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Individual and synchronized correlation in macroinvertibrate and water from Ashvi Reservoir, Sangamner, Maharashtra, India

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ABSTRACT

The paper deals the correlation in water parameters and macroinvertebrates from Ashvi reservoir water. The correlation results in macroinvertebrates revealed 53.7% positive combinations and 46.3% negative in which eight unions were high related [r>0.60]. Water parameter correlation revealed 50.8% positive and 49.2% negative unions in which pH-PO_4, EC-SO_4, TH-DO and TH-BOD were highly related. The relation between water parameters v/s macroinvertebrates species was noticed 58.8% positive and 41.2% negative unions in which eight were high [r=>0.6] and five were highly [r=>0.7] relayed. The relations were beloved to provoke the tolerance and adaptation responses observed herein.

Keywords: Synchronic correlation, macroinvertebrates, water parameters.

INTRODUCTION

The correlation is one of the most common and useful tool of statistics. A correlation is a single number that predicts the degree of relationship between two variables. They are relatively easy for sample quantifications. They are tolerance to natural and pollutant is well documented with life, also species integration to the environment. Hence present study was assigned to evaluate individual and synchronized correlation in species to water.

Macroinvertebrates have been attraractive targets of monitoring efforts because they are diverse group of longed lived, sedentary and bioindicators of aquatic ecosystem. The live species and water quality are interrelated and indicators of water quality and have influenced on biotic and abiotic habitats. They have sensitive life respond to environmental stressors and important for biodiversity. Earlier work reported their performance, biodiversity [1,2] availability, seasonal variability [3], density, diversity, distribution, biomonitoring [4], water chemistry [5], etc. But no literature is available on correlations between water and macroinvertibrate species. It was the objective of the study. However, no such type of work was documented elsewhere. Therefore it is carried out with the objectives of assigning the relationship between them and individual.

MATERIALS AND METHODS

Study area: The study was conducted in Ashvi Reservoir, Sangamner, Ahmednagar district [$19^0$50' N latitude & $74^0$51' E longitude]. The dam was constructed [1971] on river Pravara river tributary of river Godavari at Ashvi, district Ahmednagar. It experiences 58 mm annual rainfalls and capacity of water is 2.5 TMC.

Collection and identification of species: Qualitative samplings of species were performed monthly, completing 2 years-cycle [2008-09] in ten sampling sites. Species were collected using hand-net [5µ mesh] by kicking and sweeping in all ten sites. They were preserved in 70% alcohol [6]. They were successively filtered through 4µ to remove fixative and sediments. These organisms were sorted and were examined using standard [7, 8].

Physico-chemical analysis: The pH was recorded on the spot. The analysis of filtered water samples was carried out for the parameters, as Electrical Conductivity [EC], Total Dissolved Solids [TDS], Total Hardness [TH], Calcium [Ca], Magnesium [Mg], Sodium [Na], Potassium [K], Chloride [Cl], Total Alkalinity [TA], Sulphates [SO_4], Phosphate [PO_4], Nitrate [NO_3], Dissolved Oxygen [DO], Biological Oxygen Demand [BOD] and Chemical Oxygen Demand [COD]. The samples were done according to standard methods [9] and mean values were used.

Statistical analysis: The correlation was performed using Window^{TM}/Excel/2007. The correlation of macroinvertebrates [Table 1], water parameters [Table 2] and macroinvertebrates species v/s water parameters [Table 3] were presented.

RESULTS AND DISCUSSION

The correlation noticed in between macroinvertebrates were 53.7% positive unions and 46.3% negative in which 8 pairs were high correlated as four positive and four negative. The pairs in between *P. orientalis to Bithynia* sp. revealed negative correlation [r=- 0.70]. The species *M. metcalfei* revealed negative correlation with *Robertsiella* sp and *Lymmnaea* sp. as -0.72 and -0.67 respectively. The relation between species of *M. meretri* with *Diplonychus* sp. and *Robertsiella* sp. with *Bulimus* sp. were 0.60 each. The species *Bithynia* sp. revealed correlation with *Chironomous* sp. r=0.66. The genes *Iravadia* sp. showed highly positive correlation to *Bulimus* sp. [r=0.87] and *Rnatra* sp. showed negative correlation to *Agriocnemis* sp. [r=-0.67].

The correlation coefficient 'r' for various physico-chemical parameters of water is given in Table 2. Water parameter correlations revealed 50.8% positive and 49.2% negative unions in which five pairs was high related [r=>0.6]. Table 2 revealed that the high positive correlation was observed in between the pairs of pH-PO_4, EC-SO_4, TH-DO, and TH-BOD in which high negative unions were in the pH-PO_4 and TH-BOD. The data showed that pH bears negative relation with PO_4 [r=-0.66]. It indicates that resulting pH of the water sample depends upon phosphate and TH on BOD. The analysis is very useful in the rapid study of water quality.

Regarding the correlation of water parameters more contribution are paid [10]. They reported highly positive correlation between EC-TDS, EC-Cl, EC-Mg TH-Mg TDS-Cl TDS-MG and Cl-Mg from Coimbatore. High correlated parameters between EC-TDS, TDS-HCO, Mg-Cl and HCO-RSC from Sonai, Ahmednagar district [11]. They also noticed high correlation between the parameters TA-TH, Cl-SO_4 and Mg-Cl from Pravara area Ahmednagar district Maharashtra [12]. Shah [13] reported thirty five unions [64%] positive and twenty unions [36%] unions negative related from the fifteen rail stations in between Ahmedabad to Khedbrahma route. Patel & Desai [14] noticed positive correlation between forty two unions and rest was negative related from water of Surat district. So, it reveals that the correlation studies of the water quality parameters have a great significance in the study of water sources. The relation between water parameters varies water to water, season, location, industrialization, uncontrolled population, agriculture, soil and rock conditions of water habitats.

The synchronized correlation in between water parameters v/s macroinvertebrates was noticed 55.6% and 44.4% positive and negative unions in which eight pairs were high relative and five were highest relations. The species *P. orientalis* represented negative relationship to calcium, and sulphates as r=-0.89, and -0.68 respectively. A species *M. metcalfei* noticed negative correlation with biological oxygen demand such as r=-0.60. A rotifer species M. *meretri* reported positive [r=0.63] with chlorides. A species *Bithynia sp* depicted highly positive relation with calcium such as r=0.82. The unions of *Bulimus sp* with cadmium revealed positive relation [r=0.71]. A species *Culex & Anaphels* showed relation with Potassium and Total Alkalinity positively such as r=0.66 and 0.80 respectively. Species *Chironomous sp* and *Diplonychus sp*. dipcted positive corrélations. Species *Agriocnemis sp, Asellus sp,* and *Gemmarus sp*. reveraled positive [0.75], negative [-0.70] and [-0.63] relations respectively.

Thus, to draw the curtain close, it can say those relationship patterns are the most essential to host–guest commodity for all living organisms. To live happily and healthy and helps others to live same way of close and satisfied relationships. The sense of happiness with the root of belongingness creates the context of organism's sense of well

being. The correlation results in macroinvertebrates revealed positive and negative combinations. Water parameter correlations revealed less positive. The relation between water parameters v/s macroinvertebrates species was noticed more positive and less negative unions.

Table 1. Correlation among the macroinvertibrate species

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 *P. orientalis*	1.0	-0.24	-0.11	-0.12	-0.70	-0.19	-0.24	0.29	-0.06	-0.32	-0.32	0.02	0.17	-0.17	-0.10	-0.03	-0.51
2 *M. metcalfei*		1.0	-0.01	-0.72	0.54	-0.54	-0.46	-0.67	-0.13	0.38	0.06	-0.49	-0.23	-0.01	-0.03	0.15	0.46
3 *M. meretri*			1.0	0.12	0.43	0.14	0.10	-0.19	0.24	0.27	0.20	0.60	-0.03	-0.43	0.40	0.08	0.43
4 *Robertsiella sp.*				1.0	-0.18	0.57	0.60	0.37	0.35	-0.27	0.07	0.46	0.43	-0.21	0.27	0.25	-0.14
5 *Bithynia sp.*					1.0	-0.14	-0.20	-0.32	0.13	0.66	0.05	0.02	-0.07	-0.16	0.49	0.22	0.45
6 *Iravadia sp.*						1.0	0.87	-0.04	0.22	0.04	-0.29	0.43	0.42	0.01	-0.21	-0.57	-0.14
7 *Bulimus sp.*							1.0	0.05	0.21	-0.12	0.04	0.59	0.13	-0.09	-0.22	-0.47	0.04
8 *Lymmnaea sp.*								1.0	0.11	-0.31	0.02	0.42	-0.16	-0.01	0.25	0.12	-0.43
9 *Culex & Anaphels*									1.0	-0.35	0.34	0.19	-0.01	0.05	0.06	0.22	-0.03
10 *Chironomous sp.*										1.0	-0.55	0.06	0.18	-0.45	0.33	-0.14	0.29
11 *Rnatra sp.*											1.0	0.08	-0.67	0.16	-0.03	0.35	0.42
12 *Diplonychus sp.*												1.0	-0.13	-0.50	0.26	-0.22	0.07
13 *Agriocnemis sp.*													1.0	-0.07	0.09	0.06	-0.32
14 *Asellus sp.*														1.0	-0.57	-0.17	-0.09
15 *Gemmarus sp.*															1.0	0.48	-0.13
16 *Cepitella sp.*																1.0	0.27
17 *Namalycastis sp.*																	1.0

Macroinvertebrates species are represented by their code number (1-17).

Table 2. Correlation between water characteristics.

	pH	EC	TDS	TH	Ca	Mg	Na	K	Cl	TA	SO_4	PO_4	NO_3	DO	BOD	COD
pH	1.0	0.13	-0.57	0.31	0.06	-0.24	0.15	-0.03	0.07	-0.13	-0.14	-0.66	0.40	0.21	0.17	-0.23
EC		1.0	-0.08	0.13	0.19	-0.34	-0.31	-0.09	-0.04	0.28	0.62	-0.03	0.13	0.04	-0.09	-0.30
TDS			1.0	-0.35	0.26	0.31	-0.06	0.11	0.22	-0.16	0.21	0.46	-0.22	-0.25	-0.23	0.48
TH				1.0	-0.14	-0.09	-0.41	0.19	-0.11	0.29	-0.46	0.55	-0.33	0.73	-0.65	-0.06
Ca					1.0	0.001	-0.42	0.32	0.40	-0.17	0.50	0.09	-0.37	0.03	-0.36	0.06
Mg						1.0	-0.08	0.02	-0.12	-0.02	-0.37	-0.18	-0.13	0.13	-0.46	0.11
Na							1.0	-0.28	-0.19	-0.28	-0.55	0.07	0.23	0.25	-0.05	0.46
K								1.0	-0.03	0.46	-0.01	-0.01	-0.40	025	-0.54	0.52
Cl									1.0	-0.29	0.43	-0.38	0.02	0.34	0.17	0.14
TA										1.0	-0.25	-0.03	0.13	0.05	-0.25	-0.01
SO_4											1.0	0.16	-0.25	-0.18	0.22	-0.30
PO_4												1.0	-0.47	-0.56	-0.04	0.11
NO_3													1.0	-0.10	0.45	-0.14
DO														1.0	-0.55	0.44
BOD															1.0	-0.55
COD																1.0

Table 3. Synchronized correlation between water parameters and macroinvertebrates species

	pH	EC	TDS	TH	Ca	Mg	Na	K	Cl	TA	SO_4	PO_4	NO_3	DO	BOD	COD
1	-0.20	-0.44	-0.13	0.12	-0.89	0.11	0.39	-0.11	-0.43	0.27	-0.68	0.01	0.43	-0.16	0.29	0.13
2	-0.21	-011	-0.20	-0.22	0.35	0.49	-0.30	0.30	-0.12	-0.01	-0.08	-0.09	-0.51	0.43	0.60	0.03
3	0.04	-0.12	0.30	0.38	0.23	0.49	-0.32	0.16	0.63	-0.04	0.13	-0.57	0.19	0.23	0.04	0.17
4	0.11	0.23	0.15	-0.15	0.09	-0.33	0.17	0.25	0.17	-0.01	0.30	0.21	0.02	-0.19	0.09	0.37
5	-0.20	0.23	0.16	0.02	0.82	0.09	-0.59	0.32	0.55	0.02	0.54	-0.09	-0.34	0.27	0.36	0.06
6	0.15	-0.17	0.42	-0.43	0.14	-0.03	0.31	0.04	0.40	-0.05	-0.10	0.05	-0.06	0.08	-0.06	0.33
7	0.27	0.09	0.24	-0.43	-0.01	-0.05	0.35	0.03	0.33	-0.05	0.01	-0.12	-0.13	0.34	-0.16	0.29
8	0.11	0.45	-0.29	0.40	-0.42	-0.70	0.11	-0.29	-0.03	0.27	0.25	0.03	0.52	-0.21	0.62	-0.25
9	0.17	0.26	-0.03	-0.05	0.17	0.03	-0.40	0.66	-0.07	0.80	-0.07	-0.16	0.03	0.001	-0.26	0.05
10	-0.43	-0.21	0.35	-0.13	0.42	-0.03	-0.25	0.07	0.68	-0.26	0.30	0.04	-0.29	0.28	-0.11	0.27
11	0.45	0.57	-0.26	0.43	0.10	0.18	-0.45	0.01	-0.21	0.09	0.34	-0.37	0.05	-0.07	-0.02	-0.51
12	0.20	0.25	0.15	0.20	-0.18	-0.05	0.10	-0.09	0.62	0.08	0.16	-0.54	0.41	0.41	0.15	0.20
13	-0.21	-0.53	0.48	-0.48	0.17	-0.08	0.46	0.36	0.06	-0.14	-0.30	0.43	-0.09	-0.12	-0.16	0.75
14	0.50	-0.07	-0.56	0.10	0.18	-0.16	0.14	-0.22	-0.33	-0.05	-0.19	0.05	0.05	-0.28	0.16	-0.51
15	-0.63	0.33	0.48	0.13	0.22	0.02	-0.32	0.09	0.29	0.01	0.56	0.28	-0.07	-0.11	-0.03	0.21
16	-0.10	0.20	-0.02	0.26	0.16	-0.19	-0.39	0.50	-0.19	0.06	0.38	0.15	-0.18	-0.22	0.01	0.06
17	0.36	-0.06	-0.15	0.27	0.38	0.13	-0.47	0.27	0.43	-0.37	0.34	-0.52	0.35	0.33	-0.06	-0.14

Macroinvertebrates species are represented by their code number (1-17).

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