

## Assessment of habitats and conservation status of Amphibians in Sindh, Pakistan

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### ABSTRACT

Some interior areas of Sindh are poorly studied previously which are considered as main sites for present investigation. For the study of ignored amphibian fauna, we conducted a survey to observe the environmental condition of amphibian habitats. The physical characteristics of habitat such as types of vegetation and presence of predators were observed, while water samples were collected from all aquatic habitats for analysis of parameters *i.e.* pH, electric conductivity, total dissolved solids, total hardness, chloride, sulphate, phosphate, nitrite and nitrate as well as carbon dioxide. All the habitats were analyzed thoroughly and designated as highly contaminated and unfavorable especially for spawns and larvae and their conservation status was found entirely deteriorated, though abundance of vegetation was observed alongwith availability of potential predators.

Figure : 00

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KEY WORDS : Amphibians, Habitats, Pakistan, Pollution, Predators, Sindh, Threats.

### Introduction

Amphibians are amongst most neglected animals in Pakistan. Their ecology and conservation status have been abandoned so far, hence amphibians are found dealing with numerous threats that affect their diversity highly and decrease their population rapidly. Meanwhile, taxonomic status of amphibians in Pakistan is of great concern due to morphological variation. Sindh (province of Pakistan) is one of the most important abodes of amphibians as there are numerous natural wetlands and agricultural fields where lots of vegetation offers them abundance of food and shelter.

The pattern of distribution of amphibians varies on the basis of their ecology. Their distribution and abundance also vary even in adjacent areas that share same border<sup>14</sup>. It is prominently established that amphibian decline is rapid in the areas where pollution is high. Pollution in aquatic habitats affects growth and physiological development depends on the quality of their aquatic ambient<sup>2</sup>.

Because of their economic importance in ecosystem, pharmaceuticals, trade, *etc.*, amphibians have gained much importance for their problematic status worldwide since past two decades. It is evident that the ecological problems destroy habitats of wild animals especially due to anthropogenic activities and lack of interest of wildlife agencies<sup>5</sup>. Their decline indicates

problematic status of natural processes because amphibians are highly sensitive to environmental changes<sup>12</sup>.

Considering the threatened status of amphibian fauna and their habitats, present study was proposed to explore diverse forms of amphibians with deep concentration on their systematic status based on morphological variation. This study was mainly focused on divulging into problems that amphibians face and revealing their status as protected or unprotected. Furthermore, this study was carried out to bring a novel, distinguished and comprehensive knowledge about amphibians of Pakistan.

### Material and Methods

Sindh province offers different types of habitats to different group of animals. Amphibians are special group of vertebrates that have adapted to survive in many different types of habitats. The study sites, their geographical area, Global positioning System (GPS) and types of habitat are detailed (Table-1).

The physical characteristics of each study site were observed, while gross water samples were collected from aquatic habitats in stoppered polyethylene plastic bottles which were analyzed by following systematic and scientific methods<sup>1,15</sup>. pH was analyzed using pH meter (Orion, 420), however electric conductivity (EC) and total dissolved solids (TDS) were evaluated using conductivity

**TABLE-1 : Locations, their geographical area, coordinates and types of amphibian habitats**

Location	Area (2 <sup>km</sup> )	GPS coordinates	Types of habitats
Badin	6,726	24°40'N 69°00'E	Ponds, marshes, bogs
Dadu	19,070	26°20'N 67°35'E	Ponds, marshes, bogs, springs, rough grassland
Ghotki	6975	27°49'N 69°39'E	Ponds
Hyderabad	3,198	25°15'N 68°45'E	River, Ponds, marshes, springs
Jamshoro	11,517	25.43212°N 68.263171°E	Bogs, River, Ponds, marshes, springs
Jacobabad	5278	28°16'48"N 68°25'48"E	Ponds
Kashmor	2592	28°26'00"N 69°35'06"E	Ponds, shrub land, marshes, bogs, springs, rough grassland
Larkana	7423	27°33'36"N 68°13'35"E	Lakes, river, ponds, bogs, heathland
Matiari	3035.142	25°36'00"N 68°26'24"E	Ponds
Mirpurkas	2991	25°33'02"N 69°00'11"E	Shrub land, heathland, rough grassland, Ponds, marshes, bogs
Naushahro Feroze	2,945	26.8463° N, 68.1253° E	Ponds, marshes, shrub land, scrub land
Qambar Shahdad kot	5,599	27.5859° N, 68.0060° E	Lakes, streams, ponds, meadows, scrubland, shrub land, springs
Shaheed Benazirabad	4,502	26°35'N 68°10'E	Ponds, shrub land
Shikarpur	2512	28°00'N 68°40'E	Ponds, shrub land, bogs
Sukkur	5165	27°40'N 69°30'E	Ponds, shrubland
Tharparkar	19,638	24°44'24"N 69°48'00"E	Desert, shrub land, scrub land
Thatta	7,705	24.7475° N, 67.9106° E	Lakes, streams, ponds, springs, shrub land, scrubland

meter (Orion 115). Titration procedures were adopted for analysis of total hardness (T-Hard), total alkalinity (T-Alk), chloride (Cl) and carbon dioxide (CO<sub>2</sub>). Ultra-violet spectrophotometer (Hitachi 200) was used for analysis of sulphate (SO<sub>4</sub>), phosphate (PO<sub>4</sub>), nitrite (NO<sub>2</sub>) and nitrate (NO<sub>3</sub>). Status of amphibian habitats was identified

via scientifically approved water quality criteria<sup>10</sup>.

### Results and Discussion

Decline in amphibian diversity and their reduced population are issues of great concern worldwide. Amphibians are considered to have undergone decline

significantly since 1950. It is estimated that there are about more than one third threatened species of class Amphibia and over one hundred and twenty species have declined so far. Water pollution is a main reason of amphibian decline and mortality<sup>6</sup>. Dreadful ecological changes affect amphibians considerably and are greatly considered as a major reason for the decline of amphibians in most regions of the world. Existence of predators may also lessen the population of amphibians and may lead them towards mortality. Predators mainly feed on tadpoles and even adult amphibians which eventually become food of potential predators<sup>13</sup>.

Present study found amphibians living in different habitats such as bogs, grassland, lakes, marshes, ponds, rivers, scrub land, springs, streams, swamps. Among so many types of habitats, ponds especially in agricultural areas were found having abundant population of amphibians. Vegetation present in premises of amphibian habitat in Sindh included *Salvadora oleoides* (Khabar), *Prosopis cineraria* (Kandi), *Tamarix dioica* (Laya), *Tamarix aphylla* (Lai), *Typha latifolia* (Pan), *Typhae lephantiana* (Elephant grass), *Typhado mingensis* (Cattail), *Phragmites karka* (Common Reed), *Ipomoea aquatic* (Leaf vegetable) and *Salvinia molesta* (kariba weed).

All ranids including *Hoplobatrachus tigerinus*, *Euphyctis cyanophlyctis* and *Allopa hazarensis* were observed dwelling near aquatic bodies, whereas *Duttaphrynus stomaticus* was mostly found in dry habitats especially in desert area of Thar. Amphibians were found settled near terrestrial area for the vegetation appropriate for the concerned species.

A Habitat is an ecological or environmental area that is inhabited by a particular Species of Animal, Plant or other type of organism. Ecological condition of study area was determined as unstable for amphibians due to presence of potential predators. Amphibians preyed by predators in aquatic environment include *Anastomus oscitans* (asianopenbill), *Catla catla* (Thaili), *Ciconia ciconia* (whilstestrok), *Ciconia nigra* (black stork), *Labeo rohita* (Rohu), *Labeo calbas* (Dahi), *(Osteo barmacatio* (Makhni), *Puntius ticto* (Popri), *Cirrhinus mirgala* (Morakhi), *Psammophi sleithi* (Ribbon snake), *Ptyas mucosus* (Common rate snake), and *Typhlopes porrects* (Slender blind snake). Terrestrial predators of amphibians include: *Corvus splendens* (house crow), *Python Molurus* (Indian Python), *Naja naja* (Indian or Spectacled Cobra), *Echis carinatus* (Saw Scaled Viper or Carpet Viper), *Vipera russelli* (Russell's viper), *Bungares caeruleus* (Indian or Sind Krait), *Lutra lutra* (Eurasian or common otter).

Water quality of amphibian habitats was analyzed

**TABLE-2 : Analytical study of amphibian habitats in Sindh, Pakistan**

Parameters	Value
pH	7.8±0.7
ECiS cm <sup>-1</sup>	2559.4±1087.0
TDS mg L <sup>-1</sup>	1759.6±677.1
T-Hard mg L <sup>-1</sup>	1759.6±677.1
T-Alk mg L <sup>-1</sup>	1759.6±677.1
Cl mg L <sup>-1</sup>	447.9±120.7
CO <sub>2</sub> mg L <sup>-1</sup>	8.6±4.0
SO <sub>4</sub> mg L <sup>-1</sup>	475.6±162.0
PO <sub>4</sub> mg L <sup>-1</sup>	475.6±162.0
NO <sub>2</sub> mg L <sup>-1</sup>	5.7±3.5
NO <sub>3</sub> mg L <sup>-1</sup>	8.6±4.0

(Table-2).

Study of physico-chemical parameters showed an unstable condition of amphibian habitats. Values of almost all parameters except pH and CO<sub>2</sub> were extremely higher than recommended levels. Hydrogen ion concentration indicated by pH (6.5-9.2) and carbon dioxide value (12.0-26.0 mg L<sup>-1</sup>) were within normal limit<sup>7</sup>. Meanwhile value of EC (1180.5-4769.0iS cm<sup>-1</sup>) was entirely above the recommended limit (150.0-500.0 is/cm). EC shows presence of dissolved electrolytes in form of total dissolved solids and total hardness that conduct heat efficiently across the water<sup>8,9</sup>. In this context, concentration of TDS and T. Hard were also as high as 788.8-3280.5 mg L<sup>-1</sup> and 200.5-960.3 mg L<sup>-1</sup> respectively. Total alkalinity consists of Total Dissolved Solids (TDS) and total concentration of bases and in water. It plays significant role in resisting changes in pH and its value into amphibian habitats was found from 175.2 to 470.0 mg L<sup>-1</sup> regarded as dreadful especially for eggs and larvae<sup>10</sup>. Cl concentration (200.2-690.2 mg L<sup>-1</sup>) was also beyond favorable limit alike sulphate that was measured within 200.8 mg L<sup>-1</sup> to 817.9 mg L<sup>-1</sup>, considered as extremely above the normal level which is strongly

recommended to be maintained within 50-100 mg/L for survival of aquatic animals<sup>10</sup>. Other non-metallic parameter "PO<sub>4</sub>" was analyzed to occur in habitats from 200.0 to 673.5 mg L<sup>-1</sup> that also did not meet the standard criteria for water quality for amphibians<sup>16</sup>. Minimum and maximum values of NO<sub>2</sub> and NO<sub>3</sub> were evaluated respectively within 0.9-19.5 mg L<sup>-1</sup> and 1.3-20.6 mg L<sup>-1</sup>.

Concentration of physico-chemical parameters make water either safe or hazardous according to their levels. High EC, TDS and T. Hard are harmful for spawns and tadpoles of amphibians that can be severally damaged<sup>9</sup>. The eggs and larvae and juveniles also appear to be very sensitive to high EC and TDS levels which can gradually kill them through desiccation or dehydration<sup>8</sup>. Exceeded level of T-Hard may also cause negative impacts on physiological functions of amphibians<sup>17</sup>. The eggs and larvae also appear to be very sensitive to too high or too low alkalinity that leads to failure to resist changes in pH<sup>14</sup>. Range of T. Alk was recorded from 145.5 to 537 mg, whereas Cl was dissolved in habitats from 175.3 to 745.1 mg. High quantity of Cl is also toxic to amphibians as it threatens the health, survival, growth, and reproduction mainly by damaging their osmoregulation. SO<sub>4</sub> and PO<sub>4</sub> are also very influential parameters as they equally increase the eutrophication and increase population of algae that creates oxygen shortage for all the aquatic animals inhabiting same water

body<sup>3</sup>. Sindh offered amphibian habitats consisting of 200-817.9 mg/l of SO<sub>4</sub> and 150.8-800 mg of PO<sub>4</sub>. Nitrogen fertilizers may also contribute to pollute water of amphibian habitats. Value of NO<sub>2</sub> 0.1-19.5 MG/L and NO<sub>3</sub> 1.0 to 20.6 mg/l may induce behavioral and morphologic changes into them<sup>3</sup>.

High values of analyzed physico-chemical parameters may occur as a result of atmospheric deposition, surface and ground water runoff or biological degradation of organic matter. Therefore throw of unhygienic things such as garbage, plastic bottles and excessive use of toxic fertilizers, insecticides, pesticides and herbicides should be avoided to keep water bodies clean especially of those areas where wild animals inhabit.

### Conclusion

Amphibians face major threats in form of habitat destruction, potential predators and water pollution in the study area. Environmental factors have altogether deteriorated the amphibian diversity and have limited their distribution and population density in Sindh province. Sindh offers one of the most important abodes to wildlife, where there is no conservation activity witnessed for saving amphibian fauna. Therefore, it is very important to take efforts to save habitats especially from pollution and human encroachment.

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