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Evaluation of Statistical Relationships among Abiotic Parameters in Boosra Lake (Muzaffarpur, Bihar)

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Abstract

The paper deals with the abiotic parameters and its statistical correlation over a period of one year. The simple coefficient of correlation (*r*) was used to worked out among different abiotic parameters. The temperature was found to be positively correlated with pH and dissolved O_2 whereas free CO_2 was found to be negatively correlated with temperature, dissolved O_2 and total alkalinity. The positive correlation between other parameters such as DO and phosphate, DO and pH, pH and phosphate were also recorded. The study indicated that most of the abiotic parameters of this lake are positively related to each other to the larger extent.

Key words : Abiotic parameters, Water analysis, Lake ecosystem, Coefficient of correlation, Boosra lake.

The abiotic parameters of any aquatic ecosystem play a significant role in its functioning. The various statistical methods are used in assessing biological significance of variable characters and their relationship. However, no such relationships have been worked out for the lake ecosystem of North Bihar. Thus, in the present investigation simple coefficient of correlation (*r*) among abiotic parameters in Boosra lake is communicated. The correlation coefficient may be positive or negative indicating a direct or inverse relationship respectively. The coefficient relationship varies between 0 and 1, where 0 signifies absence of relationship while 1 indicates complete or perfect relationship.

Methods

Boosra lake is an ox-bow lentic and perennial fresh water lake and is located in a rural area of Gaighat block of Muzaffarpur district (North Bihar). It was once a part of lotic system of Bagmati river. It is stretched upto 45 hectares with the manifestation of different types of aquatic plants and animals. The depth of the lake was 3.5 m during summer season but 9.15 m during rainy season. It receives domestic sewage and the main source of water is from rainfall. The villegers use the water for cattle bathing and for washing cloths. About 500 fishermen are also dependent upon the lake.

Following statistical methods were applied in the biostatistical analysis of collected data during present investigation.

Mean

$$\bar{X} = \frac{\lesssim X}{N}$$

Where $\sum X$ = Sun of the values, N = Number of observations, $\bar{X}$ = Mean.

Standard Deviation

$$SD = \sqrt{\frac{(X - \bar{X})^2}{N-1}}$$

Where X = Observed value, $\bar{X}$ = Arithmetic mean, N = Number of observations.

Coefficient Correlation (r)

$$\frac{\lesssim XY - \lesssim X \,.\, \lesssim Y / N}{N \sqrt{[\lesssim X^2 / N - (\lesssim X / N)^2]\,[\lesssim Y^2/N - (\lesssim Y/N)^2]}}$$

Table 1. Statistical relationships among abiotic parameters in Boosra lake (Gaighat block), Muzaffarpur (Bihar) during 2007. 1 = Significant at 0.001 level, 2 = Significant at 0.005 level, 3 = Significant at 0.01 level, 4 = Significant at 0.025 level, 5 = Significant at 0.05 level.

		pH	DO	FCO_2	Phosphate	T. Alkalinity	Chloride	Silica
1	Temperature	r = +0.726[1] t = 4.95	r = +0.896[1] t = 9.51	r = -0.314 t = 1.55	r = +0.297 t = 1.46	r = -0.533[3] t = 2.95	r = +0.796[1] t = 6.17	r = +0.446[5] t = 2.39
2	pH		r = +0.598[2] t = 3.50	r = -0.024 t = 0.110	r = +0.250 t = 1.21	r = -0.537[3] t = 2.98	r = +0.773[1] t = 5.71	r = +0.607[2] t = 3.58
3	DO			r = -0.196 t = 0.940	r = +0.614[2] t = 3.65	r = -0.694[1] t = 4.52	r = +0.693[1] t = 4.51	r = +0.394 t = 2.01
4	FCO_2				r = +0.109 t = 0.518	r = +0.213 t = 1.02	r = -0.009 t = 0.046	r = -0.251 t = 1.21
5	Phosphate					r = -0.647 t = 3.98	r = +0.464 t = 2.45	r = +0.245 t = 1.18
6	T. alkalinity						r = -0.798 t = 6.21	r = -0.774 t = 5.73
7	Chloride							r = +0.764 t = 5.55

Where X and Y are two variables, N, No. of observations.

t - Test

$$t = r\sqrt{\frac{N-2}{1-r^2}}$$

Where r = Correlation coefficient, N - 2 = Degree of freedom (df)

This formula was applied to test the level of significance.

Results and Discussion

The statistical analysis of collected data, exhibited a varied picture of correlation among abiotic parameters (Table 1). The temperature was found to be positively (+ve) correlated with pH, dissolved oxygen (DO), chloride and silca and negatively (-ve) correlated with free CO_2 and total alkalinity. The positive correlation between temperature and pH was found to be in agreement with the findings of Bose and Lakra (1994) and between temperature and dissolved oxygen (DO) was in accordance with those of Singh et al. (1982) and Joshi et al. (1989). But no correlationship between temperature and dissolved oxygen (DO) was established as also reported earlier (e. g., Chakrabarty and Asthana 1989, Mir and Kachroo 1990). The negative correlation between temperature and free CO_2 (FCO_2) was found in conformity with the results drawn by Joshi et al. (1989) and between DO and free CO_2 was in agreement with the findings of Lakshminarayan (1985), Ray et al. (1966) and Pandey et al. (1989).

The positive and significant correlation of DO with pH and phosphate, between pH and phosphate and insignificant correlation between pH and free CO_2 during the present investigation were also observed. During present investigation free CO_2 and total alkalinity exhibited negative correlation with temperature as also observed earlier. Dobriyal and Singh 1981, Joshi et al. (1989) and negative correlation of free CO_2 and phosphate and chloride were similar with the findings of Chauhan (1995).

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