



Assessment of Water Quality of Hassan lakes by NSF-Water Quality Index

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ABSTRACT

Surface water qualities of eight lakes of Hassan district, Karnataka were assayed using the National Sanitation Foundation Water Quality Index (NSF-WQI). The calculation involves a minimum number of simple parameters. It is based on weight age of parameters derived by water quality experts. Hunsekere Lake, Jenevara Lake and Manipura Lake are rated as bad, with very low WQI values. The other seven are rated as almost medium with WQI ranging between 50 and 70. Water temperature and oxygen saturation levels have an impact on water quality. Excellent or good water quality lakes do not exist in this district. Total Maximum Daily Loads (TMDL) for various chemicals flowing into the lakes must be monitored to render the water pristine. The index can serve as a tool for surface water quality monitoring.

Keywords : Hassan, Lakes, WQI, medium, bad, water temperature, oxygen saturation

Introduction

Ecosystem structure characteristics like biodiversity, abundance and organism's health provide a way to assess lake water quality. Water Quality Index (WQI) is a means to summarize, large amount of water quality data into simple terms. This provides a means for reporting to management and the public in a consistent manner. Traditional reports on water quality typically consist of complex variable by variable and water body by water body statistical summaries. Water quality experts make use of such data, but a common man would require a concise data about the quality of a particular lake in his surroundings. Many water quality variables are comparable to water quality guidelines. The results of these comparisons are combined to generate a water quality rating for individual sites. The advantage of an index includes its ability to combine parameters in a variety of different measurement units into a single metric and its effectiveness as a communication tool. It can be used to convey relative differences in water quality between sites spread over long distances. The NSF-WQI reduces technical water quality data requirements. It is simple and more appropriate in grading surface water quality. The number of parameters to be used is less.

The present work is an attempt to determine the water quality of eight lakes of Hassan district using the NSF-WQI.

Materials and methods

Hassan district is located on the border of the Western Ghats in the Southern part of Karnataka State. It is located between 12° 30' and 13° 35' North latitude and 75° 15' and 76° 40' East longitude. The district is divided into eight taluks. The major part of the district is in Cauvery river main basin drained by Cauvery, Hemavathy and Yagachi rivers, which flow towards East to join the Bay of Bengal. A small part of the Eastern side falls in West flowing river basin. About 20.5 % of the net sown area is irrigated by surface water. The major surface waters of the district are Arsekere

Lake, Pushkarne Lake, Dwarasamudra Lake, Hunsekere Lake, Holenarasipura Lake, Channarayapatna Lake, Jenevara Lake and Manipura Lake. The lake waters are mainly used for irrigation; they are often contaminated by domestic sewage, agricultural runoff and other anthropogenic activities. This has led to constant changes in the water chemistry variables.

Surface water samples from eight lakes were collected and analysed for eight water chemistry variables, seasonally for a period of two years (2008 to 2010). Standard methods were employed for determining the tests (APHA, 1995). Faecal coli forms were also determined (Aneja, 2004). Based on the NSF-WQI, water quality scores were calculated (MitchellWilliams, 2000). Eight water quality parameters were chosen, based on the weighted mean of the combined values. Field measurements were converted to index values by graphing the level of water quality (0-100), the curves were averaged and calculations were made (Keith Alvocks, JavaScript Webmaster). The details of the analysed water chemistry variables are defined in Table 1. The standard index values and rating of water quality are shown in Table 2.

Results and discussion

Surface water in Arsekere Lake remained medium water quality for three seasons during the period of study, but attained a rating of bad quality during winter and monsoon of the second year of study. In Pushkarne Lake the water quality was rated as medium throughout the study period. This is an indication that the water quality is usually protected but occasionally threatened or impaired, and the conditions in it sometimes depart from natural or desirable levels. It is reported that when the water quality index levels are very low, it is almost always threatened or impaired. Conditions in it usually depart from natural or desirable levels. Dwarasamudra lake water is rated as medium for almost all seasons, but remains in bad condition during summer and monsoon. The WQI values during other seasons reach 51, just above 50 which is the threshold levels specified for Bad quality water, and hence this lake water is categorized bad

Table 1: Physico-chemical variables and the Water Quality Index for Lakes of Hassan District (2008-2010)

Variables	W.T	pH	BOD	TSS	DO	PO4	NO3	FC	WQI	Rating
ARSEKERE LAKE										
Seasons										
Winter	28	7.0	3.1	934	3.63	2.6	1.4	3	57	Medium
Summer	26	7.5	12.3	934	2.42	2.4	1.6	2	50	Medium
Monsoon	32	7.0	10.1	485	5.25	1.5	2.7	3	61	Medium
Winter	31	8.5	6.1	120	0.81	1.9	2.6	3	47	Bad
Summer	29	8.5	7.3	100	1.21	2.5	1.7	4	50	Medium
Monsoon	26	7.0	12.4	960	2.20	2.5	2.5	2	48	Bad
PUSHKARNE LAKE										
Winter	26	7.5	13.2	800	2.42	0.35	0.05	4	54	Medium
Summer	22	7.5	4.2	600	2.02	0.30	0.06	5	58	Medium
Monsoon	27	8.0	0.4	980	1.62	0.40	0.10	4	60	Medium
Winter	28	8.0	4.3	220	0.8	1.30	0.00	3	55	Medium
Summer	20	6.5	3.7	460	2.42	1.40	0.15	3	54	Medium
Monsoon	21	7.5	8.1	725	1.62	1.60	0.17	3	51	Medium
DWARASAMUDRA LAKE										
Winter	27	7.0	8.9	964	4.84	0.7	0.10	3	51	Medium B
Summer	23	8.8	9.3	964	2.02	2.9	0.40	4	44	Bad
Monsoon	28	7.0	8.5	785	0.02	3.6	0.50	4	45	Bad
Winter	31	7.5	10.5	1610	2.83	2.9	0.60	3	51	Medium
Summer	26	8.5	11.4	1100	32.5	3.2	0.14	2	52	Medium
Monsoon	25	7.0	8.1	1610	2.02	0.7	0.15	3	53	Medium
HUNSEKERE LAKE										
Winter	22	8.0	6.5	1214	6.45	2.9	1.4	4	62	Medium
Summer	30	7.5	8.5	1214	4.44	2.2	2.7	4	56	Medium
Monsoon	21	7.5	8.9	1306	2.42	2.1	3.2	9	47	Bad
Winter	24	8.0	8.9	1240	2.42	2.0	1.6	8	48	Bad
Summer	34	7.0	10.5	1198	1.62	2.5	0.06	4	47	Bad
Monsoon	23	6.5	9.3	1260	1.21	2.8	2.5	3	47	Bad
HOLENARASIPURA LAKE										
Winter	32	7.5	36.9	870	8.07	0.11	0.00	2	67	Medium
Summer	26	7.5	32.4	880	16.1	0.20	0.10	2	60	Medium
Monsoon	24	6.5	32.4	895	9.28	0.10	0.11	3	66	Medium
Winter	20	7.0	36.9	1495	12.1	0.50	0.00	1	64	Medium
Summer	25	8.0	37.7	835	24.2	2.50	0.06	3	50	Medium
Monsoon	23	6.5	18.2	730	8.07	1.60	0.07	2	62	Medium
CHANNARAYAPATNA LAKE										
Winter	24	6.5	21.9	1206	9.28	1.0	0.01	4	60	Medium
Summer	18	8.0	25.9	968	0.81	0.19	0.20	8	47	Bad
Monsoon	32	7.5	27.9	1345	4.04	1.6	0.00	1	55	Medium
Winter	23	7.5	27.6	1178	10.49	2.6	0.10	12	57	Medium
Summer	21	8.0	37.7	1054	2.02	1.8	0.20	9	43	Bad
Monsoon	29	7.7	39.9	768	4.04	2.9	0.16	8	49	Bad
JENEVARA LAKE										
Winter	28	7.5	8.5	865	3.63	1.6	0.06	4	54	Medium
Summer	32	8.0	15.0	886	2.83	1.7	0.00	12	46	Bad
Monsoon	24	7.5	11.4	865	2.02	1.5	0.00	8	47	Bad
Winter	30	8.5	15.4	865	1.21	1.9	0.03	16	40	Bad
Summer	20	8.5	12.2	880	1.62	1.5	0.06	4	45	Bad
Monsoon	34	7.5	8.5	710	5.65	1.7	0.13	12	58	Medium
MANIPURA LAKE										
Winter	22	8.0	6.1	875	6.46	2.6	1.5	3	63	Medium
Summer	22	7.5	6.9	855	2.42	2.4	0.10	4	51	Medium
Monsoon	23	8.0	8.5	585	2.05	1.5	0.25	4	49	Bad
Winter	28	8.0	10.5	534	1.62	1.4	1.8	3	48	Bad
Summer	21	7.0	11.4	605	2.42	2.4	0.15	3	49	Bad
Monsoon	22	8.0	14.6	621	2.42	1.5	1.6	3	48	Bad

WT: Water temperature ° C; BOD: Biochemical Oxygen Demand; TSS: Total Suspended Solids; DO: Dissolved Oxygen; PO4: Total phosphates; NO3: Nitrates (all values expressed as mg/L) FC: Faecal coli forms (#dL); WQI = Water Quality Index

Table 2: Water Quality Index Legend

Range	Quality
90 to 100	Excellent
70 to 90	Good
50 to 70	Medium
25 to 50	Bad
00 to 25	Very bad

The quality of water in Holenarasipura Lake follows that of Pushkarne Lake with water quality being medium. The WQI values for Channarayapatna Lake are very low and the lake water is rated as bad although the rating rises to medium during one season only. However Hunsekere Lake, Jenevara Lake and Manipura Lake had low water quality indices and are therefore rated as bad. The remaining lakes were rated as medium.

Surface waters with high index (95-100) are rated as Excellent, where the water quality is protected with a virtual absence of threat or impairment; where the conditions remain close to natural and pristine levels. Such lakes are not found in Hassan district. The next category of "Good" water quality was not reported based on the water quality index. Medium to bad water quality lakes are predominant in the district.

It is often noticed that sudden changes in water temperature are attributed to changes in water quality index. Many of the earlier workers like Awammawar & Shridhar, 2007; Ramakrishnan et al., 2009; Chavan et al., 2009; Brown et al., 1970; Pradyusa et al., 2009; Basavarajappa et al. 2009; Siddaraju et al., 2010), have reported the effect of water temperature on water quality. Jayashankara et al., (2010) have stressed the importance of Oxygen saturation levels that can also change the quality of water. The importance of water quality indices in monitoring polluted water bodies in lakes have been stressed by Hosmani et al., (2011) and the index can serve as a useful tool in water quality monitoring

Conclusion

The NSF-WQI used for rating of surface water quality in eight lakes of Hassan district indicate that three lakes, Hunsekere Lake, Jenevara lake and Manipura Lake reach levels of low water quality indices and are rated as bad. The other lakes with minor differences are rated as medium. Good or excellent water quality lakes are not found in the district. The index is simple and requires minimum water quality data for calculations. It can provide a convenient means of summarizing complex water quality data and facilitates communication to water quality managers and the general public. Regulating the total maximum Daily Load of water chemistry variables could help to increase the index values and thereby restore pristine water quality of the lakes.

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