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Seasonal Variation in Benthic Structure (Composition and Abundance) of Halali Reservoir (Vidisha- India)

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Abstract*: Present paper embodies the seasonal macroinvertebrate community dynamics of Halali reservoir which is 40 kms away from the Bhopal. The work was carried out seasonally during winter, summer, monsoon and post-monsoon seasons 2010-2011. A total number of forty two macoinvertebrate species have been recorded from four sampling stations that belong to eight groups namely Diptera, Odonata, Crustaceae, Ephemeroptera, Oligochaeta, Hirudinea, Gastropoda and Bivalvia. The sequence of their abundance were found in the order- Gastropoda 19 species (45.23%), Diptera and Oligochaeta 6 species each (14.28% each), Odonata and Bivalvia 3 species each (7.14% each), Ephemeroptera and Hirudinea 2 species each (4.76% each), Crustacea 1 species (2.38%).*

Key Words;- *Macrobenthos, Seasonal variation, Gastropoda, Halali Reservoir.*

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I. Introduction:-

Reservoirs are sleeping giants for generating self-employment, increasing production, assuming nutritional security, rural development, generating value added aquatic products with public and private participation [1]. Freshwater ecosystems are inhabited by great variety of organisms. Benthic macrofauna play a vital role in the circulation and recirculation of nutrients in aquatic ecosystems. They constitute the link between the unavailable nutrients in detritus and useful protein materials in fish and shellfish. Most benthic organisms feed on debris that settle on the bottom of the water and in turn serve as food for a wide range of fishes [2]. Factors that influence whether or not invertebrates settle in an aquatic ecosystem include the flow of organic and inorganic materials in the basin, temperature, oxygen content, light penetration, water flow rate, substrate type, food availability and predation by fish and invertebrate predators [3].

II. Materials and Methods:-

During the present study four sampling stations named S1 (fish landing), S2 (patra nallah), S3 (Halali river) and S4 (boat club) of the study area have been selected.

Some important morphometric features of the Halali reservoir:

Year of construction	1976
Type of dam	Earthen
River	Halali
Basin	Betwa
Location/District	Raisen/Vidisha
Latitude	23º 49´N
Longitude	77º 50´E
Shoreline	65 km
Maximum depth	29.5 m
Mean depth	5.3 m
Water spread area	5959 ha

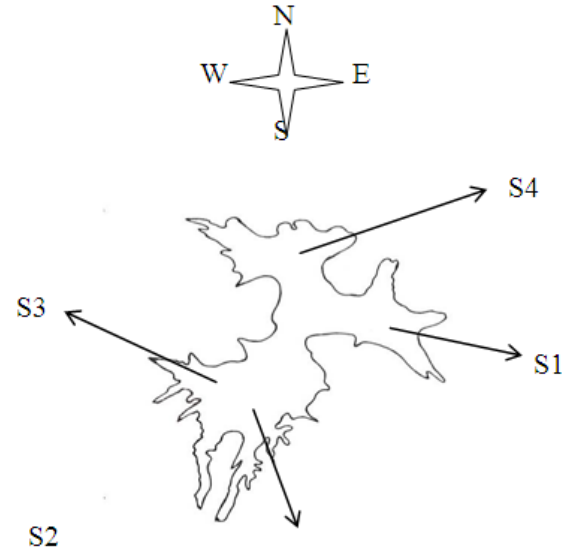

Fig 1 Map showing different sampling stations of Halali reservoir

The water and mud samples were collected in winter (January), summer (April), monsoon (July) and post-monsoon (October) seasons, 2010-2011. Sediment samples collected from four stations with the help of Peterson grab mud sampler (area or 2.7 m^2) were sieved through 1mm and 0.5 mm size mesh sieves alternately in the way so that all the organisms present in the sample are collected. The organisms thus retained on the sieves were transferred to sample bottles containing 4% formalin solution, carried safely to the laboratory and identified under binocular light microscope with the help of standard taxonomic references [4, 5, 6, 7, 8]. The population density of benthic fauna was estimated by the equation.

Calculation:

$$\text{Individuals}/m^2 = \frac{N \times 10^4}{A}$$

Where, N = No. of organisms/sample

A = Area of sampler (cm^2).

III. Results and Discussion:-

During the present study 42 macroinvertebrate species have been reported from the four study sites belonging to 8 groups, which in the order of their abundance are found as: Gastropoda (19 species), Oligochaeta and Diptera (6 species each), Odonata and Bivalvia (3 species each), Ephemeroptra and Hirudinea (2 species each), Crustacea (1species)

Table 1. Seasonal qualitative and quantitative evaluation of benthic population in Halali reservoir

S No.	Taxa	Individuals / m^2			
	Diptera	**Winter**	**Summer**	**Monsoon**	**P-monsoon**
1	*Chironomous sp.*	9	9	11	6
2	*Culicoides*	4	6	6	9
3	*Simulum*	2	8	9	6
4	*Spaniotoma*	4	8	9	6
5	*Limnophora sp.*	-	-	-	2
6	*Tripula sp.*	8	2	-	6
	Odonata				
7	*Gomphus sp.*	13	7	6	6
8	*Agrion sp.*	8	6	2	6
9	Corduligaster sp.	-	-	-	4
	Crustacea				
10	*Palemone sp.*	9	6	-	11
	Ephemeroptera				
11	*Caenis runlorum*	6	6	2	8
12	*Baetis nymph*	4	2	-	7
	Oligochaeta				
13	*Lumbricullus sp.*	4	15	17	7
14	*Nais sp.*	7	17	22	7
15	*Tubifex tubifex*	11	18	24	6
16	*Tubifex sp.*	14	22	13	7

17	*Pheretima sp.*	2	4	9	2
18	*Chaetogaster*	-	2	2	-
	Hirudinea				
19	*Hirudineria glossophonia*	17	24	22	11
20	*Eropbdella octulata*	4	6	8	6
	Gastropoda				
21	*Bellamya bengalensis*	26	24	24	17
22	*B. crassa*	6	8	13	4
23	*B. heliciformis*	8	13	9	4
24	*B. micron*	4	6	8	2
25	*Brotia costula sp.*	9	15	17	6
26	*Digoniostoma pulchella*	4	11	17	4
27	*Gabbia travancorica*	2	2	11	4
28	*Gyraulus convexiculus*	-	4	2	-
29	*Lymnaea auricularia*	2	4	11	4
30	*L. accuminata*	-	4	-	-
31	*L. articulates*	-	4	4	6
32	*Paludomus acuta*	6	8	8	2
33	*P. andersoniana*	-	4	9	4
34	*P. obesus*	4	15	19	11
35	*P. palustris*	7	8	11	11
36	*Planorbis velifer*	-	2	4	-
37	*Thiara punctate*	21	19	30	11
38	*T. tuberculate*	22	15	26	17
39	*T. tuberculata crebra*	9	21	21	13
	Bivalvia				
40	*Corbicula striata*	9	15	19	4
41	*C. fluminalis*	-	13	8	-
42	*Parreysia ocata*	7	9	11	8
Total No. of Species		33	40	36	37

Table 2. Class wise qualitative distribution of macroinvertebrates at four stations of Halali reservoir

Class	**S1**	**%**	**S2**	**%**	**S3**	**%**	**S4**	**%**
Gastropoda	18	56.25	13	38.23	8	36.36	11	57.89
Oligochaeta	5	15.62	6	17.64	4	18.18	2	10.52
Diptera	4	12.5	6	17.64	3	13.63	1	5.26
Odonata	2	6.25	2	5.88	2	9.09	1	5.26
Bivalvia	0	0	3	8.82	3	13.63	1	5.26
Ephemeroptera	1	3.12	2	5.88	0	0	1	5.26
Hirudinea	1	3.12	1	2.94	2	9.09	1	5.26
Crustacea	1	3.12	1	2.94	0	0	1	5.26
Total	**32**	**100**	**34**	**100**	**22**	**100**	**19**	**100**

Out of the 42 species, 8 were recorded from all four stations (*Gomphus sp, Nais sp, Tubiex sp, Bellamya bengalensis, B. heliciformis, Paludomus obesus, Thiara punctata and T. tuberculata*). Gastropoda was found as the most abundant group, both in terms of season (22 species in summer) and station (34 species at S2). This may be due to the alkaline nature and calcium content of water and presence of aquatic vegetation such as *Vallisnera spiralis, Potamogeton, Hydrilla, Najas* which provide suitable shelter and food to them. The same results of maximum population have also been reported by other workers [9, 10].

Diptera supports the higher degree of pollution. Chironomous larvae have a great capability of indicating slight or moderate pollution by organic enrichment. They remain unaffected by oxygen depleting wastes while others possess special adaptations for obtaining oxygen from the atmosphere [11].

Odonata and Bivalvia are reported with 3 species each. Odonata are clean water indicators so it is possible to find them easily in high oxygen concentration areas. Temperature is one of the main factors controlling the diversity and density of aquatic insects which is supported by Huryn and Wallace [12] and Huryn [13]. Among the three species of Bivalvia the density of *Corbicula striata* was found highest (12 individuals/m^2). A high quantitative enumeration of *Corbicula striata* was also recorded in Upper and Lower basins of Bhojwetland, Bhopal [9].

Table 4. Class wise quantitative distribution of macroinvertebrates (individuals/m^2) at four stations of Halali reservoir

Class	**S1**	**%**	**S2**	**%**	**S3**	**%**	**S4**	**%**
Gastropoda	68	40.83	35	21.11	21	12.7	42	25.27
Oligochaeta	16	27.2	28	48	9	15.2	6	9.6
Diptera	11	34.78	15	47.82	4	13.04	1	4.34
Odonata	6	46.66	1	10	4	26.66	2	16.66

Bivalvia	0	0	10	38.59	15	57.89	1	3.50
Ephemeroptera	3	33.33	3	33.33	0	0	3	33.33
Hirudinea	6	23.07	1	3.84	16	67.30	1	5.76
Crustacea	2	35.71	1	21.42	0	0	3	42.85

Ephemeroptera and Hirudinea were found with two species each. Hirudinea prefer to live in shallow, warm, swampy areas and are found attached to the vegetation as they feed on decaying organic matter. Almost all species of leaches are used in hirudotherapy for bloodletting. A hirudin, an anticoagulant substance present in the saliva of leeches is pharmacologically important [14].

IV. Conclusion:-

From the present study, it can be concluded that the study area has a normal benthic structure that gets varied from season to season. These variations may be attributed to the combined effect of change in shelter and food availability, fish predation, life cycle, temperature variation, availability of organic sources and presence-absence of aquatic vegetation such as *Vallisneria spiralis, Spirogyra, Hydrilla* etc. which provide a suitable habitat and food source to different macroinvertebrate species inhabiting the very aquatic system.

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