

Distribution and current status of amphibian fauna of Pakistan: A review

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Research Article

Abstract

The arid climate of Pakistan makes it less favorable for amphibian fauna to thrive. Anura, the only order of amphibian fauna, prevails here with 21 species falling in 4 families (Bufonidae, Megophryidae, Microhylidae and Dicroglossidae) and 12 genera. Himalayan highlands houses most of the anuran species contrary to central and eastern areas experiencing low populations. Conservation status of most frogs and toads of Pakistan is of least concern as are not posed to serious threats but some species including *Euphlyctis cyanophlyctis* and *Hoplobatrachus tigerinus* are confronting habitat loss, urbanization, fertilizer and pesticide exposure. Lowering pesticide application, reinstating amphibian habitat and appropriate legislation for amphibian conservation are strongly recommended to minimize the decline of anuran species in Pakistan.

Keywords: Amphibia; Pakistan; Conservation; Anura.

1. Introduction

Amphibians, the ancestors of modern reptiles and mammals, first evolved in Devonian era and flourished throughout Carboniferous period. This unique group of kingdom animalia provides an evolutionary link between aquatic and terrestrial mode of life [1].

Amphibians are represented by about 7481 species divided into three major clades, viz., Caudata (Salamander), Anura (Frog) and Gymnophiona (Caecilian). Clade Caudata comprises of 698 known species having both aquatic and land dwelling members. Most diverse clade representing class Amphibia is the order Anura numbering almost 6577 species. The third group Gymnophiona includes about 206 species of sessile and nearly blind organisms [2].

2. Geographical Position and Climatic Conditions of Pakistan

Two major biogeographic regions, the Palearctic in

the West and the Oriental in the east, houses Pakistan resulting in its diverse topography [3]. Due to its vast longitudinal (60° 52' to 75° 22' E) and latitudinal (24° to 37° N) stretch, varying climatic conditions are observed in Pakistan contributed by the highest peaks (Himalayas, Hindukush and Karakoram) in the North and North-Eastern region with freezing temperature and elevated temperature up to 50°C in the South Eastern and Eastern areas due to major deserts (Thal, Thar and Cholistan). A total of 56% of Pakistan's geographical area is arid, 23.8% semi-arid, 16.1 % alpine and 3.6% mesodermal with dry winter [4] (Figure 1).



Figure 1. Geographical position of Pakistan [3].

3. Composition and Distribution of Amphibian Fauna

Amphibian fauna is scarce in Pakistan as not a single species of two vital amphibian orders, Caudata and Gymnophiona, exists here. The only clade representing amphibian fauna in the geographical

boundaries of Pakistan is Anura with a heterogeneous assemblage of twenty one species. These species fall in twelve genera of four major families viz., Bufonidae, Megophryidae, Microhylidae and Dicroglossidae [2].

The distribution of amphibian fauna in Pakistan elevates from sea level reaching up to 4000 meters in the Himalayas and Karakoram, stretching across the latitude from Indian boundary to its western borders [3].

Genus *Duttaphrynus* and *Bufo*, family Bufonidae are the two widely distributed genera of toads in Pakistan. *Duttaphrynus himalayanus* is widely distributed throughout the Himalayan Mountains and has been reported in the neighboring countries including China and India whereas *Duttaphrynus melanostictus* is found mainly in Hazara division in Khyber Pakhtunkhwa province [5]. Olive toad, *Duttaphrynus olivaceus*, inhabits lowland areas of the North Western Balochistan whereas *Duttaphrynus stomaticus* is one of the most widely distributed and well adapted anuran species that thrives in most areas of Pakistan including both highlands and lowlands [6]. Most members of genus *Bufo* including the *Bufo pseudoraddei* (endemic), *Bufo surdus*, *Bufo zugmayeri* are distributed mainly in the western areas of Pakistan including Balochistan [3] while *Bufo latastii* (Laddakh toad) is distributed on the Himalayan highlands (Skardu) [7]. The only member of family Megophryidae, *Scutiger nyingchiensis*, commonly known as Tibetan toad, is restricted to highlands of Deosai in the northern highlands [3].

Members of family Microhylidae, *Uperodon systoma*, localized in the capital territory (North Punjab) and Murree hills is a secretive subterranean frog whereas *Microhyla oronata* shares same habitat [8] as *U. systoma* [9]. Western, central, and eastern Himalayas (Kashmir, Hazara) houses the frogs of genus *Allopa* (*Allopa hazarensis* and *Allopa barmoachensis*). Balochistan Karez frog, *Chrysopaa sternosignata*, extends throughout Balochistan province and Kashmir valley. It has been reported inhabiting the irrigating channels, karez in the Balochistan highlands. Grass fields of northwestern mountains of Pakistan and areas of Kashmir valley provide an ideal habitat to the altitude adapted *Scutiger nyingchiensis* [10] (Table 1).

Two species of genus *Euphlyctis*, wide ranging anuran members prefer plain areas especially in Punjab. Other species with high populations in plain areas include *Hoplobatrachus tigrinus*, *Fejervarya syhadrensis* and members of genus *Sphaerotheca* (*Sphaerotheca breviceps* and *Sphaerotheca strachani*). Genus *Sphaerotheca* is distributed mainly along the river channels and expands its habitat to the

coastal areas in Sindh [11]. North-central Pakistan and Kashmir valley is inhabited by the Murree frog, *Nanorana vicina* [12].

4. Threats and Conservation Status

Biodiversity directly or indirectly benefits mankind. Its conservation is of critical importance as this very diversity is threatened by the danger of extinction. Being a universal wealth, serious steps must be taken, ensuring its conservation and protection [13].

Different anuran species inhabit different areas of Pakistan and as not all species occupy the entire geographic range so threats faced by amphibian fauna varies from species to species. One of the leading threat that is being faced by the frogs and toads in Pakistan includes rapid urbanization and industrialization. Suitable breeding habitats of amphibians have been destroyed by the rapid establishment of vast industrial zones and housing schemes. The major cities of Pakistan including Gujranwala, Wazirabad, Rawalpindi, Sheikhupura, Faisalabad, Karachi and many others have extended their boundaries and thus resulting in serious decline in amphibian population [13]. Not only cities but in villages, removal of water ponds to eliminate mosquitoes for controlling Malaria and dengue also adversely affect the amphibian population. Effluent discharge containing toxic chemicals into main stream water bodies have also been reported as a serious threat to population decline near industrial estates in different regions of Pakistan. Anuran species including *M. ornata*, *E. cyanophlyctis*, *F. syhadrensis*, *H. tigrinus* are among the seriously affected organisms [14].

Another serious threat faced by this fauna includes mechanization of agriculture in villages. Previously the old methods applied for ploughing did not dig deep into the field thus burrows provided a safe haven to the fauna contrary to the modern agricultural techniques that damage them resulting in their direct exposure to predators. Shaikh et al., reported that major threat to nine amphibian species in District Larkana is exposure to predators including *Catla catla*, *Labeo calbasu*, *Osteo barmacatio* and *Ptyas mucosus* [15].

In recent years use of pesticides against pests for increasing crop yield has been a serious hazard for major amphibian populations. As amphibian skin is porous, the impact of pesticide increases manifold thus resulting in massive accumulation in organism's body leading to its death [16]. Fumigation of different poisons for pest control contaminates multiple

Table 1. Distribution of amphibian fauna in Pakistan [3].

Family	Genus	Specie	Common Name	Distribution	Reported by
Bufonidae	Duttaphrynus	<i>Duttaphrynus stomaticus</i>	Indus toad	Throughout Pakistan	Lutkin, 1862
		<i>Duttaphrynus olivaceus</i>	Olive toad	Dasht, West Balochistan	Blanford, 1874
		<i>Duttaphrynus himalayanus</i>	Himalayan toad	Himalayan Range	Gunther, 1864
		<i>Duttaphrynus hazarensis</i>	Hazara toad	District Hazara, KPK, Punjab	Schneider, 1799
	Bufotes	<i>Bufotes latastii</i>	Ladakh toad	Laddakh, Shigar valley	Boulenger, 1882
		<i>Bufotes pseudoraddei</i>	Swat toad	Mingora, Swat, KPK	Mertens, 1971
		<i>Bufotes surdus</i>	Iranian toad	Balochistan	Boulenger, 1891
<i>Bufotes zugmayeri</i>		Baloch toad	Pashin, SE Balochistan	Eiselt and Schmidtler, 1973	
Megophryidae	<i>Scutigera</i>	<i>Scutigera nyingchiensis</i>	Tibetan toad	Deosai, KPK	Fei, 1977
Microhylidae	<i>Microhyla</i>	<i>Microhyla oronata</i>	Ant frog	North Punjab, Murree Hills	Dumeril and Bibron, 1841
	<i>Uperodon</i>	<i>Uperodon systoma</i>	Marble frog	Shakarparian Hills, Islamabad	Schneider, 1799
Dicroglossidae	Allopa	<i>Allopa hazarensis</i>	Hazara frog	Hazara, KPK	Dubois and Khan, 1979
		<i>Allopa barmoachensis</i>	Kashmir frog	Barmoach, Azad Kashmir	Khan and Tasnim, 1989
	<i>Chrysopaa</i>	<i>Chrysopaa sternosignata</i>	Balochistan Karez frog	Quetta, Balochistan	Murray, 1885
	Euphlyctis	<i>Euphlyctis cyanophlyctis</i>	Skittering frog	Throughout Pakistan	Schneider, 1799
		<i>Euphlyctis hexadactylus</i>	Green pond frog	Khuzdar, Kallat, Balochistan	Lesson, 1834
	<i>Fejervarya</i>	<i>Fejervarya syhadrensis</i>	Southern cricket frog	Souh Punjab, Sindh	Annandale, 1919
	<i>Hoplobatrachus</i>	<i>Hoplobatrachus tigerinus</i>	Bull frog	Punjab, Sindh	Daudin, 1802
	<i>Nanorana</i>	<i>Nanorana vicina</i>	Murree frog	Murree, Punjab	Stoliczka, 1872
	<i>Sphaerotheca</i>	<i>Sphaerotheca breviceps</i>	Digging frog	Thattha, Sindh	Schneider, 1799
<i>Sphaerotheca strachani</i>		Pakistan bull frog	Malir, Karachi, Sindh	Murray, 1884	

waterbodies inhabited by tadpoles and adult species. Not only directly, indirect intake of pesticides (ingesting effected prey) also lead to serious complications in anurans in Pakistan.

The rapid infrastructure development including the extended road network with heavy vehicular traffic in both urban and rural areas is becoming a major contributor in anuran population decline in Pakistan. Besides this infrastructure development is also causing habitat defragmentation that may lead to lack of genetic ability of the species to cope up with new environment [13]. Use of both frog and toad species in research work, laboratory experimentation and demonstrations in school, colleges and universities is also a factor that seriously affects local populations [14].

Besides Pakistan, the status of amphibian diversity in China is quite promising. Being world's second largest country, China houses more than 410 species. Major threats to amphibian diversity in China are similar to that of Pakistan [17]. Whereas major threat to amphibian species in India include forest destruction for Jhoom cultivation resulting in habitat loss. With major biodiversity hotspots, 342 amphibian species are thriving in India [18]. In Sri Lanka air pollution leading to acid rain in montane rainforests and tropical lowlands has threatened 65% of the amphibian fauna but in Maldives illegal trade and absence of any specific conservation measures is the principal cause amphibian decline [17].

5. Recommendations

1. Community participation in creating awareness among masses needs to be promoted at all levels.
2. Organizing national and international conferences, symposia and seminars in academic institutions focusing conservation of amphibian fauna.
3. Experienced fieldworkers should collaborate with students both at field areas as well as research centers.
4. New field surveys should be carried out to report current status of amphibian fauna.
5. Genetic barcoding and frozen-tissue bank of all amphibian species for molecular research is urgently needed.
6. Special measures must be taken to control the declining populations of especially Critically Endangered and Endangered species.

6. Conclusion

The data of amphibian species in Pakistan needs to be updated by exploration and application of modern molecular techniques. In this context, identification through DNA barcoding and mitochondrial DNA gene sequencing is a better option for elimination of ambiguity in the taxonomic data of amphibian fauna of Pakistan. As environmental contamination is one of the most pervasive threats to amphibian fauna and poses a serious challenge for humankind to deal with, minimization of the factors resulting in amphibian decline and focus on efforts to ensure the conservation and protection of amphibian fauna is seriously needed. To ensure amphibian conservation in Pakistan, research is needed for the examination of patterns along with evolutionary consequences of contamination, consequences of major contaminant exposure at population level and ways to minimize pollution at national level.

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