"Assessment of Nutrient Dynamics and Physico – Chemical Status of Freshwater Reservoirs of Vadodara District, Gujarat, India"

SUMMARY

Considering the importance of freshwater reservoirs in general and smaller (wetland type) reservoirs in particular; the current study was designed. Specific objectives were to investigate nutrient dynamics and variability in physico-chemical properties of water and sediments; assessment of floral (phytoplankton) and faunal (avifauna) diversity at three (03) reservoirs of Vadodara District, Gujarat, India. Evaluation of the study sites on the basis of above properties was the terminal objective. The study sites were selected based on specific characteristics that they possessed in terms of area, surrounding land-use, climatic condition, utility of reservoir water etc. All the study sites, viz., Timbi, Vadadala and Dhanora, were reasonably comparable in above properties.

Representative water samples were collected on monthly basis whereas, sediment samples were collected during the pre-monsoon and post-monsoon seasons. Water sampling duration for Timbi was from January, 2016 to March, 2018, whereas, for Vadadala and Dhanora it was from August, 2016 to March, 2018. The sample collection, preservation and analysis was done as per the existing standard protocol. Water quality parameters selected for investigation were Temperature, pH, Electrical Conductivity (EC), Dissolved Oxygen (DO), Chlorophyll–a (Chl–a), Nitrate, Phosphate, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Total Solids (TS) and Chloride.

A total of four (04) composite sediment samples were collected from the study sites from August, 2016 to March, 2018 encompassing two (02) pre-monsoon season and two (02) post-monsoon seasons. The sample preparation and analysis was done using the standard protocol. Sediment quality parameters selected for investigation were Temperature, pH, EC, Organic Carbon (OC), Organic Matter (OM), Nitrate and Phosphate. Phytoplankton were sampled, identified and enlisted and a reservoir wise presence – absence inventory was prepared. Checklist of avifaunal diversity was prepared during entire duration of the research work at each study site.

Data management and data analysis was done using MS Excel as well as SPSS software. Pearson's correlation (for all sites and site wise) calculation, ANOVA and Post-Hoc analysis was done for analyzing the similarity and dissimilarity among the study sites based on parameters estimated for water quality. Sorenson's Similarity Index was calculated for the pairs of study sites using the presence-absence data of phytoplankton diversity and avifaunal diversity; which was expressed as % (percentage) similarity between the sites.

Water Quality

The average values of water quality parameters are as follows:

Sr. No.	Parameter	Timbi	Dhanora	Vadadala
1	Temperature (°C)	23.1°C	22.2°C	22.3°C
2	pH	7.9	8.0	8.1
3	EC (µS/cm)	335.1	327.3	352.4
4	DO (mg/l)	5.1	5.1	4.9
5	Chl – a (µg/l)	23.7	24.7	23.8
6	Nitrate (mg/l)	1.2	1.3	1.4
7	Phosphate (mg/l)	0.2	0.2	0.3
8	TDS (mg/l)	334.5	385.4	367.3
9	TSS (mg/l)	32.6	37.9	37.8
10	TS (mg/l)	367	423.3	4.5
11	Chloride (mg/l)	69.5	7.03	71.4

Temperature, pH, EC, Chl –a, TDS and Chloride were high during the summer season; DO levels were high during the winter seasons whereas Nitrate, Phosphate and TS were high during the monsoon season. Agricultural practices in catchment area is responsible for addition of nutrient and dissolved solid into these reservoirs. Parameters pH, EC, Chl – a and chloride showed strong positive correlation with temperature, while negative correlation of Dissolved oxygen with temperature indicates more dissolution of oxygen at cold temperature. Phosphate and nitrate show positive correlation. Chloride shows strong correlation with most of the parameters except nitrate, phosphate and Total Suspended Solids. In Dhanora wetland, nitrate and phosphate show strong correlation with TSS with values,whereas, in Timbi only phosphate shows high correlation with both TDS and TSS. In case of Vadadala nitrate have very strong correlation with TSS phosphate is not having significant correlation with either TDS or TSS. Chl – a does not show any correlation in Dhanora wetland, but it has significantly positive correlation with temperature, pH, EC and chloride in Timbi reservoir, while in Vadadala reservoir it shows positive correlation with temperature, EC, TDS, TS and chloride.

ANOVA test indicate that level/concentration of pH, Total solids, Nitrates and Phosphate in water significantly different in wetlands ($p<0.05$). Post-hoc analysis indicates that level of pH of Dhanora is similar to that of Vadadala and Timbi ($p>0.05$). The pH of Timbi and Vadadalais significantly different from each other and pH of Vadadalais higher than that of Timbi ($p< 0.05$). In case of Total solids Vadadala and Dhanora wetland have significantly higher concentration than Timbi ($p<0.05$).

Sediment Quality

The average values of sediment quality parameters are as follows:

Sr. No.	Parameter	Timbi	Dhanora	Vadadala
1	Temperature (°C)	23.53	22.83	23.13
2	pH	7.75	7.89	7.81
3	EC (µS/cm)	362.00	356.75	385.00
4	OC (%)	1.19	1.23	1.24
5	OM (%)	1.87	2.16	2.25
6	Nitrate (ppm)	1.55	1.50	1.49
7	Phosphate (ppm)	0.27	0.30	0.30

The pH of the sediments at all the three reservoirs remained slightly alkaline during the study period. The EC, OC, OM were partially higher in the pre-monsoon season in comparison to the post-monsoon seasons. As a general trend observed at the study sites, the concentration of Nitrogen and Phosphorous was higher during the pre-monsoon season.

Phytoplankton Diversity

30 species of phytoplankton belonging to 05 (five) classes were present during the study period. Timbi showed highest diversity with 24 species followed by Dhanora with 22 species and Vadadala with 17 species. *Mallomonas* sp. belonging to class Chrysophyceae was only present in Timbi which is a typical inhabitant of shallow water bodies similar to the ones under investigation. Sorenson's similarity index show that Dhanora and Vadadala are 56 % similar with respect to phytoplankton diversity, whereas they are similar to Timbi with 72 % and 71 % similarity, respectively.

Avifaunal diversity

A total of 71 bird species were recorded belonging to 39 families during the study period. Highest diversity was present at timbi with 64 species, followed by Dahnora with 47 species and Vadadala with 42 speceis. Out of the total, 36 were the wetland birds and 35 were the non-wetland birds.

As per the Sorenson's Similarity index, Vadadala and Dhanora were most similar amongst the other pairs with 79 % similarity followed by Timbi and Vadadala with 70 % similarity and Timbi and Dhanora with 68% similarity with respect to bird diversity.

Water and sediment quality, phytoplankton and avifaunal diversity, in addition to the absence of any visual signs of deteriorated status indicate that all the three study sites are in their ecological integrity.

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