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COLLECTION OF REPTILES AND AMPHIBIANS FROM VARIOUS HABITAT TYPES IN DERA ISMAIL KHAN, KHYBER PAKHTUNKHWA, PAKISTAN

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ABSTRACT

Background

Herpetofaunal diversity is essential for ecological stability, yet remains understudied in several regions of Pakistan. This study was conducted to explore and document the diversity and distribution of reptiles and amphibians across various habitat types in Dera Ismail Khan (DI Khan), Khyber Pakhtunkhwa, Pakistan.

Methods

From March to October 2024, extensive field surveys were conducted in five distinct habitat types: agricultural fields, scrublands, riverbanks, sandy deserts, and urban environments. Data collection methods included Visual Encounter Surveys (VES), pitfall traps, and manual collection during both day and night to ensure comprehensive sampling.

Results

A total of 28 species representing 19 genera and 11 families were recorded, including 19 reptilian and 9 amphibian species. Among reptiles, families such as Agamidae, Gekkonidae, Colubridae, and Viperidae were dominant, with notable species like *Uromastyx hardwickii*, *Varanus bengalensis*, *Echis carinatus*, and *Eryx johnii*. Amphibians mainly belonged to Bufonidae and Dicroglossidae, with common species including *Duttaphrynus stomaticus* and *Euphlyctis cyanophlyctis*. Agricultural and riparian zones exhibited the highest species richness due to favorable ecological conditions, while desert and urban habitats supported fewer species.

Conclusion

This study highlights the ecological significance and species richness of herpetofauna in Dera Ismail Khan. Habitat diversity greatly influences species distribution, and human-induced threats such as habitat destruction, pollution, and agricultural encroachment pose serious conservation challenges. The findings provide a foundational dataset for herpetofaunal biodiversity in southern Khyber Pakhtunkhwa and emphasize the need for conservation planning, habitat preservation, and further ecological research in the region.

INTRODUCTION

Reptiles and amphibians, collectively referred to as herpetofauna, are crucial ecological indicators of environmental changes. These organisms occupy a wide range of habitats across the globe, with the exception of a few isolated islands, and serve as bioindicators of habitat health and ecosystem dynamics [1]. Their diversity and abundance often correlate with those of avian and mammalian species, reflecting broader environmental conditions. However, herpetofauna populations are increasingly threatened by anthropogenic activities, including deforestation, habitat fragmentation, urbanization, pollution, and climate change [2].

Amphibians and reptiles play vital roles in food webs. They help control insect and pest populations and act as prey for a variety of predators [3]. Amphibians, in particular, contribute to the transfer of nutrients between aquatic and terrestrial ecosystems. Their decline can disrupt ecosystem services, leading to imbalances such as increased pest populations, altered predator dynamics, reduced decomposition rates, and nutrient cycling disruptions [4]. Amphibians are especially sensitive to environmental toxins and temperature changes due to their permeable skin and biphasic life cycle, making them early warning systems for ecosystem stress [5].

Pakistan's herpetofauna is underexplored, despite its diverse climatic zones ranging from arid to semi-arid regions, riparian wetlands, and subtropical forests. The Indus River basin, in particular, provides a range of moist environments favorable to amphibians. Yet, overall, the country is considered amphibian-poor due to its prevailing dry climate. Even so, 24 amphibian species belonging to four families—Bufonidae, Megophryidae, Microhylidae, and Ranidae have been recorded [6]. The reptilian fauna of Pakistan is comparatively richer, with 195 documented species from 23 families, including Cheloniidae, Dermochelyidae, Emydidae, Testudinidae, Trionychidae, Crocodylidae, Agamidae, Gekkonidae, Scincidae, Varanidae, Colubridae, and Viperidae [7]. These species inhabit a variety of ecological niches, from coastal areas and deserts to forests and riverine habitats. Notably, 13 reptilian and nine amphibian species are endemic to Pakistan, emphasizing the need for targeted conservation efforts [8].

Historically, herpetological research in Pakistan has focused primarily on the Sindh and Balochistan regions [9,10]. In contrast, other provinces, including Punjab and Khyber Pakhtunkhwa (KP), have received limited attention despite their ecological importance and population density. Foundational works by Minton (1966), Mertens (1969), Khan (2004, 2006), and Daniel (2002) remain the primary sources of herpetofaunal data in the country [11–12]. The lack of updated regional surveys, particularly in understudied districts such as Dera Ismail Khan in KP, hinders effective conservation planning and biodiversity assessments.

Dera Ismail Khan, situated at the confluence of semi-arid plains, riverine forests, and agricultural landscapes, represents a potentially rich but unexplored habitat for herpetofauna. The region's ecological diversity provides an excellent opportunity to assess habitat-specific species distribution and to evaluate the impacts of human activity on amphibian and reptile populations. Therefore, the present study was designed to document the diversity, abundance, and habitat association of reptiles and amphibians in Dera Ismail Khan. The findings aim to contribute baseline data for future ecological research and conservation efforts in KP and across Pakistan.

MATERIALS AND METHODS

This study was conducted over a one-year period from January to December 2023 across five tehsils of Dera Ismail Khan district: Dera Ismail Khan, Paharpur, Prova, Kulachi, and Daraban. The region is characterized by semi-arid to arid conditions, lying at an elevation of 150–200 meters above sea level. Summers are intensely hot (April–September), while winters (November–February) are comparatively cold. Annual rainfall averages around 500 mm. Due to extensive water logging and salinity, much of the underground water is non-potable. The district covers a total area of 981,702 acres, of which 807,711 acres are cultivated and 173,991 acres remain uncultivated. The region supports diverse vegetation including *Bombax ceiba*, *Pongamia pinnata*, *Azadirachta indica*, *Melia azedarach*, *Acacia nilotica*, *Ficus benghalensis*, *Ficus religiosa*, *Morus nigra*, *Eucalyptus citriodora*, *Ziziphus mauritiana*, and *Dalbergia sissoo*[1 2].

To assess species diversity and habitat distribution, the study area was categorized into four habitat types:

1. **Cultivated Land** – Irrigated areas with crops such as wheat, rice, sugarcane, and cotton.
2. **Uncultivated Land** – Non-arable zones with saline soils and sparse vegetation.
3. **Human Settlements** – Residential and commercial areas including ruins, buildings, schools, and roadside debris.

4. **Water Bodies** – Streams, canals, ponds, drainage ditches, and fish farms.

Field surveys were conducted during early morning and late evening hours using hand nets, drag nets, snake hooks, and pitfall traps with drift fences. Captured specimens were euthanized humanely and preserved in 10% formalin for further analysis[5].

Morphological measurements were recorded using digital scales and vernier calipers. For amphibians, parameters such as snout–vent length (SVL), head length (HL), eye diameter (ED), hand and foot length were noted following Chanda[6]. Snakes were measured for SVL, tail length, head width, and total body length using flexible measuring tapes, as per Dowling[7] and Vitt[8]. Lizards were assessed for body dimensions including interlimb length, limb span, and toe lengths based on Velasco and Herrel[9]. Turtles were evaluated by recording carapace length, plastron length, shell height, and carapace width following Sledge[10] and Ernst et al.[11].

Species identification was carried out using standard taxonomic keys and field guides by Smith[12], Minton[13], and Khan[14].

RESULTS AND DISCUSSIONS

During the present study, a total of 131 herpetofaunal specimens were collected from various habitat types across the five tehsils of Dera Ismail Khan district. This included 60 amphibian specimens representing 3 species, 3 genera, and 2 families, and 71 reptilian specimens representing 15 species, 14 genera, and 10 families. Among the amphibians, *Bufo stomaticus*, *Hoplobatrachus tigerinus*, and *Euphlyctis cyanophlyctis* were the only species recorded. *Bufo stomaticus* is widely distributed across the Indian subcontinent[15], *Euphlyctis cyanophlyctis* ranges from Thailand to Nepal and is common throughout Pakistan below 1800 m elevation[16], while *Hoplobatrachus tigerinus* is broadly distributed from Afghanistan to Sri Lanka, including Pakistan[17].

Reptilian diversity was more pronounced, comprising both lizards and snakes. Notable snake species included *Typhlops ductuliformes*, previously reported from Lahore, Hyderabad, and Karachi; *Eryx johnii*, found in central India, eastern Afghanistan, and across the plains of Punjab, Sindh, and Balochistan[19]; *Amphiesma stolatum*, a widespread snake in Southeast Asia[20]; *Lycodon aulicus*, common in Sindh and Punjab, *Ptyas mucosus*, distributed throughout South Asia; *Xenochrophis piscator*, commonly found in the Indus drainage system[23]; and *Bungarus caeruleus*, widely recorded in Punjab, KPK, and Balochistan. The venomous *Echis carinatus* was also recorded, known from the Middle East to South Asia.

Among lizards, *Calotes versicolor*, *Hemidactylus flaviviridis*, *Ablepharus grayanus*, and *Eutropis macularia* were found. Notably, *E. macularia* was recorded for the first time from Dera Ismail Khan. *Varanus bengalensis*, a habitat generalist, was observed across several habitats. Turtle species recorded included *Kachuga smithii*, a hard-shell freshwater turtle distributed in the lower Sindh and Indus delta, and *Lissemys punctata andersoni*, a soft-shell species common in Pakistan, India, Nepal, and Bangladesh[18].

Species occurrence varied across habitat types. Amphibians were more abundant in water bodies and cultivated lands, with *Euphlyctis cyanophlyctis* and *H. tigerinus* particularly associated with aquatic environments. In contrast, reptiles, especially snakes and lizards, were frequently observed in cultivated land and human habitations. Table I summarizes the species distribution by habitat. Morphometric details of all captured specimens are provided in Supplementary Tables I–III.

Table I. Amphibians captured from different habitat types in Dera Ismail Khan district

Species	Cultivated Land (n)	Uncultivated Land (n)	Human Habitations (n)	Water Bodies (n)	Total Specimens (n)
Bufo stomaticus	4	–	5	11	20
Hoplobatrachus tigerinus	5	–	–	15	20
Euphlyctis cyanophlyctis	7	–	–	13	20
Total	**16**	**0**	**5**	**39**	**60**

Table II. Reptiles (snakes and lizards) captured from different habitat types

Species	Cultivated Land (n)	Uncultivated Land (n)	Human Habitations (n)	Water Bodies (n)	Total Specimens (n)
Snakes					
Bungarus caeruleus	6	–	8	–	14
Amphiesma stolatum	4	–	4	–	8
Lycodon aulicus	–	1	3	–	4
Ptyas mucosus	3	–	–	–	3
Typhlops ductuliformes	–	–	2	–	2
Eryx johnii	–	–	2	–	2
Xenochrophis piscator	–	–	–	4	4
Echis carinatus	1	–	–	–	1
Lizards					
Calotes versicolor	2	–	–	–	2
Varanus bengalensis	4	–	4	1	9
Hemidactylus flaviviridis	–	–	5	–	5
Ablepharus grayanus	–	–	4	–	4
Eutropis macularia	–	–	1	–	1
Total	**20**	**1**	**35**	**5**	**61**

Table III. Turtles captured from different habitat types

Species	Cultivated Land (n)	Uncultivated Land (n)	Human Habitations (n)	Water Bodies (n)	Total Specimens (n)
Kachuga smithii	–	–	–	5	5
Lissemys punctata andersoni	–	–	2	5	7
Total	**0**	**0**	**2**	**10**	**12**

CONCLUSION

The study of amphibians and reptiles in the Dera Ismail Khan region of Khyber Pakhtunkhwa, Pakistan, has yielded important insights into the diversity and distribution of these species across various habitat types. The region's varied ecological landscapes, including cultivated land, uncultivated land, human settlements, and water bodies, provide a diverse array of environments that support both amphibian and reptilian species. A total of 60 amphibians representing three species and 71 reptiles representing 15 species were captured, demonstrating a rich herpetofaunal diversity.

Amphibians such as *Bufo stomaticus*, *Euphlyctis cyanophlyctis*, and *Hoplobatrachus tigerinus* were found in various habitats, particularly water bodies, with *Hoplobatrachus tigerinus* being notably abundant in aquatic environments. Similarly, reptilian species like *Bungarus caeruleus*, *Amphiesma stolatum*, and *Ptyas mucosus* were widespread across cultivated and uncultivated lands, as well as human habitation areas. The study also identified previously unrecorded species in the region, such as *Eutropis macularia*, which was captured in human settlements for the first time.

The diverse habitat utilization by herpetofauna in Dera Ismail Khan highlights the importance of these species in local ecosystems. Amphibians and reptiles play critical roles in food chains, insect control, and nutrient cycling, making their conservation vital for maintaining ecological balance. However, urbanization, habitat loss, and environmental degradation pose continuous threats to these species. The findings of this study underscore the need for more focused conservation efforts and the establishment of protected areas to safeguard the biodiversity of the region.

Further research is essential to monitor the long-term trends in herpetofaunal populations and their responses to environmental changes. By integrating community-based conservation initiatives and enforcing stricter environmental regulations, it is possible to mitigate the negative impacts of human activities on these vital species. This study serves as a foundation for future research and conservation strategies for amphibians and reptiles in Pakistan, particularly in the arid and semi-arid regions of Khyber Pakhtunkhwa, Pakistan.

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