

Status of herpetofauna in Rupandehi and Arghakhanchi districts, Nepal

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ABSTRACT

Herpetofauna are unique creature which comprise both amphibians and reptiles. The present study was carried out on herpetofaunal diversity in Rupandehi and Arghakhanchi districts. Each of six sampling stations was conducted in the study areas. Ten standardized 10 x 200 m strip transects and 20-25 standard Quadrat sizes of 20 m x 20 m were set in each station. Observed museum specimens and questionnaire survey were also conducted during data collection. A total of 45 species of herpetofauna was recorded with 9 species of amphibians) and 36 species of reptiles. Six species were from the family Ranidae, two species from Bufonidae and one species from Rhacophoridae. Lizards were represented by 11 species belonging to four different families. Each of Gekkonidae, Agamidae and Scincidae family was represented by 3 species and the Varanidae by two species. The family Crocodylidae was represented by one species. The order Testudines (turtles) was represented by 2 species from family trionychidae and bataguridae. Twenty two species of snakes were recorded from 6 different families. The amphibian species, namely; *Euphlyctis cyanophlyctis*, *Zakerana nepalensis*, *Bufo melanostictus* and *B. stomaticus* and reptile species *Calotes versicolor* were relatively abundant. Seven species of amphibians and 18 species of reptiles were common in both districts. The study areas were diverse microhabitats due to the elevation from 71 m to 2004 m with plain, Churia and mountain range.

Keywords: Amphibian, diversity, richness, reptile

INTRODUCTION

Herpetofauna are poikilothermic tetrapods. Amphibians were represented by frogs, toads, caecilians and salamanders, whereas reptiles include crocodiles, turtles, tortoises, snakes and lizards. Many of them were dependent on terrestrial cum aquatic habitats and wetlands for some parts of their life cycles. Different habitats were needed for many life activities like nesting, hibernating, aestivating, dispersal, biological functions etc. Their microhabitats include lotic and lentic water, swamps, rocks and different vegetations.

Amphibians were known to be extremely variable as so many different morphs of the same species exist in all geographical variations (Barlett & Barlett, 2003). Reptiles occupy and live in a great variety of aquatic and terrestrial habitats (Mc Diarmid *et al.*, 2012) and there is interrelationship between terrestrial and neighboring wetlands (Gibbons, 2003).

The habitat modifications determine the quantitative and qualitative data of herpetofaunal biodiversity in particular areas. Many activities indispensable for human subsistence lead to

biodiversity loss (Aerts *et al.*, 2006; Diaz *et al.*, 2006). Land-use change results in the decline of diversity (Lajmanovich *et al.*, 2003; Storfer, 2003). Altitudinal gradients and the physical environment were prime factors that determine spatial and temporal distribution, abundance and richness patterns of organisms (Korner, 2000). Gibbons *et al.* (2000) reflects that decline of herpetofauna species diversity and population size can be attributed in part to causes including anthropogenic factors like habitat loss, and presence of invasive and introduced species, pollution, and disease.

Sri Lanka is very rich in herpetofauna and was included in the revised hot spots of the world with 55 species of herpetofauna belonging to 39 genera and 15 families (Mittermeier *et al.*, 1998; Majumder *et al.*, 2012). Grismer *et al.* (2010) as well as Das & Norsham (2007) listed a total of 107 species of herpetofauna from Banjaran Bintang in Perak and that 600 herpetofauna species including 203 species of amphibians and 397 species of reptiles were from Peninsular Malaysia. Hasan & Feeroz (2014) reported species diversity and habitat preferences in Bangladesh. A total of 32 amphibian species under 6 families had been reported from six protected areas of Bangladesh. The herpetofauna in Thummalapalle uranium mining areas resulted in a collection of 52 species belonging to 17 families. Snakes were the dominant group with 20 species (Reddy *et al.*, 2013).

Nepal has variety of habitats due to presence of altitudinal variation with macro and micro habitats which are suitable for rich diversity of herpetofauna. Schleich and Kastle (2002) reported an account of 50 amphibians and 123 reptiles. At the same time, Shrestha (2001) reported that 206 species of herpetofauna including one species of salamander, one species of caecilians, 59 species of toad and frogs, 39 species of lizards, 81 species of snakes, two species of crocodiles, and 16 species of tortoise and turtles in Nepal. There was a total number of 138 species of reptiles from Nepal including 17 species of turtles, 2 species of crocodiles, 39 species of lizards and 80 species of snakes (Shah & Tiwari, 2004). Bista (2010) carried out a survey in a Ramsar site of Nepal reporting 43 species of herpetofauna including 8 species of amphibians belonging to 3 families and 7 genera and 35 species of reptiles belonging to 13 families and 25 genera. Similarly the herpetofaunal studies were carried out in different National parks of Nepal as well.

Very few species have been described from disturbed habitats, indicating a diminished species composition when compared with the original habitat (Molur, 2008). From a conservation point of view also, herpetofauna conservation efforts have been limited (Shah & Tiwari, 2004). Despite these facts, the herpetofauna are poorly studied and determination of distribution, population status and habitat suitability for populations has not been carried out in these study areas so far. Therefore, the aim of this study is to identify and document the status as well as explore the venomous and non-venomous snakes of Rupandehi and Arghakhanchi districts of Nepal which helps to generate the current status of herpetofaunal species to current list, habitat situation, sensitization of the conservation efforts along with species association analyses.

MATERIALS AND METHODS

Study areas

This study was undertaken in hilly Arghakhanchi and plain Rupandehi districts of Nepal. Twelve sampling stations were selected covering different habitats of these two districts (fig. 1)

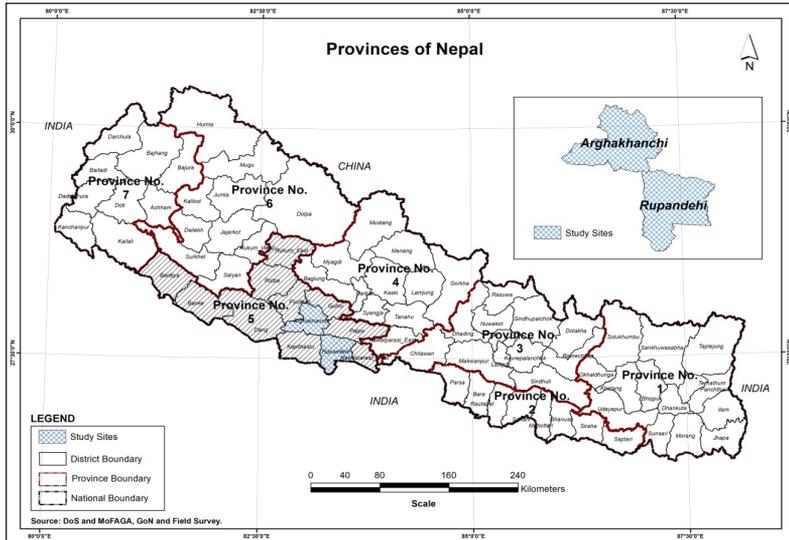


FIG. 1. Map of Nepal showing Arghakhanchi and Rupandehi districts in Province No. 5.

TABLE 1. Districts, stations, locations, elevations and habitat types in study areas.

District	Stations	Locations	Elevations	Habitat types
Arghakhanchi	Sandhikharka	27°58'.626'N & 83°07'.385'E	935 m	Agricultural fields, wetlands, town areas and community forest
	Sitapur	28°00'.256'N & 83°10.281'E	906 m	Subtropical forest, few agricultural land, village areas, riparian vegetation, hilly areas
	Gokhunga	28°06'.125'N & 83°0.595'E	2004 m	Agricultural lands, village areas and community forest, sloppy lands.
	Arghatosh	28°0'.25'N & 83°10'195' E	890 m	Riparian, community and government forests, agricultural lands and small villages
	Pokharathok-Khidimand	27°51'.055'N & 83°18.465'E	915 m.	Wetlands, community and government forests, agricultural lands and small villages, hilly areas
	Siddhara	27°49'21.11'N & 82°50'58.1'E	460 m	Riparian, Churia range, tropical forest, agricultural lands

Rupendehi	Khaireni	27°37'.855'N & 83°34.279'E	127 m.	Agricultural fields, small urban areas, tropical forest, plain
	Belbas	27°41'525'N & 83°26'436'E	147 m	Plain to Churia range, few agricultural lands and small urban areas ,tropical forest
	Gajedi	27°40'.295'N & 83°21.385'E.	107 m.	Agricultural fields, wetland, small town, small tropical forest, plain
	Sainamaina	27°39'.255'N & 83°21.383'E	106 m	Agricultural lands, village areas, small forest and plain
	Bhairahawa-Madhulia:	27°30'.655'N & 83°24'.595'E	71 m.	Agricultural fields, riparian, urban areas, plain
	Chhapiya	27°30'.377'N & 83°12'599'E	79 m	Agricultural fields, wetlands, town areas, plain

Data collections: In each station (table 1), the data collection was carried out by applying the different methods like transects, quadrats, visual encounter, spot light, catching etc. Samplings were carried out in the study sites, beginning from February 2016 till to the end of January 2017. The active search was carried out during the day time in selected sites. The samplings were taken in the mornings (approximately 9:00 a.m. to 12:00 p.m., depending on weather) and at nights (7:00 p.m. to 10:00 p.m.).

Surveys on herpetofauna were conducted in 10 standardized 10 × 200 m strip transects, the number of which varied depending on patch size. Standard quadrat sizes of 20 m × 20 m were set in different stations. Twenty quadrats were taken in mid hills and Chure regions and 25 quadrats were set randomly according to the type of locality in Terai region. Observation of museum specimens and questionnaire survey were also developed for data collection. The data were collected for each individuals of a species encountered during field work. The locality, date, time, weather condition, habitat, microhabitat and behavioral note were recorded in a field data sheet.

Specimens were captured for identification. Information recorded for each individual included species, snout-vent-length (SVL), tail length maximum, head width (HW), axilla-groin distance (AGD), fore-limbs (FL: axilla to tip of longest finger) and hind-limbs (HL: groin to tip of longest toe), and webbing formula etc. followed Anders & Schleich (2002) and Rai (2003). Photographs were taken of representatives of each species and habitats. Geographic coordinates for each survey site were determined in the field with a Garmin GPS (etrex 10) receiver. Coordinates were recorded as latitude and longitude in decimal degrees.

Identification of the species was carried out by using the identification keys developed by field

guide of Smith (1981), Dixon (2000), Schleich & Kaestle (2002), and Rai (2003). Amphibian specimens were also identified with the aid of Bossuyt & Dubois (2001), Dutta & Manamendra-Arachchi (1996), Das (2008), Kabir *et al.* (2009) etc. The species encountered were identified using field guides and color photographs (Shah & Tiwari, 2004).

RESULTS AND DISCUSSION

In this study, a total of 9 species of amphibians and 36 species of reptiles were recorded in study areas. In amphibians, 6 species were from the family Ranidae, two species from Bufonidae and one species from Rhacophoridae (table 2). Lizards were represented by 11 species belonging to four different families. In each family of Gekkonidae, Agamidae and Scincidae was represented by 3 species and Varanidae with two species. Order Testudines (turtles) was represented by 2 species from family trionychidae and bataguridae. Family Crocodylidae had species of *Crocodylus palustris*. Twenty two species of snake were recorded with five different families (table 3).

In Arghakhanchi district, there were 115 individuals of 8 amphibian species (two families and five genera) and 163 individuals of 26 reptile species (9 families and 22 genera). The amphibian species; *Limnonectes teraiensis* and reptile species *Laudakia tuberculata*, *oligodon erythrogaster*, *Trachischium guentheri*, *Ramphotyphlops braminus*, *Oligodon arnensis*, *Hemibungarus macclellandii*, *Xenochrophis sanctjohannis*, and *Ovophis monticola* were recorded in this district. *Crocodylus palustris* species recorded in small pond of Chure hill of this district.

A total of 88 individuals of 8 amphibian species under 3 families and 146 individual of 28 reptile species under 12 families and 21 genera were recorded from six stations of Rupandehi district. During the study, *Pungshura smithii*, *Lissemys punctata*, *Varanus flavescens*, *Python molurus*, *Python bivittatus*, *Bungarus fasciatus*, *Naja kaouthia*, and *Naja naja* were fairly recorded in this district.

The pond frog (*Euphlyctis cyanophlyctis*) and Cricket frog (*Zakerana nepalensis*) were relatively abundant in the study sites. The common Indian toad (*Bufo melanostictus*) and *Bufo stomaticus* (Marbled balloon frog) were commonly occurred. The tree frog (*Polypedates leucomystax*) was found in the forest and rocky areas. The snake belonged to five families, more number of snakes recorded from the family Colubridae (11 species) followed by Elapidae (5 species), Viperidae (2 species), Boidae (2 species), and Typhlopidae (1 species).

The lizard (*Calotes versicolor*), Rat snake (*Ptyas mucosus*) and Chichred keelback (*Xenochrophis piscator*) and Common wolf snake (*Lycodon aulicus*) were relatively common. Very rarely recorded species were *Varanus flavescens*, *Python molurus*, *P. bivittatus*, *Pungshura smithii*, *Lissemys punctata*, *Dendrelaphis tristis*, *Oligodon erythrogaster*, *O. arnensis*, *Trachischium guentheri*, and *Xenochrophis sanctjohannis*.

In the reported 22 species of snakes, seven species (2 families of Elapidae and Viperidae) were venomous. The common venomous snakes recorded were *Bungarus caeruleus*, *B. fasciatus*, *Hemibunarus macclellandii*, *Naja kaouthia*, *Naja naja*, *Trimeresus albolabris*, and *Ovophis monticola*. Fifteen non-venomous species recorded in the present study were *Python*

molurus, *P. bivittatus*, *Ramphotyphlops braminus*, *Amphiesma stolatum*, *Boiga trigonata*, *Coelognathus helena*, *C. radiates*, *Dendrelaphis trisis*, *Lycodon aulicus*, *Oligodon arnensis*, *Oligodon erythrogaster*, *Ptyas mucosa*, *Trachischium guentheri*, *Xenochrophis piscator*, and *Xenochrophis sanctjohannis*.

The *Bufo stomaticus* and *B. melanostictus* were found in arid habitats and *Polypedates leucomystax* was an arboreal species recorded during the study. Ocock, *et al.* (2016) reported similar habitat of tree frog which had specialized toe-discs for climbing and a relatively high resistance to water-loss. The *Euphlyctis* spp. and *Hoplobatrachus* spp. preferred aquatic habitat, while the remaining species of amphibians were found in semi-aquatic and shady habitats. A similar biology was explained by Andreone (1993, 1994) taking into account the scarcity of still water bodies at the analysed sites, and therefore to a local rarity of this species, elsewhere almost abundant. According to Omogbai *et al.* (2002), populations of amphibians were excess during the rainy season. Amphibians presented their highest diversity where they had spent most of their evolutionary history (Alexandra & Troumbis, 1997). Aryal *et al.* (2010) reported Turtle trade surveys conducted in the markets mainly in Kailali, Kapilbastu, Rupandehi, Nawalparasi, Sunsari and Saptari districts and 16 species were reported the status of species distributions and incorporating the turtles in conservation issues. In the present study *Pungshura smithii* and *Lissemys punctata* were recorded from study sites.

Abundantly encounter species found to be were *Calotes versicolor*, *Hemidactylus brookii*, *H. flaviviridis*, *Eutrophis carinata*, *Coelognathus helena*, *C. radiates*, *Lycodon aulicus*, *Ptyas mucosa*, *Xenochrophis piscator*, *Trimeresurus albolabris*, *Bufo melanostictus*, *B. stomaticus*, *Euphlyctis cyanophlyctis* and *Hoplobatrachus tigerinus*. Shah (1998) prepared a checklist of herpetofauna of Nepal in which he recorded 64 snake species. Similarly, Shah & Tiwari (2004) reported abundantly available species *Euphlyctis cyanophlyctis* and *Calotes versicolor* in Nepal. The diversity of herpetofauna in the study area was reflected in species richness due to wide range of temperature, diverse topography, land use and diverse microhabitat. Diversity of herpetofuna is high due to land of topographic contrast climate and water condition etc. A total of 45 species of herpetofauna were recorded in which 9 species of amphibians (6 genera, and 3 families) and 36 species of reptiles (27 genera, 12 families, and 3 suborders). In Arghakhanchi district, there were 115 individuals of 8 amphibian species including 2 families with 5 genera and 162 individuals of 25 reptile species (22 genera and 10 families). In Rupandehi district, a total of 88 individual of amphibian under 8 species (5 genera and 3 families) and 146 individual of reptile under 28 species (21 genera and 10 families) were recorded. Out of 9 amphibian species, 7 species were common in both district but *Limnonectes teraiensis* was only found in Arghakhanchi and *Polypedates leucomystax* was only found in Rupandehi district. A total of 36 reptile species, 18 species were common in both sites but 8 species were only recorded in Arghakhanchi and other 10 species were only found in Rupandehi district.

The *Euphlyctis cyanophlyctis*, *Zakerana nepalensis*, *Bufo melanostictus* and *B. stomaticus* were relatively abundant in study sites. The most common reptile species was *Calotes versicolor*. The species richness of reptiles was found to be more in Rupandehi than in Arghkhanchi district. Habitat type may be a main contributing factor on major effect on species richness,

diversity, distribution and abundance of amphibians and reptiles of study sites. Amphibian species were recorded in aquatic, semi-aquatic and shady habitats and found active in rainy season. On the other hand, the main habitats of reptiles were forests, grasslands, trees, tunnels, cliffs, rocks, different aquatic bodies, agricultural lands and human dwellings. There were 22 species of snakes in which 7 species were venomous species under 2 families (Elapidae and Viperidae) and 15 non-venomous species under 3 families (Boidae, Colubridae and Typhlopidae). Out of 7 venomous species, 2 species were common in both districts but 2 species were recorded in Arghakhanchi and 3 species were recorded in Rupandehi district. A total of 15 non-venomous species, 7 species were common in both districts while 5 species in Arghakhanchi and 3 species in Rupandehi districts were recorded.

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TABLE 2. Amphibian of order Anura in different stations of Arghakhanchi and Rupandehi districts.

S. N.	Scientific name	Family	Arghakhanchi						Rupandehi							
			TI	Sandhikharaka	Sitapur	Pokhrathok	Arghatosh	Gokhunga	Siddhara	TI	Khairni	Belbas	Sainamaina	Gajedi	Bhairahawa	Chhapia
1.	<i>Bufo melanostictus</i>	Bufoidea	14	+	+	+	+	+	+	+	+	12	+	+	-	+
2.	<i>Bufo stomaticus</i>	Bufoidea	4	+	+	+	+	-	-	-	-	9	+	+	-	+
3.	<i>Euphyctis cyanophlyctis</i>	Ranidae	65	+	+	+	+	+	+	+	+	35	+	+	+	+
4.	<i>Hoplobatrachus crassus</i>	Ranidae	5	+	-	-	-	+	-	-	-	7	-	-	-	-
5.	<i>Hoplobatrachus tigerinus</i>	Ranidae	4	+	-	-	-	-	-	-	-	9	+	+	-	-
6.	<i>Limnonectes teraiensis</i>	Ranidae	5	-	-	-	-	+	-	-	-	-	-	-	-	-
7.	<i>Zakerana nepalensis</i>	Ranidae	15	+	+	+	+	+	-	-	-	8	-	-	-	+
8.	<i>Zakerana teraiensis</i>	Ranidae	3	-	+	-	-	-	-	-	+	5	-	-	+	+
9.	<i>Polypedates leucomystax</i>	Rhacophoridae	--	--	-	-	-	-	-	-	-	3	-	-	-	-
	Total		115									88				

(TI= Total individuals)

TABLE 4. Distribution of venomous and non venomous snakes in Arghakhanchi and Rupandehi districts, Nepal.

S.N.	Scientific name	Family	Venomous		Non venomous	
			Arghakhanchi	Rupandehi	Arghakhanchi	Rupandehi
1.	<i>Amphiesma stolatum</i>	Colubridae	-	-	+	+
2.	<i>Boiga trigonata</i>	Colubridae	-	-	+	+
3.	<i>Coelognathus Helena</i>	Colubridae	-	-	+	+
4.	<i>Coelognathus radiatus</i>	Colubridae	-	-	+	+
5.	<i>Dendrelaphis trisris</i>	Colubridae	-	-	+	+
6.	<i>Ptyas mucosa</i>	Colubridae	-	-	+	+
7.	<i>Xenochrophis piscator</i>	Colubridae	-	-	+	+
8.	<i>Oligodon arnensis</i>	Colubridae	-	-	+	-
9.	<i>Oligodon erythrogaster</i>	Colubridae	-	-	+	-
10.	<i>Trachischium guentheri</i>	Colubridae	-	-	+	-
11.	<i>Xenochrophis sanctijohannis</i>	Colubridae	-	-	+	-
12.	<i>Ramphotyphlops braminus</i>	Typhlopidae	-	-	+	-
13.	<i>Python bivittatus</i>	Boidae	-	-	-	+
14.	<i>Python molurus</i>	Boidae	-	-	-	+
15.	<i>Lycodon aulicus</i>	Colubridae	-	-	-	+
16.	<i>Bungarus caeruleus</i>	Elapidae	+	+	-	-
17.	<i>Trimeresurus albolabris</i>	Viperidae	+	+	-	-
18.	<i>Hemibungarus maclellandii</i>	Elapidae	+	-	-	-
19.	<i>Ovophis monticola</i>	Viperidae	+	-	-	-
20.	<i>Naja kaouthia</i>	Elapidae	-	+	-	--
21.	<i>Naja naja</i>	Elapidae	-	+	-	-
22.	<i>Bungarus fasciatus</i>	Elapidae	-	+	-	-
	Total		4	5	12	10