



## Physico-chemical Parameters and Their Variations in Relation to Fish Production in Zhob River Balochistan

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### Abstract

The study of physico-chemical parameters of Zhob River was carried from January- December 2011 and correlated with fish production. The samples of fish were procured from, Zhob River Balochistan with the help of local fishermen. Total 557 (342 *Schizothorax progestus*, 105 *Caratus auratus*, 60 *Tor tor* and 50 *Glypothorax sp.*) were procured from January to December. Noticeable difference in the values of temperature, pH, transparency and DO were not observed throughout the year and as per standards for aquatic biota. The length- weight relationship values indicated positive allometric and regression co-efficients (b) are 2.67, 2.50, 2.17 and 2.65 termed as satisfactory growth in *C. auratus*, *S. progestus*, *Tor tor* and *Glypothorax sp.*, respectively. The values of condition factor (Kn = 1.0, 1.01, 0.97 and 1.31) in case of *C. auratus*, *S. progestus*, *Tor tor* and *Glypothorax sp.* respectively from Zhob River, Balochistan. Condition factor values show fluctuations in all size groups in different fish species. It is concluded that the physico-chemical parameters of Zhob river Balochistan were found to be within the suitable ranges of fish culture.

**Keywords:** Physico-chemical parameters; Length- weight relationship; Zhob River; Balochistan.

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### Introduction

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 [1] Temperature is one of important independent factor, which influences aquatic biota. The temperature is regarded as essential parameter for the metabolic activities of aquatic organisms and also considered as a biologically significant factor [2]. Acidity and alkalinity can be determined by the production of hydrogen and hydroxyl ions. The pH of an aquatic ecosystem is closely associated to biological productivity and hence, fluctuation of water, pH can be caused by excessive primary production [3, 4]. The turbidity/ transparency influenced number of aquatic parameters like planktonic biomass, visibility and suspended

particles of any water body [1, 5, 6]. Dissolved oxygen in water is of great limnological significance as it regulates many metabolic processes of aquatic organisms. Oxygen content is important for direct need of many organisms and affects the solubility of many nutrients and therefore the productivity of aquatic ecosystem. The decrease in the amount of DO in summer may be attributed to high temperature due to which the oxygen holding capacity of water decreases [7, 8].

### Materials and Methods

Physico-chemical parameters were recorded during January 2011 to December 2011. Observations were taken once in a month. Water sample were taken in 4-L plastic cans from near the surface on the lake and depth of about 5-10

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inch at random, fortnight interval between 10-12 A.M. Following physico-chemical and biological parameters like temperature, pH, TDS (Total Dissolved Solids), DO (Dissolved oxygen), and alkalinity, were determined in the field with the help of multiparameter. The sampling sites are mentioned below:

Station 1 = Badizai water (Fig. 1)

Station 2 = Kila shirak

Station 3 = Mir Ali khail

Station 4 = Mugal kot

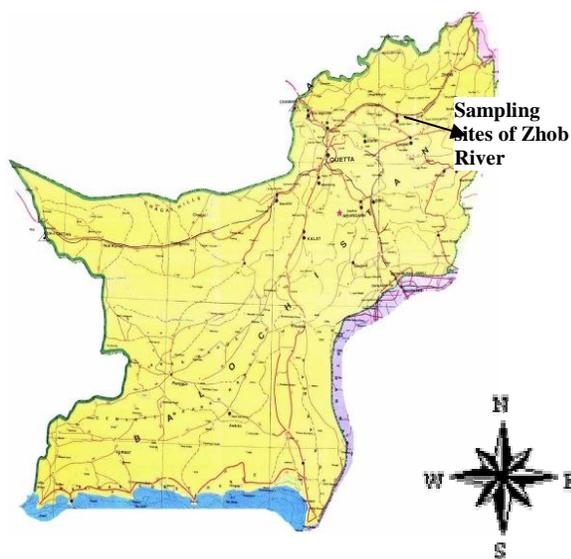


Figure 1. Showing sampling sites of Zhub River Balochistan, Pakistan.

Temperature was determined with the help of mercury thermometer with 0-1 °C divisions during sampling period. The light penetration in water (transparency) was recorded by Secchi disc. The disc was suspended in water and depth on which it disappeared was measured on a calibrated line. The values of transparency were calculated by using following formula.

$$\text{Secchi disk reading (cm)} = \frac{A + B}{2}$$

Where

A= depth at which Secchi disc disappear

B= depth at which Secchi disc reappears

2= standard value of equation.

The pH was noted on the field by using portable pH Meter and Merck Indicator paper with range 1-14 which was later confirmed by in

laboratory by using a pH meter Janway Model No. 3305. Before using it was calibrated by buffer solutions for accuracy. The samples for salinity, conductivity TDS were analyzed by using the conductivity meter Janway Model No 4520. Dissolved oxygen was noted on the field by using portable meter which was later confirmed in the Laboratory by using a DO meter Janway Model No 9500. The total alkalinity was measured through following calculation.

$$\text{Total alkalinity (mg/L)} = \frac{(\text{ml}'\text{N}) \text{ of } \text{H}_2\text{SO}_4 \cdot '50' \cdot 1000}{\text{ml of sample taken}}$$

The samples of fish were procured from, Zhub River Balochistan with the help of local fishermen. Total 557 (342 *Schizothorax progustus*, 105 *Caratus auratus*, 60 *Tor tor* and 50 *Glypothorax sp.*) were procured from January to December. The weight of fish was measured on electronic machine and length was recorded on measuring scale. The estimation of length-weight parameters was determined by using [9] formulae to determine the growth parameters for different species of different length groups. It was calculated for each 5cm interval.

## Results and Discussion

The present investigations on the physico-chemical parameters and its effect on fish production in Zhub River, Balochistan is an attempt to characterise the water bodies in terms of productivity. The physico-chemical variables of Zhub River were estimated during the months of January – December 2011. In Zhub River the higher values of water temperature was recorded from July – August, the higher temperature values was observed during August (Table 1). The mean value shows two maxima July and August. Therefore, the effect of maximum temperature is more important as compared with minimum temperature. According to its thermal properties Zhub River can be classified as a tropical water of the third order where temperature of the surface water always remains within the suitable ranges [10]. According to [11, 12] the temperature of water is of vital importance in terms of productivity in aquatic life. Therefore, the variation of temperature in different months during study period is considered insignificant.

The low transparency of water was found in Zhob River during the month of January, August, and September 37- 41.75 cm and high value was observed during the period of March 92.5 cm (Table 1).

**Table 1.** Month-wise variations of Physical parameters water from Zhob River during January to December 2011.

Months	Physical variables	
	Mean Temperature	Mean Transparency (cm)
January	13.25 ±1.5	37 ± 1.0
February	18.25 ±1.5	52.5 ±0.5
March	20.25 ±1.5	92.5 ±1.5
April	27.25 ±1.6	90.5 ±1.5
May	32.25 ±1.5	48 ±1.0
June	38.25 ±1.5	72 ±1.0
July	32.75 ±0.5	58.25 ±1.5
August	30.5 ±0.5	41.5 ±1.5
September	26.25 ±1.5	41.75 ±1.5
October	22.25 ±1.5	51.25 ±1.5
November	19.75 ±1.5	70 ±1.0
December	15.25 ±1.5	70.5 ±1.5

The fluctuation in pH during the period is shown (Table 2). The minimum pH values 7.2 - 7.3 have been noted in September. Maximum pH values 8.3 - 8.4 were recorded in April and November. The variation in pH values basically depends upon hydrolysis the low acids and high bases or vice versa, so that the pH value 7.2 denotes an excess, probably accompanied by reduced percentage of oxygen [10, 13]. The pH value never reached 8.4 which indicated that the respiratory processes were greater than the photosynthetic processes. Maximum values of pH for fish culture operation vary from 7.8 to 8.5, the acidic and alkaline pH lesser than 4.4 and higher 8.8 generally causes gill irritation and death [14, 15]. The pH of water alone cannot be considered as a single isolated factors, each of which itself may exert a great ecological influence, these includes effects due to respiration by plants and animals, photosynthesis by plants and removal of carbonates by marl forming organisms. The fish and other aquatic organisms prefer pH value between 6.7 and 8.4 and pH value below the 5 or above 8.8 may be detrimental or even lethal to aquatic life [15, 16]. Lower and higher pH ranging

from 5.0 to 6.6 and 9.1 to 11.0 result in low productivity [15].

**Table 2.** Month-wise variations of Chemical parameters water from Zhob River during January to December 2011.

Months	pH	Mean DO (mg/L)	TDS (ppm)	Alkalinity (mg/L)
January	8.12 ±1.8	9.2 ± 1.8	189.7 ±1.3	169.7±1.3
February	8.02 ±1.8	7.57 ± 1.3	222.7±1.3	153.7±1.3
March	7.67 ±1.3	7.07 ± 1.3	262.5±1.5	146.2±1.4
April	8.32 ±1.8	6.90 ±1.0	282.0±1.0	141.5±1.5
May	8.22 ±1.8	6.12 ± 1.8	301.2±1.8	132.7±1.3
June	7.92 ±1.8	5.75 ± 1.5	342.7±1.3	125.7±1.3
July	8.05 ±1.5	5.05 ± 0.5	369.5±1.5	123.0±1.0
August	8.125 ±1.5	7.32 ±1.8	389.5±1.5	131.5±1.5
September	7.22 ±1.8	7.79 ± 1.1	304.5±1.5	127.2±1.8
October	7.25 ±1.5	7.92 ± 1.8	319.7±1.3	146.7±1.3
November	8.30 ±1.0	7.38 ± 1.2	337.0±1.0	138.5±1.5
December	8.25 ±1.5	7.97 ±1.3	386.7±1.3	

The results of dissolved oxygen contents during the period are given in Table 2. The amount of dissolved oxygen fluctuated between 5.0 -9.2 mg/liter. The minimum amount 5.0 mg/L was recorded in July. Whereas the maximum amount 9.2.mg/L was recorded in January. The DO was found to be inversely proportional to temperature, with respect of fishes, fish requires much oxygen for their metabolic activity. The rate of increase and decrease of microorganisms largely depends upon temperature variation of a water body [11]. In general no minimum concentration of DO necessary for fish culture is listed, because the dissolved oxygen requirements of any fish species varied with the age, temperature and concentration of minerals in water Ellis [16] state dissolved oxygen values must be at least 5 mg/L suitable for any fish culture operation. According to [15] equivalent levels for carps and tilapia may range from 3 – 4 mg/L. Both these ranges are found in Zhob River. Therefore dissolved oxygen content is suitable to support a rich fish fauna (American water Association Journal, 1938).

The results of total dissolve solids during the study period (Table 2) reveal that the total dissolved solids fluctuated between 189.7-389.5 ppm. The lowest total dissolved solids were observed 189.7 in January and the highest total

solids was recorded 389.5 ppm in August. According to [10] total dissolved solids vary qualitatively and quantitatively in different waters depending upon the seasons, location and other factors. Alkalinity is the capacity of water containing a compound or compounds, with or without hydrolysis, for neutralizing strong acid to pH 4.5. The values of alkalinity during study (Table 2) the minimum value 123 mg/L of alkalinity was recorded in Jul and the highest 169.7 mg/liter was recorded in January. The determination of alkalinity is a measure of the excess basic constituents over the amount necessary to balance the strong acid constituents. Alkalinity in water is due to primarily presence of carbonates and bicarbonates. Temperature, pH, and concentration of dissolved solids influence the alkalinity. In some water alkalinity may change appreciably in a few hours. The amount though low is suitable for fish fauna. The alkalinity and zooplankton abundance was found to be positively correlated with each other [17-19].

The experimental fish samples were procured monthly from the various fishermen of the Zhob River, Baluchistan. A total of 557 fishes (342 *Schizothorax progastus*, 105 *Caratus auratus* 60 *tor tor* and 50 *Glypothorax sp.*) were ranging in length from 9.43-20.2, 9.35-20.7, 13.9-21.8 and 7.5-11.95cm respectively (Table 3). The regression coefficient of length- weight relationship and condition factor of experimental fishes when calculated gave following equations.

$$\text{Log W} = -0.12 + 2.67 \text{ Log L (C. auratus)}$$

$$\text{Log W} = 0.01 + 2.50 \text{ Log L (S. progastus)}$$

$$\text{Log W} = -0.07 + 2.17 \text{ Log L (Tor tor.)}$$

$$\text{Log W} = -0.66 + 2.65 \text{ Log L (Glypothorax sp.)}$$

The length –weight relationship values indicated that growth of all species was found to be positive allometric and regression co-efficient (b= 2.67, 2.50, 2.17 and 2.65 respectively), it indicated as satisfactory and close to the ideal (b= 3) growth in all fish species from Zhob river, Balochistan. The values of relative condition factor (Kn) was calculated for combined sexes for all the fish species (mean Kn= 1.0, 1.01, 0.97 and 1.31) in case of *C. auratus* and *S. progastus*, *Tor tor* and *Glypothorax sp.* as shown in (Table 4), respectively.

The values of length- weight regression co-efficient b obtained for combined sexes from Zhob river, Balochistan (b= 2.27, 2.25, 2.65 and 2.65) in the present study. The t- test determined either the values of b obtained significantly varied from the ideal values in either sexes at 95 % confident limit. The b values were found to be lesser than the ideal (3) in fish under study. Various workers calculated regressions co-efficient from other fish and reported the values of regression coefficient less than ideal [20-21] in *Tenuulosa ilisha* from Pakistan and [22] calculated value of regressions co-efficient from Kuwait in *Tenuulosa ilisha* [23] and *Labeo bata* and [24]. Reported values of regressions co-efficient b = 2.40 in *Gudusia chapra* from Bangladesh [25]. Regressions co-efficients ranging from 2.5 and 4.0 were determined in cisco, *Leuchthysartedi*. Condition factor values show fluctuations in all size groups in different fish species. The highest Kn values were found in *Schizothorax progastus* and *Glypothorax sp.* in agreement with [23] for *Catla catla* and *Cirrhinus mrigala*.

Table 3. Data on Length- weight of Fishes of Zhob River from Balochistan, Pakistan.

Length groups	<i>C. auratus</i>		<i>S. Progastus</i>		<i>Tor tor</i>		<i>Glypothorax</i>	
	Mean length (cm)	Mean weight (g)	Mean length (cm)	Mean weight (g)	Mean length (cm)	Mean weight (g)	Mean length (cm)	Mean weight (g)
5.1-10.0	9.35 ± 1.5	55.5 ± 1.5	9.4 ± 1.6	16.7 ± 1.3	-	-	7.5 ± 1.5	8.4 ± 2.4
10.1- 5.0	12.4 ± 1.6	61.0 ± 1.0	13.0 ± 1.0	23.3 ± 1.7	13.9 ± 1.1	29.6 ± 1.4	11.9 ± 1.1	14.8 ± 2.2
15.1- 0.0	16.6 ± 1.4	78.5 ± 2.5	16.3 ± 1.7	38.0 ± 1.0	17.1 ± 1.9	41.2 ± 1.8	16.1 ± 1.1	18.2 ± 1.8
20.1- 5.0	20.7 ± 1.3	121.7 ± 1.3	20.2 ± 1.8	62.2 ± 1.8	21.8 ± 1.2	88.7 ± 1.3	-	-

Table 4. Data on condition factor of fishes in Zhob River from Balochistan, Pakistan.

Length groups	<i>C. auratus</i>			<i>S. progasus</i>			<i>Tor tor</i>			<i>Glypthorax sp.</i>		
	Obs. Wt.	Cal. Wt.	Kn	Obs. Wt.	Cal. Wt.	Kn	Obs. Wt.	Cal. Wt.	Kn	Obs. Wt.	Cal. Wt.	Kn
5.1-10.0	1.50	1.48	1.01	1.18	1.21	0.97				0.85	0.52	1.63
10.1-15.0	1.74	1.71	1.01	1.28	1.36	0.94	1.47	1.60	0.91	1.17	1.17	1.0
15.1-20.0	1.85	1.88	0.98	1.56	1.49	1.04	1.61	1.49	1.08	1.20	1.28	0.93
20.1-25.0	2.08	2.06	1.0	1.79	1.61	1.11	1.94	1.38	1.4			
Mean Kn			1.0			1.01			0.97			1.3

## Conclusion

The present investigation on length-weight relationship and relative condition factor of fishes of Zhob River, Balochistan indicated that the growth rate is quite satisfactory in this river. It is concluded that the physico-chemical parameters of Zhob River Balochistan found to be within the suitable ranges of fish culture.

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