 3). Among species, the Green Rat Snake *Ptyas nigromarginata* has the highest observation record with 10 sightings. Two ophidians, *Bungarus caerulus* and *Bungarus lividus*, are new records for Bhutan, and *Python bivittatus* was recorded at an elevation of 1350m, a new highest elevation record for the species.

Lizards

We recorded eight species of lizards belonging to three families (Table 2; Images 24–31). The family Scincidae was the most diverse with three species and two genera. In the families Gekkonidae and Agamidae, we recorded two species each. Based on the individual numbers, the family Scincidae was the most abundant accounting for

Table 1. Checklist of snake species found in Jigme Singye Wangchuck National Park

	Family	Species	Locality	IUCN status
1	Colubridae	*Ahaetulla prasina* (Boie, 1827)	Tingtibi	LC
2		*Herpetoreas platyceps* (Blyth, 1854)	Taksha, Tingtibi	DD
3		*Boiga multifaciata* (Blyth, 1861)	Langthel, Taksha	DD
4		*Boiga ochracea* (Günther, 1868)	Langthel, Taksha	LC
5		*Coelognathus radiatus* (Boie, 1827)	Langthel, Taksha	LC
6		*Dendrelaphis cyanochloris* (Wall, 1921)	Nabji	LC
7		*Lycodon aulicus* (Linnaeus, 1758)	Langthel, Taksha	LC
8		*Lycodon septentrionalis* (Günther, 1875)	Langthel	NE
9		*Oligodon taeniolatus* (Jerdon, 1853)	Langthel, Taksha	LC
10		*Orthriophis cantoris* (Cantor, 1839)	Nabji, Taksha	NE
11		*Orthriophis taeniurus* (Anderson, 1879)	Nabji, Tingtibi	NE
12		*Pseudoxenodon macrops* (Blyth, 1855)	Nabji	LC
13		*Ptyas korros* (Schlegel, 1837)	Taksha	NE
14		*Ptyas nigromarginata* (Blyth, 1854)	Langthel, Nabji, Taksha, Tingtibi	NE
15		*Rhabdophis himalayanus* (Günther, 1864)	Nabji, Tingtibi	NE
16		*Sibynophis collaris* (Gray, 1853)	Langthel, Taksha	LC
17	Elapidae	*Naja kaouthia* (Lesson, 1831)	Langthel, Nabji, Taksha, Tingtibi	LC
18		*Bungarus caeruleus* (Schneider, 1801)	Tingtibi	NE
19		*Bungarus lividus* (Cantor, 1839)	Langthel	NE
20		*Ophiophagus hannah* (Cantor, 1836)	Tingtibi	**VU**
21		*Sinomicrurus macclellandi* (Reinhardt, 1844)	Tingtibi	NE
22	Pythonidae	*Python bivittatus* (Kuhl, 1820)	Taksha	**VU**
23	Viperidae	*Ovophis monticola* (Günther, 1864)	Tingtibi	LC
24		*Protobothrops himalayanus* Pan et al. 2013	Langthel	NE

NA: Not Available, NE: Not Evaluated, DD: Data Deficit, LC: Least Concern, VU: Vulnerable, EN: Endangered

Table 2. Checklist of lizards and tortoises found in Jigme Singye Wangchuck National Park

	Family	Species	Locality	IUCN status
1	Agamidae	*Calotes versicolor* (Daudin, 1802)	Langthel, Taksha, Tingtibi	NE
2		*Calotes jerdoni* (Guenther, 1870)	Langthel	NE
3		*Japalura variegata* (Gray, 1853)	Langthel, Nabji, Taksha	NA
4	Gekkonidae	*Hemidactylus brookii* (Gray, 1845)	Langthel, Taksha	NE
5		*Hemidactylus platyurus* (Schneider, 1792)	Langthel, Taksha, Tingtibi	NE
6	Scincidae	*Asymblepharus sikimmensis* (Blyth, 1854)	Langthel	NE
7		*Sphenomorphus indicus* (Gray, 1853)	Langthel, Nabji, Taksha, Tingtibi	NE
8		*Sphenomorphus maculatus* (Blyth, 1853)	Langthel, Taksha,	NE
9	Geoemydidae	*Cuora mouhotii* (Gray, 1862)	Tingtibi	EN
NA - Not Available, NE - Not Evaluated, DD - Data Deficient, LC - Least Concern, VU - Vulnerable, EN - Endangered				

Table 3. The diversity of anurans in Jigme Singye Wangchuck National Park

	Family	Species	Locality	IUCN status
1	Ranidae	*Amolops marmoratus* (Blyth, 1855)	Langthel, Nabji, Taksha, Tingtibi	LC
2		*Amolops formosus* (Günther, 1876)	Langthel	LC
3	Bufonidae	*Duttaphrynus himalayanus* (Günther, 1864)	Taksha	LC
4		*Duttaphrynus melanostictus* (Schneider, 1799)	Taksha	LC
5	Dicroglossidae	*Euphlyctis cyanophlyctis* (Schneider, 1799)	Nabji, Taksha	LC
6		*Nanorana liebigii* (Günther, 1860)	Taksha	NA
7	Rhacophoridae	*Polypedates himalayanus* (Annandale, 1912)	Nabji, Taksha	NE
8		*Polypedates teraiensis* (Dubois, 1987)	Langthel, Nabji	LC
9		*Rhacophorus maximus* (Günther, 1858)	Taksha, Tingtibi	LC
NA - Not Available, NE - Not Evaluated, DD - Data Deficient, LC - Least Concern, VU - Vulnerable, EN - Endangered				

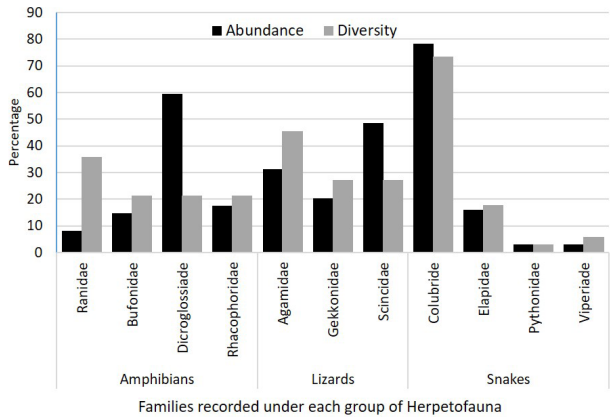

Figure 3. The diversity and abundance of herpetofauna in JSWNP

52% (n=59) of the total individual lizards sighted, followed by Agamidae with 32% and Gekkonidae with 15% (Fig. 2). Himalayan Litter Skink *Sphenomorphus indicus* and Common Garden Lizard *Calotes versicolor* were the most sighted species with 23 and 15 sightings, respectively. We also recorded a lone turtle species, *Cuora mouhotii* belonging to Geometridae family (Image 32), which is listed as endangered in IUCN Red List of Threatened Species.

Anurans

We recorded a total of nine frog species belonging to six genera and four families (Table 3; Images 33–40). Of these, Rhacophoridae was the most diverse with three species, followed by Bufonidae, Dicroglossidae, and Ranidae with two species each. Maximum count of individuals was recorded for the family Dicroglosidae accounting for 60% (n=336), followed by Rhacophoridae with 18%, Bufonidae with 14%, and least for family Ranidae with only 7% (Fig. 3). One species of anuran, *Amolops formosus*, is a new record for Bhutan.

DISCUSSION

Our results show JSWNP as a rich repository of reptiles and amphibians. With 42 species recorded, this diversity in JSWNP accounts for 23% (n=183) of the total species recorded from Bhutan. This can be attributed to the great elevation gradient and various habitat types of the park. The species were observed in diverse habitats such

as along footpaths and agricultural fields, by streams and rivers, near villages, and in various forests types, indicating that holistic habitat management is vital for the conservation of herpetofauna.

Of the 42 species of herpetofauna recorded in JSWNP, at least three species are new records for Bhutan, namely *Bungarus caeruleus*, *Bungarus lividus*, and the anuran *Amolops formosus*. *Bungarus caeruleus*, which was earlier listed as an expected species in the country (Wangyal 2014), is now in the confirmed list with our first record from Tingtibi Park Range. *Bungarus lividus* was recorded during our survey at Adha under Taksha Range in May 2016, and later also observed in Langthel Range in 2017. *Bungarus lividus* differs from all other kraits like *Bungarus niger* and *Bungarus caeruleus* in having normal-sized or only slightly enlarged mid-dorsal scales (arrows mark scales of the mid-dorsal row) (Kuch et al. 2011). *Amolops formosus* was also listed by Wangyal (2014) as an expected species, which we have recorded for the first time from Peka Chhu at an elevation of 1,350m, in the Taksha Park Range.

Two species of snakes and the lone turtle species are also found to be in the threatened category of the IUCN Red List of Threatened Species. The Burmese Python *Python bivittatus*, categorized as Vulnerable was reported from the tropical regions of India, Bangladesh, Nepal, China, and southeast China (Stuart et al. 2012). In Bhutan, it was first reported by Ahmed, Das & Dutta (2009) from an unspecified location but later its presence was reconfirmed when it was observed at Gortey and Kanamakura (245m) in Royal Manas National Park (Wangyal 2012), which has tropical climatic conditions. Unexpectedly, we recorded this threatened giant reptile at an altitude of 1,350m at Adha under Taksha Range during the recent survey, thus setting a new elevation record. The highest elevation at which the species was recorded was 1200m by Orlov, Murphy & Papenfuss (2000) in a bamboo forest of the Tam-Dao Mountain Range of Vietnam. Other higher records were without proper validation (Cota 2010). The King Cobra *Ophiophagus hannah* is another threatened snake species recorded in JSWNP. Listed as Vulnerable in the IUCN Red List, it is widely distributed in southern Asia (Stuart et al. 2012) with few sightings from Bhutan. Its presence was reported from Royal Manas National Park, Sarpang Dzongkhag, and Tashi Yangtse Dzongkhag (Wangyal & Tenzin 2009). In JSWNP, we observed one individual (SVL 120cm, TL 20cm) by the side of Berti Chhu in the Tingtibi Park Range, adding a new distribution record for the species in Bhutan. The Keeled Box Turtle *Cuora mouhotii* is the lone turtle species that we recorded in JSWNP and it too falls under the threatened category of the IUCN Red List. Found in freshwater and terrestrial habitats, the Keeled Box Turtle is native to China, India, Lao People's Democratic Republic, Myanmar, and Vietnam, and is listed as Endangered in the IUCN Red List of Threatened Species (Asian Turtle Trade Working Group 2000). In Bhutan, its presence was first reported by Wangyal et al. (2012) at an elevation of 370m in Zhemgang District.

Some species could not be identified while some were identified at the genus level, and these will be added to the checklist after proper identification. While the national park has many intact habitats, the coming up of numerous developmental activities like hydropower construction, road construction, installation of high tension electric lines, and the use of fertilizers and pesticides by the park residents are likely to threaten the habitats of herpetofauna. Cross-sectoral consultation is necessary to safeguard prime habitats of herpetofauna and further studies with sample collection are vital to confirm the species that could not be identified from the photographs and field notes. The areas that were not covered during the present study should be explored as well. Besides that, it is also vital to educate the communities within the park regarding the implications of herpetofauna conservation, so that members of herpetofauna do not fall victim to killing by humans out of fear.

REFERENCES

Ahmed, M.F., A. Das & S.K. Dutta (2009). *Amphibians and Reptiles of northeast India: A Photographic Guide*. Aaranyak.

Alford, R.A. & Richards, S.J. (1999). Global amphibian declines: a problem in applied ecology. *Annual Review of Ecology and Systematics* 30: 133–165.

Asian Turtle Trade Working Group (2000). Cuora mouhotii, Keeled Box Turtle. In: The IUCN Red List of Threatened Species. Retrieved from https://doi.org/10.2305/IUCN.UK.2000.RLTS.T163414A5604435.en

Becker, C.G., C.R. Fonseca, C.F.B. Haddad, R.F. Batista & P.I. Prado (2007). Habitat split and the global decline of amphibians. *Science* 318(5857): 1775–1777; https://doi.org/10.1126/science.1149374

Böhm, M., B. Collen, E.B.M. Jonathan, P. Bowles, J. Chanson, N. Cox,..S. Wren, T. Zamin, K. Zhou & G. Zug (2013). The conservation status of the world's reptiles. *Biological Conservation* 157: 372–385; https://doi.org/10.1016/j.biocon.2012.07.015

Campbell, H.W. & S.P. Christman (1982). Field techniques for herpetofaunal community analysis, pp. 193–200. In: Scott, N.J. (ed.). *Herpetological Communities*. U.S. Department of the Interior, Fish and Wildlife Service, 239pp.

Cota, M. (2010). Geographical distribution and natural history notes on *Python bivittatus* in Thailand. *The Thailand Natural History Museum Journal* 4(1): 19–28.

Das, A., P. Sharma, H. Surendran, A. Nath, S. Ghosh, D. Dutta & Y. Wangdi (2016). Additions to the herpetofauna of Royal Manas National Park, Bhutan, with six new country records. *Herpetology Notes* 9: 261–278.

Daniel, J. C. (2002). *The Book of Indian Reptiles and Amphibians*. Bombay Natural History Society and Oxford University Press, 238pp.

Image 1. *Ahaetulla prasina*

Image 2. *Boiga multifasciata*

Image 3. *Boiga ochracea*

Image 4. *Bungarus caeruleus*

Image 5. *Bungarus lividus*

Image 6. *Coelognathus radiatus*

Image 7. *Dendrelaphis cynochloris*

Image 8. *Herpetoreas platyceps*

Image 9. *Lycodon aulicus*

Image 10. *Lycodon septentrionalis*

Image 11 a & b. *Naja kaouthia*

Image 12. *Oligodon taeniolatus*

Image 13. *Ophiophagus hannah*

Image 14. *Orthriophis cantoris*

Image 15. *Orthriophis taeniurus*

Image 16. *Ovophis monticola*

Image 17. *Protobothrops himalayanus*

Image 18. *Pseudoxenodon macrops*

Image 19. *Ptyas korros*

Image 20. *Ptyas nigromarginata*

Image 21. *Python bivittatus*

Image 22. *Rhabdophis himalayanus*

Image 23. *Sinomicrurus macclellandi*

Image 24. *Asymblepharus sikimmensis*

Image 25. *Sphenomorphus indicus*

Image 26. *Sphenomorphus maculatus*

Image 27. *Japalura variegata*

Image 28. *Calotes jerdoni*

Image 29. *Calotes versicolor*

Image 30. *Hemidactylus brookii*

Image 31. *Hemidactylus platyurus*

Image 32. *Cuora mouhotii*

Image 33. *Amolops formosus*

Image 34 a & b. *Amolops marmoratus*

Image 35. *Duttaphrynus melanostictus*

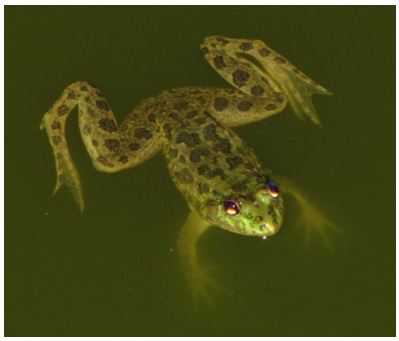

Image 36. *Euphlyctis cyanophlyctis*

Image 37. *Nanorana liebeiii*

Image 38. *Polypedates himalayensis*

Image 39. *Polypedates teraiensis*

Image 40. *Rhacophorus maximus*

Dirzo, R. & P.H. Raven (2003). Global state of biodiversity and loss. *Annual Review of Environment and Resources* 28: 137–167; https://doi.org/10.1146/annurev.energy.28.050302.105532

Gibbon, J.W., D.E. Scott, T.J. Ryan, K.A. Buhlmann, T.D. Tuberville, B.S. Metts & C.T. Winne (2000). The global decline of reptiles, Déjà Vu amphibians. *BioScience* 50(8): 653–666; https://doi.org/10.1641/0006-3568(2000)050[0653:TGDORD]2.0.CO;2

JSWNP (2014). *Conservation management plan, Jigme Singye Wangchuck National Park*. Trongsa.

Kiesecker, J.M., A.R. Blaustein & L.K. Belden (2001). Complex causes of amphibian population declines. *Nature* 410: 681–684; https://doi.org/10.1038/35070552

Koirala, B.K., D. Gurung, P. Lhendup & S. Phuntsho (2016). Species diversity and spatial distribution of snakes in Jigme Dorji National Park and adjoining areas, western Bhutan. *Journal of Threatened Taxa* 8(12): 9461–9466; https://doi.org/10.11609/jott.2617.8.12.9461-9466

Kuch, U., S.K. Sharma, E. Alirol & F. Chappuis (2011). Fatal neurotoxic envenomation from the bite of a Lesser Black Krait (*Bungarus Lividus*) in Nepal. *Southeast Asian Journal of Tropical Medicine and Public Health* 42(4): 960–964.

Letro, L. (2015). Jigme Singye Wangchuck National Park, pp. 45–59. In: Norbu, C., N. Bidha, N. Gyeltshen, N. Norbu, S. Wangchuk, S. Wangchuck & S. Wangdi (eds.). *Protected Areas of Bhutan, 1st Edition*. Department of Forests and Park Services.

Orlov, N.L., R.W. Murphy & T.J. Papenfuss, T.J. (2000). List of snakes of Tam-Dao mountain ridge (Tonkin, Vietnam). *Russian Journal of Herpetology* 7(1): 69–80; https://doi.org/1026-2296/2000/0701-0069

Purkayastha, J. (2013). *An Amateur's Guide to Reptiles of Assam*. EBH Publishers (India), 149pp.

RGoB. Forests and Nature Conservation Act of Bhutan (1995). Thimphu: Royal Goverment of Bhutan.

Roy, D. (2002). Amphibians as environmental sentinels. *Journal of Biosciences* 27(3): 187–188; https://doi.org/10.1007/BF02704906

Schneider, R.L., M.E. Krasny & S.J. Morreale (2001). *Hands-on Herpetology: Exploring Ecology and Conservation*. NSTA Press, Arlington, Virginia.

Stuart, B., T.Q. Nguyen, N. Thy, L. Grismer, T. Chan-Ard, D.T. Iskandar, E. Golynsky & M.W.N. Lau (2012). *Python bivittatus*. The IUCN Red List of Threatened Species 2012: e.T193451A2237271. Downloaded on 12 October 2018; https://doi.org/10.2305/IUCN.UK.2012-1.RLTS.T193451A2237271.en

Stuart, B., G. Wogan, L. Grismer, M. Auliya, R.F. Inger, R. Lilley, T. Chan-Ard, N. Thy, T.Q. Nguyen, C. Srinivasulu & D. Jelić (2012). *Ophiophagus hannah*. King Cobra. *The IUCN Red List of Threatened Species*, 8235. Retrieved from https://doi.org/10.2305/IUCN.UK.2012-1.RLTS.T177540A1491874.en

Stuart, S.N. (2004). Status and trends of amphibian declines and extinctions worldwide. *Science* 306(5702): 1783–1786; https://doi.org/10.1126/science.1103538

Urbina-Cardona, J.N. (2008). Conservation of neotropical herpetofauna: research trends and challenges. *Tropical Conservation Science* 1(4): 359–375; https://doi.org/10.1177/194008290800100405

Wangyal, J. (2012). New records of snakes and lizards from Bhutan. *Hamadryad* 36(1): 25–31.

Wangyal, J. (2013). New records of reptiles and amphibians from Bhutan. *Journal of Threatened Taxa* 5(13): 4774–4783; https://doi.org/10.11609/JoTT.o3539.4774-83

Wangyal, J. (2014). The status of herpetofauna of Bhutan. *The Journal of Bhutan Ecological Society* 2(1): 20–39.

Wangyal, J., D. Wangchuk & I. Das (2012). First report of turtles from the Himalayan Kingdom of Bhutan. *Chelonian Conservation and Biology* 11(2): 268–272; https://doi.org/10.2744/CCB-0995.1

Wangyal, J.T. & K. Tenzin (2009). *Snakes and Lizards Diversity in Bumdeling Wildlife Sanctuary, Chortenkora, Trashiyangtse, Bhutan*. Kuensel Corporation Ltd., Thimphu, 103pp.

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