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## A study of habitats for amphibians in district Larkana, Sindh-Pakistan

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### Abstract

An analytical study was conducted for analyzing some parameters i.e. electric conductivity (EC), total dissolved solids (TDS) and total hardness (T-Hard) from amphibian habitats at District Larkana. The study conducted from March to October for three years (2011-2013) recorded all 26 amphibian habitats consisting of unfavorable values of studied parameters. The value of EC was recorded as 1180.5-7472.6 uS/cm, while concentration of TDS and T-Hard was analyzed as 788.8-4309.2 mg/L and 200.5-980.7 mg/L respectively. Maximum upsurge in value of studied parameters was recorded during breeding and hatching period of animals in question. This deplorable condition of aquatic habitats may induce negative effects on growth and development of amphibian populations of the study area and may also cause decline in their population status.

**Keywords:** Amphibians, habitats, water quality analysis, district Larkana, Pakistan

### Introduction

Physico-chemical parameters influence quality of water according to their concentration and effect inhabitants (aquatic animals) <sup>[1]</sup>. Study of physico-chemical parameters shows the rate of pollution; hence aquatic habitats need to be regularly checked through study of physico-chemical parameters for the conservation of socio-economically valuable amphibians. Peptides in skin of amphibian species have defensive mechanism with bioactivity such as vasorelaxin that help vascular tissues of human body to relax normally <sup>[2]</sup>. Many frog species are investigated and determined to possess antihistaminic capacity also <sup>[3]</sup>.

Electric conductivity (EC) shows concentration of all the electrolytes which are responsible for conducting heat or electricity across the water. Meanwhile, test of total dissolved solids (TDS) specifies the concentration of a broad range of chemical contaminants or impurities <sup>[4]</sup>. Most common chemical constituents of TDS are calcium, phosphate, nitrates, sodium, potassium and chloride. Calcium and magnesium are also main source for making water hard but total hardness (T-Hard) also shows concentration of various divalent salts including iron and zinc etc. <sup>[5]</sup>. Impact of these parameters (EC, TDS and T-Hard) has previously been studied and proved to effect amphibians badly <sup>[6]</sup>. Seasonal variation in value of physico-chemical parameters is of great importance as it causes either too few or too much concentration of certain parameters beyond the tolerance of delicate creatures like amphibians <sup>[6, 7]</sup>.

High amounts of physico-chemical parameters in water are called as pollutants which can be detrimental to amphibians <sup>[8]</sup>. Investigation on conservation of amphibians has been conducted in several parts of the world and pollution is recorded to affect them severely <sup>[8]</sup>. Several studies have previously been conducted in District Larkana and its vicinities for the determination of amphibian diversity, morphology and ecology <sup>[9-19]</sup>. In the view of high impact of water quality parameters, present study was conducted with the objective of determining status of amphibian habitats and the parameters selected for present investigation are aggregate indicators of impurities of water.

### Material and Methods

Field surveys were conducted in District Larkana where numerous habitats (Fig. 1) were found inhabited by amphibian populations in agricultural area. These habitats were marked for water sampling from March to October during years i.e. 2011, 2012 and 2013.

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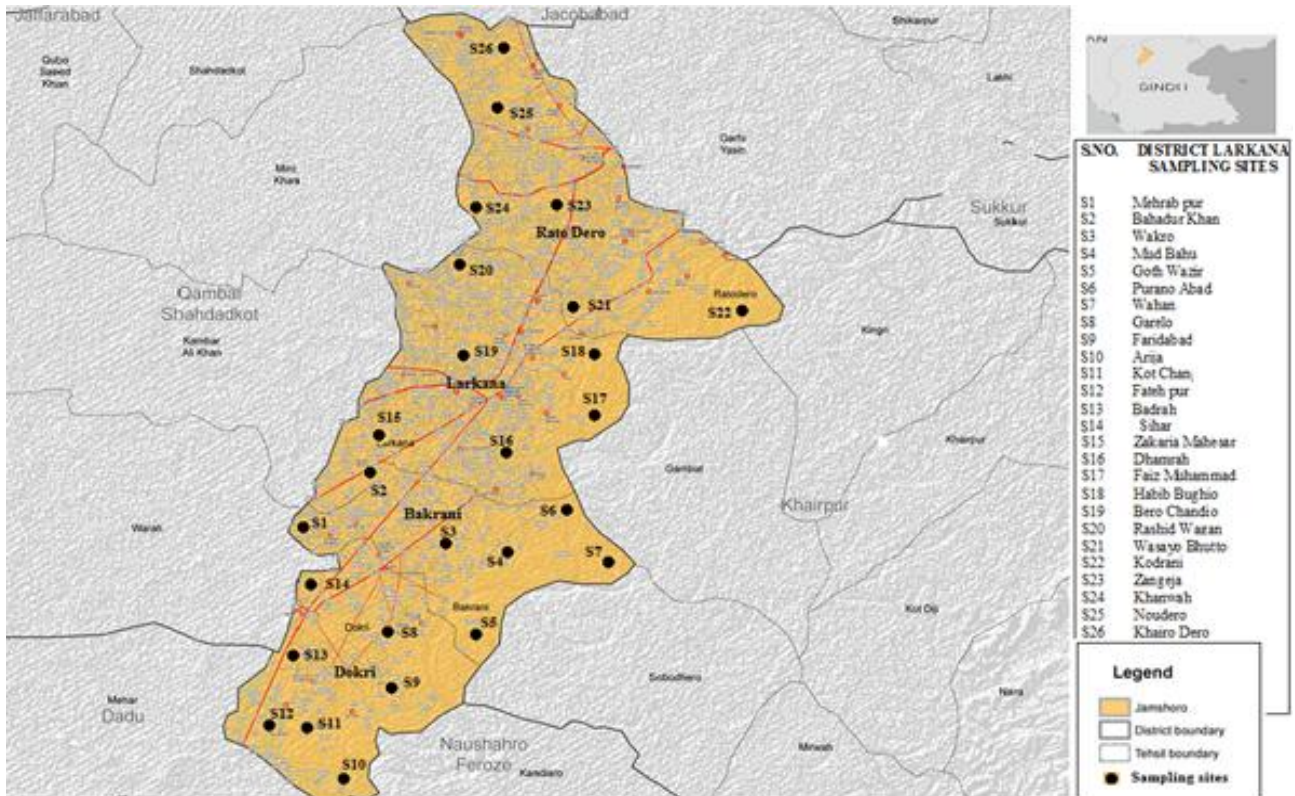


Fig 1: Location of amphibian habitats (study/sampling sites: S) in District Larkana

Water samples were collected in Van Dorn plastic bottles and were brought to the laboratory of Institute of Advanced Research in Chemical Sciences at University of Sindh, Jamshoro where analysis of physico-chemical parameters was carried out using analytical methods [7]. Conductivity meter (Model: Orion. 115) was used to measure values of EC TDS, whereas concentration of T-Hard was recorded through EDTA complexometric titration [7]. The statistical study of

scientific data of present research work was carried out using Microsoft Excel 2010.

**Results and Discussion**

Analysis of amphibian habitats revealed the values of parameters (EC, TDS and T-Hard) as mentioned in detail through total range, mean value and standard deviation for comprehensive understanding (Table 1-3).

Table 1: Values of parameters in amphibian habitats during the year 2011

Parameters	Volume	March	April	May	June	July	August	September	October
EC $\mu\text{S/cm}$	Range	1245.0-6352.0	1209.3-6360.5	1200.5-6430.0	1250.3-7441.0	1280.0-7472.6	1268.8-6505.8	1227.2-6244.4	1180.5-6179.5
	Mean	2480.2	2501.3	2595.5	2726.4	2811.4	2552.4	2445.4	2348.6
	Stdev	1224.8	1209.6	1370.4	1491.6	1501.4	1252.4	1178.4	1161.4
TDS $\text{mg}^{-1}$	Range	9857.3-3155.2	788.8-3241.3	850.5-3420.9	900.2-4220.0	990.0-4309.2	978.2-3305.2	800.8-3209.2	800.2-3000.5
	Mean	1644.5	1681.3	1746.4	1862.2	1920.3	1753.6	1611.2	1518.8
	Stdev	579.8	583.5	649.8	748.1	758.0	628.0	563.2	511.3
T-Hard $\text{mg}^{-1}$	Range	267.4-900.2	250.0-890.0	258.2-950.2	300.8-963.5	331.1-980.7	288.7-929.5	200.5-900.8	250.7-775.2
	Mean	500.8	518.4	535.7	568.2	601.4	536.7	488.7	460.6
	Stdev	163.9	176.9	180.0	184.1	188.2	173.7	157.4	137.2

Table 2: Values of parameters in amphibian habitats during the year 2012

Parameters	Volume	March	April	May	June	July	August	September	October
EC $\mu\text{S/cm}$	Range	1270.5-6250.2	1285.2-6438.5	1350.0-6532.1	1386.5-6550.8	1478.3-6639.8	1385.3-6475.8	1350.7-6469.2	1289.5-6400.7
	Mean	2435.1	2508.7	2553.8	2635.8	2732.9	2566.4	2477.4	2379.0
	Stdev	2435.1	1111.7	1140.7	1143.4	1167.9	1137.2	1131.0	1084.6
TDS $\text{mg}^{-1}$	Range	880.2-3180.2	1000.0-3329.5	1000.5-3280.1	1070.8-3450.5	1138.2-3508.5	1000.2-3420.5	920.8-3300.8	928.5-3057.2
	Mean	1633.4	1696.4	1754.8	1821.1	1915.4	1764.0	1679.3	1589.1
	Stdev	558.6	544.9	570.0	588.0	608.3	571.3	570.6	499.5
T-Hard $\text{mg}^{-1}$	Range	300.5-910.5	315.8-921.5	350.0-900.8	350.5-954.2	364.3-960.3	330.5-940.9	300.0-887.2	300.7-850.8
	Mean	511.6	531.9	544.3	568.7	605.7	548.0	520.3	488.3
	Stdev	170.8	168.2	166.0	170.1	174.3	171.3	168.0	149.3

**Table 3:** Values of parameters in amphibian habitats during the year 2013

Parameters	Volume	March	April	May	June	July	August	September	October
EC $\mu\text{S}/\text{cm}$	Range	1250.2-6465.2	1283.7-6509.5	1309.3-6533.7	1359.2-6580.2	1450.2-6610.2	(1400.8-6538.5)	(1309.2-6500)	1290.0-6448.2)
	Mean	2423.9	2466.6	2535.1	2585.8	2681.2	2543.8	2472.8	2362.0
	Stdev	1128.0	1124.6	1125.9	1125.3	1125.0	1120.0	1120.3	1125.7
TDS $\text{mg}^{-1}$	Range	985.8-3238.5	990.2-3375.4	1000.0-3380.6	1036.2-3450.6	1182.9-3475.2	1100.2-3400.2	980.5-3350.2	900.5-3200.9
	Mean	1623.2	1678.5	1751.8	1794.1	1888.5	1754.6	1677.6	1559.0
	Stdev	542.5	550.7	568.1	566.2	587.4	561.4	548.8	539.5
T-Hard $\text{mg}^{-1}$	Range	275.0-885.2	280.5-892.5	300.8-900.2	328.5-935.8	358.3-950.8	350.0-900.9	300.0-879.2	265.9-850.8
	Mean	504.0	527.5	549.4	568.5	606.6	546.5	522.2	476.6
	Stdev	163.2	163.5	162.0	170.2	178.5	163.6	164.4	163.3

According to the results of present study, the status of all 26 amphibian habitats consisted of high values of electric conductivity, total dissolved solids and total hardness (Table 1-3). The habitats where inorganic solids are dissolved in high amounts increase the risk of mortality of amphibians or may induce variety of abnormalities into them<sup>[20-21]</sup>. Dissolution of TDS and T-Hard in water bodies increases EC which make inhabitants to suffer<sup>[22]</sup>. In all, high values of EC, TDS and T-Hard are highly adverse for the amphibians especially to their eggs and larvae which die even before developing into adults due to harmful effects induced by these parameters<sup>[23-24]</sup>.

TDS and T-Hard are the parameters which increase electric conductivity and thus value of all parameters were interdependent and synchronizing at all study sites. Furthermore, combined study of three years indicated mean value and standard deviation of EC as  $2473.9 \pm 1198.2$  (total range 1180.5-7472.6  $\mu\text{S}/\text{cm}$ ) in year-2011,  $2536.1 \pm 1112.5$  (1270.5-6639.8  $\mu\text{S}/\text{cm}$ ) in year-2012 and  $2508.9 \pm 1109.1$  (1250.2-6610.2  $\mu\text{S}/\text{cm}$ ) in year-2013 (highest value of EC was noted in year 2012, whereas lowest value persisted in 2011). Maximum and minimum values of EC were recorded respectively in July and October each year. EC is highly effective parameter that affects amphibians not only at population level but also at species level<sup>[8]</sup>.

Highest quantity of solids was dissolved into all study sites (habitats) during year-2012, recorded as  $1731.7 \pm 563.8$  (880.2-3508.5  $\text{mg}/\text{L}$ ) with slight difference from that of TDS value in year-2013 i.e.  $1715.9 \pm 557.3$  (900.5-3475.2  $\text{mg}/\text{L}$ ), while lowest concentration of TDS ( $1688.8 \pm 622.4$  (788.8-4309.2  $\text{mg}/\text{L}$ ) persevered in year 2011. Upmost and bottommost values of TDS were recorded alike values of EC due to fact that the level of EC is directly proportional to the amount of dissolved salts<sup>[25]</sup>. Therefore values of both of these parameters were recorded corresponding to each other.

Concentration of T-Hard was recorded as high as  $525.0 \pm 176.2$  (200.5-980.7  $\text{mg}/\text{L}$ ) in year-2011,  $540.0 \pm 168.0$  (300.0-960.3  $\text{mg}/\text{L}$ ) in year-2012 and  $537.7 \pm 167.6$  (265.9-950.8  $\text{mg}/\text{L}$ ) in year-2013. Concentration of T-Hard was highest in 2012 during which  $539.85 \pm 36.17$   $\text{mg}/\text{L}$  value of this parameter was noted from entire study sites, while lowest concentration of the parameter in question was evaluated as  $526.31 \pm 44.78$   $\text{mg}/\text{L}$  in year 2011. Fluctuation in concentration of hardness was recorded alike variation in other parameters (maximum value in July and minimum value in October). Value of all the parameters was recorded highest between March to August each year, this condition may have more drastic effects on amphibian populations as they spawn and undergo metamorphosis during this period.

Water quality of amphibian habitats in District Larkana was out of auspicious water quality standard may impact amphibians of study area negatively<sup>[25-27]</sup>. Hindered growth, poor development, anomalous behavior, variety of cancers

and disruption in endocrine and reproductive systems<sup>[23]</sup>, sexual malformations, developmental deformities and impaired immune system are some abnormalities which are induced into amphibian fauna by contaminated water due to chemical contamination<sup>[27-29]</sup>. High values of analyzed parameters indicate careless role of local community to the wild animals as water is contaminated when pollutants are either directly or indirectly discharged into water bodies by anthropogenic activities. In this context, manmade encroachment may be controlled to save amphibian populations from devastation animals. Human encroachment deteriorates water quality of natural reservoirs such as ponds which are main habitats of amphibians. Untreated agricultural and domestic effluents not polluted environment for man, but also effects aquatic animals which play important part in ecosystem. Pollutants have toxic effects and ability to bio-accumulates in aquatic systems of animals and therefore agricultural fields are highly responsible for the reduction of amphibian population<sup>[28]</sup>.

Amphibians living in polluted habitats may become susceptible to variety of lethal diseases<sup>[23]</sup>. Many organizations including International Union for the Conservation of Nature (IUCN) and International Society for the Study and Conservation of Amphibians (ISSCA) have taken suitable efforts for the conservation of amphibians in many countries of the world<sup>[30]</sup>, but in Pakistan, conservation efforts for amphibians are yet to be implemented.

## Conclusion

Amphibians in wide area of district Larkana require urgent implementation of management plans for their conservation. The chemical contamination recorded at the area of this study may create lethal effects as it persisted for the extensive period of three years. The persistence of extremely unfavorable environmental factors may have highly adverse impact on the amphibian fauna of the study area.

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