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Effect of Physico-chemical Parameters on Fish Growth in Hanna Lake, Balochistan, Pakistan

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Abstract

Effect of physico-chemical parameters on fish growth in Hanna lake was conducted during March – December 2013. There is no significant ($p > 0.05$) difference was recorded in the values of temperature, pH, salinity and dissolve oxygen (DO) within sampling sites, but significantly difference was ($p > 0.05$) noticed in the values of conductivity, transparency, total dissolved solids (TDS) and alkalinity. The values of length –weight relationship of *Carrasus auratus* and *Glypothorax sp.* were found to be satisfactory and regression co-efficient ($b = 2.10$ and 2.0 respectively) indicated as satisfactory growth of two fish species from Hanna lake, Balochistan. The values of relative condition factor (Kn) was calculated for combined sexes for both the fish species (mean $Kn = 0.98$ and 0.96) in case of *C. auratus* and *Glypothorax sp* respectively. It is therefore concluded that the physico-chemical parameters of Hanna lake found to be suitable for the fish growth

Keywords: Physico-chemical, Parameters, Fish growth, Hanna Lake, Balochistan

Introduction

Hanna lake is man-made lake it lies between Latitude: 30.254444467 Longitude: 67.0985881 surface elevation 1,898 m (6,227 ft) was constructed by the British Empire in 1894. Just about 10 kilometers away from Quetta city near the Urak valley [1, 2]. The lake is filled with water from streams coming down the Zarghoon and Murdar mountains. Ahmad and Yasmeen [3] described the study of physico-chemical and biological parameters of any water body used to analyze the production potential. The chemical and physical factors affect productivity, abundance and species composition of any lentic and lotic environments [3]. As there is change in physico-chemical parameters it will affect the fish production present in the water body. Earlier identification of water quality parameters through routine monitoring permits aqua culturist to implement minor operational changes to correct identified problem before it reaches on extreme [5]. Temperature is one of the vital parameter which effect on aquatic biota. [2] Variation in temperature depends on climatic condition [7]. pH is also important factor and it is closely related with biological productivity. Variation in pH can be caused by excessive primary production [8]. Dissolve oxygen (DO) is of great significance it regulates metabolic processes of aquatic organisms. DO is inversely proportional with temperature due to which oxygen capacity decreases [9] Conductivity is the measure of the ability of an aqueous solution to convey an electric current which is used an indicator of total concentration of ions or electrolytes in water solution. There is a high degree of correlation between electrical conductivity (EC) and total dissolved solids (TDS) as both signify the amount of dissolved solid [10].

No any published information is available on fish production and physicochemical parameters from Hanna lake. Lake was completely dried since 2000-2011 and again filled with rain water during the month of March 2011 [1]. Due to drought condition ecology of lake was disturbed, till it receives water from the surrounding areas. So that the present study was design to monitor physico-chemical parameters and its effects on fish growth from Hanna lake.

Materials and Methods

Four stations were selected from Hanna Lake for collection of water samples during March- December 2013.

Sampling sites of hanna lake

Station 1 = Murder mountain

Station 2 = Loiwala

Station 3 = Bridge nala

Station 4 = Chisma nala

For determination of physico-chemical parameters samples were taken once in a month. Water sample were taken near the surface of the lake and depth of about 5-10 inch at random interval from the same place between 10-11 AM monthly bases. During January to February the Hanna lake was dried due to drought and filled with heavy rain during March, the possible variations and changes were noticed. Following physico-chemical and biological studies were carried out during the period of March - December 2013. The factors like temperature, pH, TDS, DO, EC, salinity, and alkalinity were determined in the field with the help of multi parameters Analyzer Model no C6030 For subsequent studies water samples were collected in 4-liter plastic cans. For the fish growth study experimental fishes were procured from Hanna lake, Balochistan with the help of local communities. Samples of different length groups were collected monthly for a period of ten months (March- December 2013). Two fish species 55 *Carrasus auratus* and 30 *Glypothorax sp.* in total 85 fish samples ranging in length 9.3-16.6 cm and 7.5-10.5cm, respectively. The weight of fish was measured on electronic machine and length was recorded on measuring scale. The estimation of weight-length parameters was determined by using formulae to determine the growth parameters as reported earlier [4].

Results and Discussion

Physico-chemical parameters of Hanna lake

Physico-chemical parameters and its variations in Hanna Lake were carried out during March- December 2013. The values of parameters like temperature, pH, alkalinity, TDS, salinity, conductivity, DO and transparency were recorded throughout the study period. The temperature was found to be fluctuated between (13.0 – 36.0°C), the minimum temperature was recorded in the month of December; whereas maximum was observed during June and July and showed two peaks. The temperature found to be increased gradually from the month of March and reaches to maximum in July decline in November. The low transparency value of water was found during the month of July (42.75 cmL^{-1}) and high value was observed during the December (87.5 cmL^{-1}). The difference between pH values at different stations in various months of the year was significant. The fluctuation in pH values were between 7.1-8.03. The minimum pH values 7.1 were noted in the month of December. Maximum pH values 8.03 were recorded in May. The results of DO contents from Hanna lake during January- December 2013 are summed up in (Table 1). During the period of sampling the amount of DO fluctuated between 4.5-8.37 mgL^{-1}. The minimum (4.5 mgL^{-1}) was recorded in July. The maximum (8.37 mgL^{-1}) was recorded in March. The TDS fluctuated between 140.361.25 µs/cm. The lowest TDS observed in the month of March while highest TDS were recorded in the month of October. The TDS in Hanna lake increased gradually from June; it reached to the maximum in October and showed a noticeable decline from November- December. The salinity of Hanna lake found to be varied between 0.4 -1.5 gL^{-1} (Table 1). It was noticed that no such remarkable fluctuation observed in the salt contents (chlorides) of the water. The conductivity values were deviated between 93.75-226 µs/cm.

Table 1. **Mean values of physico-chemical parameters of Hanna lake, Balochistan, Pakistan.**

Months	Temperature °C	pH	Transparency (cmL^{-1})	DO (mgL^{-1})	Salinity (gL^{-1})	Alkalinity (mgL^{-1})	Conductivity (µs/cm)	TDS (mgL^{-1})
March	18.0	7.83	79.0	8.37	0.4	131.5	114.0	140.25
April	22.0	8.0	75.25	7.8	0.7	123.5	132.0	155.75
May	26.5	8.03	50.0	6.4	0.9	129.0	146.25	185.0
June	33.0	7.78	58.5	5.2	1.0	121.5	168.75	287.25
July	36.0	7.80	42.75	4.5	1.2	121.75	226.0	308.75
August	31.0	7.65	49.25	4.8	1.0	112.25	129.75	332.25
September	27.0	7.65	57.25	5.3	1.5	120.25	127.25	306.0
October	22.0	7.33	58.25	6.0	0.7	131.75	120.0	361.25
November	17.0	7.25	80.75	6.6	0.9	124.25	132.75	281.5
December	13.0	7.1	87.5	8.0	1.2	110.25	93.75	319.5

The lowest conductivity value was recorded 93.75 µs/cm was recorded in the month of December, and the highest conductivity level was recorded 226 µs/cm in July. The conductivity level increased gradually from March, its level reached the maximum in July and showed a noticeable decline from August-September. The minimum value (110.25 mgL^{-1}) of alkalinity was recorded in December. The highest alkalinity was observed in March and October. Effect of physico-chemical parameters on fish growth in Hanna lake, Balochistan is an attempt to characterise the water body in terms of fish growth. In the present investigations it was revealed that the water temperature was varied between 13-36°C throughout the year. The average values of temperature exhibits two peaks in June and August. Wisdom *et al.,* [5] described the temperature of water is of vital importance in terms of productivity in aquatic life. LeCren [6] recorded temperature ranged between 15-33°C from the coast of Balochistan. Kumar [7] also reported temperature ranges 13-37°C from Zhob River. Finding of the above researchers are in accords with the present study. The DO was found to be inversely proportional to the temperature, with respect of fishes. Fish requires much oxygen for their metabolic activity. The water of the Hanna lake was neutral to bit alkaline round the study period and varied from 7.1 – 8.03. The variations in pH values from various stations during different months were found to be significant. Tesch [1] and Elahi *et al.,* [12] also reported pH from 7.0-7.8 from District Nanded, Maharashtra and Chhattisgarh. Dastagir *et al.,* [13] reported (6.5 to 9.5) pH from Kano metropolis. These all are similar with the present research. In case of oxygen Hanna lake seems to be higher throughout the year, the maximum concentration (8.37 mgL^{-1}) and minimum was (4.5 mgL^{-1}) was recorded respectively in March and July. Dastagir *et al.,* [13] reported (6.0-8.1 mgL^{-1}) from coast of Balochistan. Hussain *et al.,* [14] reported similar observation from Zhob River (4.5-9.0 mgL^{-1}). Salinity is an ecological factor of considerable importance, influencing many aquatic organisms directly or indirectly. Majority of sweet water animals showed zero tolerance in high salinity. In Hanna lake the salinity of water fluctuated between (0.4-1.5 gL^{-1}). Tasaduque *et al.,* [15] recorded similar results from Zhob River. TDS and total suspended solids and dissolved solids in water, are very important factors for determining the chemical constituents of the water body also recognized as general of edaphically relation which contributes to improve the productivity of any water body. TDS ranged 140.25-361.25 mgL^{-1} were recorded during the study. According to Eze

and Madumere *et al.,* [16] the value of TDS in the dry season than the wet season is in agreement with [17,18, 19, 20] and present study.

Weight-length- relationship of fishes from Hanna lake

Fish growth purely depends on upon the quality of water, so the physicochemical parameters of Hanna lake were taken in to account as a basis to determine the suitability of water for fish culture operations. The study of weight-length relationship serves to quantify good and poor growth of fish in given water body. The regression coefficient of weight -length relationship and condition factor of two fish species *C. auratus* and *Glypothorax sp.* when calculated gave the following equations

Log W = -0.12+2.1 Log L (*C. auratus*),

Log W = -0.66+2.0 Log L (*Glypothorax sp*.)

The length –weight relationship values indicated that growth of *C. auratus* and *Glypothorax* from Hanna lake was found to be positive allometry and regression co-efficient (b= 2.1 and 2.0), respectively. It indicated as satisfactory growth of both the fish species from Hanna lake, the data on weight- length relationship shown in (Table 2).

Table 3. **Data on condition factor of fishes in Hanna Lake from Balochistan, Pakistan.**

Length groups (cm)	*Carrasus auratus*			*Glypothorax sp.*		
	Obs. Wt. (g)	Cal. Wt. (g)	Kn	Obs. Wt. (g)	Cal. Wt. (g)	Kn
5.1-10.0	1.50	1.48	0.99	0.85	0.52	0.96
10.1-15.0	1.74	1.71	0.97	1.17	1.17	0.95
15.1-20.0	1.85	1.88	0.98			
Mean Kn			**0.98**			**0.96**

Condition factor analysis

The values of relative condition factor (Kn) was calculated for combined sexes for both the fish species (mean Kn= 0.98 and 0.96) in case of *C. auratus* and *Glypothorax sp.*, respectively. The values of relative condition factor revealed that the *C. auratus* was found to be slightly better in condition than that of *Glypothorax sp*. as shown in (Table 3).

Table 2. **Length- weight relationship of fishes from Hanna lake, Balochistan.**

Length groups (cm)	*C. auratus*		*Glypothorax*	
	Mean length (cm)	Mean weight (g)	Mean length (cm)	Mean weight (g)
5.1-10.0	9.35± 1.5	55.5± 1.5	7.5± 1.5	8.4± 2.4
10.1-15.0	12.4± 1.6	61.0± 1.0	10.5±1.1	14.8± 2.2
15.1-20.0	16.6±1.4	78.5± 2.5	-	-

Obs. = observed weight
Cal. = Calculated weight
Kn = Condition factor

Conclusion

It was concluded that the physico-chemical parameters of Hanna lake found to be suitable for the fish growth. The values of length –weight relationship of *Carrasus auratus* and *Glypothorax sp.* were found to be satisfactory.

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