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HARDNESS AND ALKALINITY IN AMPHIBIAN ENVIRONMENT AT DISTRICT HYDERABAD SINDH, PAKISTAN

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ABSTRACT

Present study was proposed to investigate the status of amphibian ambient in District Hyderabad. Water samples were collected from eight amphibian habitations for the analysis of hardness and alkalinity using titration procedures. The results of analyzed parameters were compared with scientifically approved water quality criteria to understand the status of aquatic environment. Present study recorded whole area polluted due to extreme level of hardness (618.5 ± 124.2) as well as alkalinity (319.8 ± 46.5) which may cause dreadful effects on amphibians.

Figures : 02

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Tables : 02

KEY WORDS : Alkalinity, Amphibian environment, District Hyderabad, Hardness, Pakistan

Introduction

Water quality has great impact on amphibian fauna. These wild animals are sensitive to physical and chemical components of their environment which may lead them towards mortality or induce different types of abnormalities into them.

Present study is the extension of previous investigation which provided information regarding unfavorable environment of District Hyderabad to its poor amphibian diversity of only four species: *Hoplobatrachus tigerinus*, *Euphlyctis cyanophlyctis*, *Allopa hazarensis* and *Bufo stomaticus*¹. It was also recorded that all amphibian dwellings were

containing high level of electric conductivity (EC) and total dissolved solids (TDS) which might have negative effects on all amphibians but more especially on their eggs and larvae¹.

Present research was conducted to analyze some other important physico-chemical parameters such as hardness and alkalinity from the same study sites¹. It was also planned to record monthly variation in values of hardness and alkalinity to know whether their concentration also fluctuates like pH, EC and TDS¹ or there is no variability in their level throughout the study period.

Water is a main source for the healthy living

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of organisms, but when it becomes polluted by the suspension of physical and chemical contaminants may affect the life negatively². Animals like amphibians remain unprotected to water pollution because of their semipermeable skin through which gases and other soluble substances can move across. For this reason amphibians are called “environmental sponges” because of the efficacy of their skin which absorbs elements from the aquatic environment². Amphibians respond negatively to poor water quality that may cause deformities such as deformed limbs in them². Contaminants have great influence on the development and survival of amphibian eggs which are destroyed even before hatching due to pollution into their exclusive habitat³. Amphibian larvae are also susceptible to non-optimum water quality as they cannot move out of the water bodies till completion of their development into adults⁴. Environmental pollution hinder growth and development of amphibians making them physiologically and physically weak and increase their susceptibility to the predators, parasites and other infectious organisms in their surroundings⁵⁻¹¹.

The parameters selected for present research (hardness and alkalinity) are constituents of natural water but when water is affected by anthropogenic activities, these elements become dreadful to the aquatic life¹¹.

The hardness is measured to know total concentration of several divalent salts including calcium, magnesium, iron, zinc into water *etc*. Calcium and magnesium are the most common

sources for making water hard¹². These chemical elements are essential for the normal functioning of biological process but when exceed high above or below the normal level, may inhibit normal functioning of physiological activities¹³. Hard water may not be tolerated by the sensitive aquatic animals such as fishes and amphibians¹³. Amphibians reflect polluted nature of their ambient through exhibiting some abnormalities and their declination. Water hardness has notable effect on pH and pH instability makes aquatic environment stressful¹².

Alkalinity is buffering capacity of water which measures total value of base present in water. It resists the changes in pH to maintain hydrogen ion concentration of a substance¹³. Carbonates and bicarbonates are main constituents of alkalinity¹⁴. When Alkalinity is not maintained within normal level, it may change the range of pH that may cause poor growth and even death of aquatic animals¹³.

Material and Method

Present research was carried out in same agricultural ponds of District Hyderabad which have already been investigated by the previous evaluation¹. Altogether eight permanent ponds were analyzed monthly from March to October during the year 2013. The ponds (amphibian habitations) were measured having size of 10-15 feet. However the depth of all ponds extended from 5 to 8 feet. The measurement of size and depth could be possible using the measuring tape and Secchi disk respectively. The different kinds of crops recorded at each specific study site are described in Table 1.

Water samples were collected between 09 am to 05 pm and stored into Van Dorn sterilized bottle sealed under specific label. Water samples were delivered on the same sampling day to the laboratory of Institute of Advanced Research in Chemical Sciences, University of Sindh, Jamshoro. The samples were kept at 4 °C in refrigerator until evaluated by following the analytical procedures¹⁵⁻¹⁶. Scientific literature helped in understanding the quality of aquatic environment of amphibians by providing limit for the value of each parameter¹⁶⁻¹⁸.

Results

Hardness as well as alkalinity was higher than normal level in all the amphibian habitations during whole study period (Table 1-2). The level of each parameter fluctuated every month in

TABLE-1 : Names of study sites with their distinct agricultural products

Study Sites (S)	Name of study sites	Crops
1	Saman Pur	Wheat
2	Shadab Pur	Wheat
3	Khan Pur	Rice
4	Khushhal Khan	Vegetables
5	Sahib Khan	Vegetables
6	Rabi Dero	Fruits
7	Khuman	Fruits
8	Mohammad Alam	Sorghum

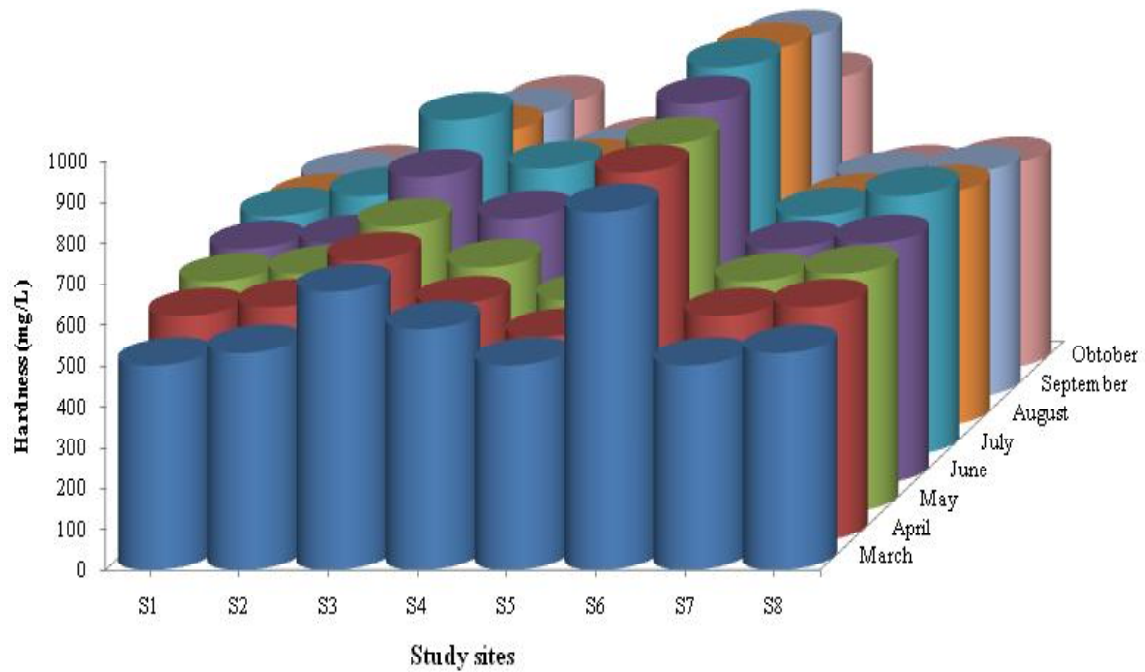


Fig. 1 : Seasonal variation in hardness at amphibian environment in District Hyderabad

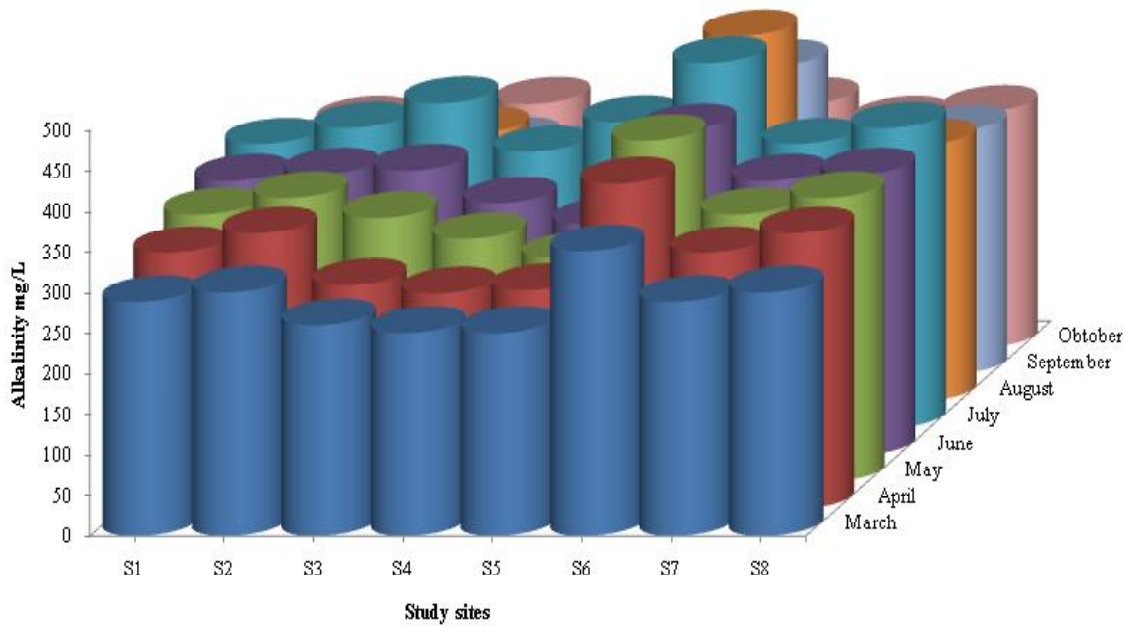


Fig. 2. Seasonal variation in alkalinity at amphibian environment in District Hyderabad

synchronizing manner at all study sites as shown in Figures 1-2.

Discussion

This investigation revealed ambient of District Hyderabad not suitable for the survival of amphibians in relation to high values of analyzed parameters. Physico-chemical analysis of eight amphibian haunts showed unfavorable level of hardness and alkalinity throughout the study (Table 2).

The favorable level of hardness lied between 75.0-200.0 mg/l for the survival of amphibians¹⁷⁻¹⁸. Thus hardness of whole District Hyderabad was much higher than favorable range during entire extent of water evaluation (Table 2). The concentration of hardness was recorded high at study site 6 (Rabi Dero) that contained maximum concentration of hard substances throughout the investigation but more especially in July (950.8 mg/l). The minimum concentration of hardness was recorded from study site 5 (Sahib Khan) that exhibited persistently low range of hardness as compared to other amphibian localities (Table 1). Monthly analysis recorded highly abundant quantity (651.3±129.3) of hardness in July, though its most reduced value (543.8±88.3) was recorded in October (Figure 1). The concentration of hardness fluctuated in same and corresponding manner at all study location (Figure 1).

Alkalinity was also influencing parameter as its level was also high up to harmful level during the course of entire water analysis (Table 2). Alkalinity is recommended between 50.0-150.0 mg/l to resist fluctuations in pH because instability of pH may create stress that ultimately harms eggs and larvae of amphibians¹⁹⁻²¹. Like hardness, alkalinity was also high at the study site 6 (Rabi Dero), whereas study site 4 (Khushhal Khan) and 5 (Sahib Khan) were consisting on alternatively low value of this

parameter. The level of alkalinity was recorded comparatively low at study site 4 but only in April and July, however other months of study presented lower value of the parameter at study site 5 (Table 1). Monthly variation indicated maximum level of alkalinity high upto 450.5 and 450.2 respectively in July and August (Table 2), while lowest level (284.5±13.7) was recorded in October (Figure 2).

Our previous analysis recorded high values of EC and TDS at study site 6 (S-6), wherein study site 1, 4, 5 and 7 alternatively lowest level of studied parameters was recorded¹. Present study also indicated similar environmental status in relation to high values of hardness and alkalinity which persisted copious at study site 6 (Figure 2-3). The comparison of low value also exhibited likenesses between previous and present analysis *i.e.* low value of hardness and alkalinity was evaluated from study site 4 and 5 (Table 2).

Present investigation exhibited kinship in monthly fluctuations of hardness and alkalinity alike to variation in pH, EC and TDS¹. All the parameters rose to utmost level in July and decreased to bottommost value in October (Figure 1-2).

Overall analysis revealed unprotected status of amphibian environment by the study of hardness and alkalinity which remained persistently beyond the normal limit. This destructive condition of natural water bodies may occur due to misuse of chemical fertilizers and negligent anthropogenic activities.

In order to save amphibians from declination, Pakistan wild life department and other concerned authorities should educate the local people about the importance of wild animals and motivate them to avoid misuse of chemicals and throw of garbage and other waste products in agricultural ponds. Their contribution has great importance in creation and maintenance of suitable environment for the survival of all wild animals including amphibians.

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