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Biodiversity of Amphibians in Pakistan, causes of their decline and their conservation

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Abstract

Objectives: The present study was conducted to review the biodiversity of Amphibians, their decline in population and conservation. **Methods/Statistical analysis:** This study was done by reviewing the previous papers on biodiversity of Amphibians and available literature on various search engines. **Findings:** Species of amphibians estimated worldwide reveals 7481 species consisting of three orders, Salientia (Anura), Urodela (Caudata) and Apoda (Gymnophiona). The Salientia contains 6577, Urodela (Caudata) entail 698 species of both land and aquatic inhabitants and Apoda (Gymnophiona) virtually blind and non-motile animals include 206 species. However, the population of Amphibians is reduced in Pakistan because of dry conditions and is a prominent indicator of climatic change. In Pakistan, the dominating population of Amphibians is Salientia (Anura), consisting of 21 species, 12 genera, and 4 families. Due to anthropogenic activities like the use of pesticides and fertilizers, deforestation, pollution, fragmentation and urbanization affects the amphibians. For conservation and protection, serious initiatives may be mediated to manage the situation. **Application/Improvements:** The present study will be helpful to conserve the diversity of Amphibians in the region and present findings may be useful in future studies.

Keywords: Amphibia; Pakistan; Decline; conservation; Population

1 Introduction

Amphibians are considered to be originated in the period of Devonian but their population dominated in Carboniferous period. This unique group shows a phylogenetic link between water and land forms of life. The evolution of Mammals, Birds and Reptiles occurred from amphibians⁽¹⁾. The Amphibians are distributed throughout the globe comprising about 7481 species. The three orders of Amphibians are Salientia (Anura) Urodela (Caudata) and Apoda (Gymnophiona). The Salientia (Anura) encompasses most of the amphibian species about 6577, Urodela (Caudata) includes 698 species of both land and aquatic inhabitants and Apoda (Gymnophiona)

virtually blind and non-motile animals comprises 206 species⁽²⁻⁵⁾. The total area of Pakistan is 796,096 km² and the region falls in zoo-geographically into Palearctic and Oriental regions⁽⁶⁾. The northern part of Pakistan is at the border of Oriental and Palearctic regions and it is the point where three mountain ranges such as Himalaya, Karakoram, and Hindukush meet. Regardless of these exceptional features amphibian diversity is feebly studied. The climate of Pakistan shows great variation during winter and summer⁽⁷⁾. Amphibian population is deprived in Pakistan, and less widespread because of averagely no to little rainfall, nevertheless, Microhylidae, Ranidae, Bufonidae, and Megophryidae are four families, consisting of 24 species are present at the Indus valley in the west bank of the river, runnel of Himalayan North region, water channel and sub-mountainous regions of western Baluchistan⁽⁸⁾. The southern area of Pakistan is rich in amphibian population; only one species of amphibians was recorded from the northern areas⁽⁹⁾. Four species of a family Bufonidae were observed in different regions of the districts Larkana and Jamshoro⁽¹⁰⁾. Pakistan's amphibians consist of 21 species and 4 families, i.e. Bufonidae, Ranidae, Microhylidae and Megophryidae, initial three were present in Margala Hill National Park⁽¹¹⁾. Amphibian's body temperature regulation depends upon external sources, their food and energy demand is small because of the low metabolic rate⁽¹²⁾. An Amphibian in the diet pyramids have a significant place because their food habits depend on the insects, this in turn controls the population of the insects. These amphibians are used by many predators leading to sifting of nutrients from aquatic to aerial ecosphere⁽¹³⁾. Amphibians have pharmaceutical value, *Rana tigerina* contains antimicrobial protein as well as collagen protein and special lipid components; these components have the capability in amplifying the cell division and differentiation of epidermal and dermal cells to facilitate wound healing naturally. They have other economic, aesthetic and cultural values⁽¹⁴⁾. There is a dearth of information regarding the distribution of most amphibians in most parts of Pakistan because of less consideration by the scientific community⁽¹⁵⁻¹⁷⁾. They have an estimated one-quarter of all classified vertebrates, but their existential threat caused due to hostile conditions because of pollution, habitat loss, deforestation, urbanization and fragmentation⁽¹⁸⁾.

2 Discussion

Genus *Duttaphrynus* (Family Bufonidae) comprises about 5 species. In Pakistan *D. stomaticus* is widely distributed (Lutkin, 1862) in Dasht, the west city of Baluchistan *D. olivaceus* is mainly distributed (Blanford, 1874) in the Himalayan Range which is home to *D. himalayanus* (Gunther, 1864). *D. hazarensis* found in District Hazara, KPK and Punjab. *D. melanostictus* found in Indus valley (Schneider, 1799). Genus *Bufotes* (Family Bufonidae) also contains 4 species such as i) *Bufotes latastii*, found in Ladakh, Shigar Valley (Boulenger, 1882), ii) *Bufotes zugmayeri* found in Pashin, SE Balochistan (Eislet and Schmidtler, 1973) iii) *Bufotes surdus* found in Balochistan (Boulenger, 1891) and iv) *Bufotes pseedooraddei* found in Mingora Sawat and KPK, (family Megophryidae) which contains only one species found in Deosai KPK i.e., *Scutigera nyngchiensis*, (Fei, 1977). In Murree Hills and North Punjab only one species i.e. *Microhyla oronata* of the genus *Microhyla* of *Microhylidae* family is distributed (Dumeril and Bibron, 1841). The Shakarparian Hills and Islamabad are the home to *Uperodon systoma* species of *Uperodon* Genus of *Microhylidae* (Schneider, 1799). The *Allopaa hazarensis* and *Allopaa barmoachensis* belongs to the family *Dicroglossidae* and Genus *Allopaa*. The *Allopaa hazarensis* is distributed in Hazara, KPK, Larkana, Jamshoro, Sindh (Dubois and Khan, 1979) and *Allopaa barmoachensis* found in Barmoach, Azad Kashmir (Khan and Tasnim, 1989). In Quetta, Balochistan, Genus *Chrysopaa* (family *Dicroglossidae*) consisting of *Chrysopaa sternosignata* is found (Murray, 1885). The *Euphlyctis* Genus of *Dicroglossidae* family has two species i.e. *Euphlyctis cyanophlyctis* (Schneider, 1799) and *Euphlyctis hexadactylus*. The *Euphlyctis cyanophlyctis* is found throughout Pakistan and *Euphlyctis hexadactylus* is found in Khuzdar, Kallat, Balochistan (Lesson, 1834). The single species *Fejervarya syhadrensis* belongs to genus *Fejervarya* of *Microhylidae* family is found in South Punjab and Sindh (Annandale, 1919). The *Hoplobatrachus tigerinus* found in Punjab and Sindh (Daudin, 1802) belongs to the genus *Hoplobatrachus* of *Microhylidae* family. The *Nanorana vicina* found in Murree, frog is found in Punjab (Stoliczka, 1872) of genus *Nanorana* which belongs to *Microhylidae* family. The *Sphaerotheca strachani* is present in Sindh, Karachi, Malir Sindh (Murray, 1884) and *Sphaerotheca breviceps* found in Sindh, Thatta (Schneider, 1799) are the species of Genus *Sphaerotheca* which belongs to *Microhylidae* family Table 1⁽¹⁹⁾.

Causes of decline and conservation of Population of amphibians in Pakistan

Amphibians are inhabited in the parts of Pakistan where water is aplenty. By and large, Pakistan is poor in amphibian fauna because of large parched environmental conditions, habitat loss, amphibian chytrid fungi, and common causes are anthropogenic activities such as deforestation (forest decline to 3.8%), industrialization (which dumps chemical waste in water making water unsuitable for amphibian), urbanization (increase in human population closes the living and breeding water bodies of amphibians for constructing buildings), mechanization of agriculture (ploughing of soil by machines or ox-driven killing the amphibians living in holes and crevices), use of pesticides (kills the amphibian population due to decreased insects in the

Table 1. Distribution of amphibian fauna in Pakistan

Specie	Common Name	Distribution	Genus	Family
<i>Duttaphrynus stomaticus</i>	Indus toad	Throughout Pakistan	<i>Duttaphrynus</i>	Bufonidae
<i>Duttaphrynus olivaceus</i>	Olive toad	Dasht, West Balochistan		
<i>Duttaphrynus himalayanus</i>	Himalayan Toad	Himalayan Range	<i>Bufotes</i>	
<i>Duttaphrynus hazarensis</i>	Hazara toad Asian black spined toad	District Hazara, KPK, Punjab		
<i>Bufotes latastii</i>	Ladakh toad	Laddakh, Shigar Valley	<i>Scutigera</i>	
<i>Bufotes pseudoraddei</i>	Swat toad	Mingora, Swat, KPK		
<i>Bufotes surdus</i>	Iranian toad	Balochistan	<i>Microhyla</i>	
<i>Bufotes zugmayeri</i>	Baloch toad	Pashin, SE Balochistan		
<i>Scutigera nyingchiensis</i>	Tibetan toad	Deosai, KPK	<i>Uperodon</i>	
<i>Microhyla oronata</i>	Ant frog	North Punjab, Murree Hills		
<i>Uperodon systoma</i>	Marble frog	Shakarparian Hills, Islamabad	<i>Allopaa</i>	
<i>Allopaa hazarensis</i>	Hazara frog	Hazara, KPK, Sindh Larkana Jamshoro		
<i>Allopaa barmoachensis</i>	Kashmir frog	Barmoach, Azad Kashmir	<i>Chrysopaa</i>	
<i>Chrysopaa sternosignata</i>	Balochistan Karez frog	Quetta, Balochistan		
<i>Euphlyctis cyanophlyctis</i>	Skittering frog	Throughout Pakistan	<i>Euphlyctis</i>	
<i>Euphlyctis hexadactylus</i>	Green pond frog	Khuzdar, Kallat, Balochistan		
<i>Fejervarya sayhadrensis</i>	Southern cricket frog	South Punjab, Sindh Indus Valley	<i>Hoplobatrachus</i>	
<i>Hoplobatrachus tigerinus</i>	Bull frog	Punjab, Sindh Larkana Jamshoro, Indus valley		
<i>Nanorana vicina</i>	Murree frog	Murree, Punjab	<i>Sphaerotheca</i>	
<i>Sphaerotheca breviceps</i>	Digging frog	Thatta, Sindh		
<i>Sphaerotheca strachani</i>	Pakistan bull Frog	Malir, Karachi, Sindh		

food-chain) fumigation of granaries, casualties on road (amphibians are squashed by vehicles when they cross roads to reach their propagation sites), fragmentation by constructing roads and use in scientific experimentation and wide use of *Hoplobatrachus tigerinus* species as an example for the illustration of vertebrate anatomy decreasing the population of beautiful Indus plains amphibians, and the other concerned phenomena as well⁽²⁰⁾. Although none of the species of amphibians is taken for edible purpose in any Pakistani culture⁽²¹⁾. However, some ecosystems support more Amphibians than birds and mammals, because of the good use of energy^(22,23). Not only the scientific community but media also takes into account the decline rate of amphibians causing worry^(24,25) as shown in [Figure 1](#).

Recommendations

1. Look, listen and learn; educate yourself and your family about amphibians.
2. Society's contribution to bringing attentiveness is needed to advance at all levels.
3. Arrange seminar and symposia, domestic and global conferences in educational centers.
4. Plan the conservation activities to revive and protect the population of amphibians.
5. Create an amphibian friendly environment by providing clean water, habitat and the insects that are part of the amphibian food chain.
6. Do not pollute their habitat.
7. Reduce the use of fossil fuels, fertilizers and pesticides.
8. Creation of road free wetlands and the large swampy region as the amphibians dwell all over the plains of Pakistan.

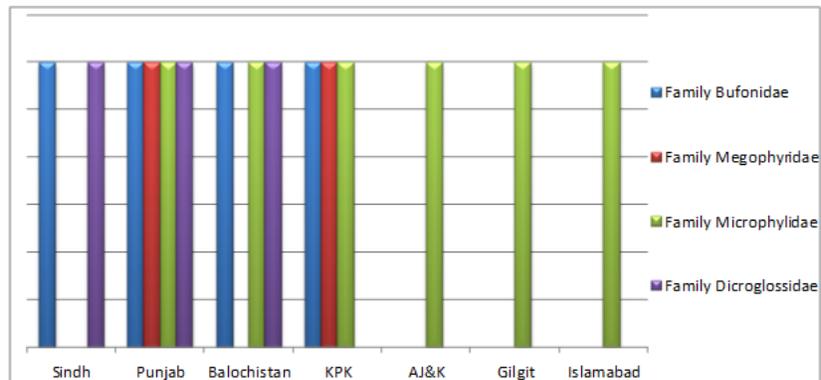


Fig 1. Distribution of Amphibia throughout Pakistan

Where roads currently go across potential breeding sites, construction of underpass or ‘frog ways’ will considerably reduce amphibian road slaughter.

9. Use legislative regulation to protect amphibian population
10. A comparison study of a single gene and comparative tissue studies of different species of amphibians.
11. Create biopark and Children Park displaying the amphibians in conducive environment.
12. Create genetic pool in conserving the endangered species.
13. Promote virtual Laboratory learning instead of live-specimen dissection in zoology practical classes.
14. Conduct field trips to promote awareness of the amphibian population among student learners at school and college level.
15. Create awareness camps among farmers to impart the role of amphibians as natural pest controlling agents.

3 Conclusion

By and large, Pakistan is poorer in amphibian fauna because of increasing parched environmental conditions due to pollution, deforestation, habitat loss, fragmentation and urbanization. Compiling information regarding the amphibian fauna of Pakistan requires special attention. Government should initiate project studies and GIS-based barcoding of the indigenous species. Pakistan has its population dependent on agriculture involving farming and ploughing causing injuries and death of amphibian and reptile fauna.

Due to lack of knowledge, there is a constant threat to amphibian species due to use of fertilizers and in agriculture. So for saving and securing the life of amphibians and reptiles, the effective measures of awareness must be taken by the interest of scientists, government organizations, law enforcement agencies and local communities as well.

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References

- 1) F D, Grant J, Faivovich RH, Bain A, Haas FB, Haddad O, et al. The Amphibian Tree of Life. *Bulletin of the American Museum of Natural History*. 2006; (279):1–291.
- 2) Boulenger GA. 1980. Available from: https://en.wikipedia.org/wiki/The_Fauna_of_British_India,_Including_Ceylon_and_Burma.
- 3) Ms, British SFO, India. *Including Ceylon and Burma Reptile and Amphibia*. 1943; (1).
- 4) Smith WR, of Minto MC. India, Minto, and Morley, 1905-1910. *The American Historical Review*. 1935; 41(1):147–147. Available from: <https://dx.doi.org/10.2307/1839379>; doi:10.2307/1839379.
- 5) British MASFO, India. *Including Ceylon and Burma Reptile and Amphibia*. 1931; (1):85–85.
- 6) Duellman WE. The pattern of distribution of Amphibian. Baltimore. Johns Hopkin University Press. 1999. Available from: <https://www.google.com/search?q=1.+Duellman+WE.+The+pattern+of+distribution+of+Amphibian.+Johns+Hopkin+University+Press%2C+Baltimore%2C+M.D.+1999.&dq=1>.
- 7) Khan MS. Herpetology of habitat types of Pakistan. *Pakistan Journal of Zoology*. 1201; (31):275–289.

- 8) Khan MS. Herpetology of Pakistan Part 1-Frog. *Nia Zamana Publication*. 2011; (1).
- 9) Crittini AGF, Casiraghi M, Padoa-Schioppa E. New data on Amphibian and Reptiles of the northern area of Pakistan: distribution, genetic variability, and conservation issue. *North-Western Journal of Zoology*. 2010; (6):1–12.
- 10) Guchal KS, Shaikh GS, Qadri MY, H. Diversity, morphology, distribution and Population of amphibian fauna in district Jamshoro and Larkana Sindh-Pakistan. *Journal of Entomology and Zoology studies*. 2015; 3(3):475–479.
- 11) Mansoor R. An annotated checklist of Amphibians and Reptiles of Margalla Hill National Park. *Pakistan Journal of Zoology*. 2011; 43(6):20–522.
- 12) Zug GR, Vitt LJ. Academic Press. 2001. Available from: <https://books.google.es/books?id=qdpxsIPm8kkC>.
- 13) Fazey I, Cooper R, Hyde T, Deri A, Hughes L, Bush G, et al. An evaluation of economic and noneconomic techniques for assessing the importance of biodiversity to people in developing countries. Report to the Department for Environment, Food and Rural Affairs. London, UK.. 2008. Available from: <https://esanalysis.colmex.mx/Sorted%20Papers/2012/2012%20GBR%20-Biodiv%20Econ%202.pdf>.
- 14) Sarwar MK, Malik MF, Hussain M, Azam I, Iqbal W, Ashiq U. Distribution and current status of amphibian fauna of Pakistan: A review. *Electronic Journal of Biology*. 2016; 12(3):243–246.
- 15) Khan MS. A new toad of genus Bufo from the foot of Siachen Glacier, Baltistan, northeastern Pakistan. *Pakistan Journal of Zoology*. 1997; 29:43–48.
- 16) Anuradha S, Khan MY. Peripapillary subretinal neovascular complex complicating papillitis. *Eye*. 1999; 13(1):112–113. doi:10.1038/eye.1999.22.
- 17) Khan MS. Amphibians and Reptiles of Pakistan. Malabar, Florida. Krieger Publishing Company. 2006. Available from: <http://muhammadskhan.wildlifeofpakistan.com/publications.htm>.
- 18) Petrov BP. Petrov the herpetofauna (Amphibia and Reptilians) of the Eastern Rhodopes (Bulgaria and Greece). 2004 p. 863–879.
- 19) Mk S, Malik MF, Hussain M, Azam I, Iqbal W, Ashiq U. Distribution and current status of amphibian fauna of Pakistan: A review. *Electronic Journal of Biology*. 2016; 12(3):243–246.
- 20) Ms, Khan. A Checklist and Key to the Amphibia of Pakistan. *Bullerit Chicago Herpetological Society*. 2002; 37(9):163–163.
- 21) Khan MS. The impact of human activities on the status and distribution of amphibians in Pakistan. *Hamadryad*. 1990; (15).
- 22) Fh. Pough the advantages of ectotherm for tetrapod. *The American Naturalist*. 1980; (115):92–112.
- 23) Wyman RL. Experimental assessment of salamanders as predators of detrital food webs: effects on invertebrates, decomposition and the carbon cycle. *Biodiversity and Conservation*. 1998; (7):641–650.
- 24) Gibbons PW, Stangel JW. Savannah River Eco, laboratory. Herpetology Outreach Publication # 2. In: Proceedings of the partners in amphibians and conservation (PARC) Conference. 1999 .
- 25) Collins JP. Storfer Global amphibian declines: sorting the hypotheses. *Diversity and Distributions*. 2003; 9:89–98.