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CHANGES IN TROPHIC STATUS: A STUDY ON RESTORED FRESHWATER LAKE, KALABURAGI (GULBARGA), KARNATAKA STATE

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Abstract: In the present study attempt has been made to evaluate trophic status of freshwater lake, Kalaburgi city, Karnataka during two distinct phases of lake, i.e. before restoration (2005-06) and after restoration (2012-13). The results clearly state that, before restoration the lake was under eutriphic condition (TSI values are 71 to 73), which intern impact on the diversity of biotic community. After restoration (TSI values are 43 to 46) the lake is under oligotrphic condition and supporting high diversity of biotic community.
Keywords: Freshwater Lake, TSI index, Kalaburagi.

INTRODUCTION

Determining the trophic state in lakes is essential for the purpose of evaluating and managing the water quality. Generally, nutrients concentration (tota1 phosphorus; TP or total nitrogen; TN), chlorophyll a concentration and transparency have been provided as useful factors to decide the trophic level. A number of researchers have indicated the trophic state using above mentioned parameters (Dion and Rigler, 1974; Carlson, 1977; Vollenwieder, 1976; Forsberg and Ricing, l980 and Aizaki *et al.,* 1981). However, TP and transparency is variable when inorganic particulate materials flow into 1ake water from watershed. Chlorophyll a concentration was used an indicator for phytoplankton biomass, but it can not be expressing the production of organic matter by phytoplankton. The ranges in photosynthetic rate have been suggested for determining the trophic state (Rodhe, 1969; Likens, 1975). However, Ryther (1960) showed that integrate photosynthetic rate over the photic zone in an oligotrophic lake are nearly as high as that in a eutrophic lake. Ichimura and Aruga (1964) have suggested criteria for trophic state with photosynthetic carbon assimilation Rumber (AN, maximal preductivity at optimal light intensity in terms of unit amounts of chlorophyll a) which has been known as high values in the high nutrient conditions (Falkowski, 1980).

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The trophic state is defined as the total weight of living biological material (*biomass*) in a water body at a specific location and time. Trophic state is understood to be the biological response to forcing factors such as nutrient additions (Naumann, 1929). In accordance with the definition of trophic state given above, the trophic state index (TSI) of Carlson (1977) uses algal biomass as the basis for trophic state classification. Three variables, chlorophyll pigments, Secchi depth, and total phosphorus, independently estimate algal biomass.

Materials and Methods

Kalburagi township situated in the northern part of Karnataka state, which falls under 76^0 04″ to 77^0-42″ N Latitude and 16° 12″ to 17^0 46″ E Longitude (Fig. No. 6) and it is 454 m above MSL. Sharanabasaveshwara lake situated in the heart of the city having an area of 158 acres.

Using these measurements based on typical ranges for phosphorus, chlorophyll a and Secchi depth values were done according to APHA 2000 and Carlson (1977)

Calculation of TSI values by using following formula

TSI - P = 14.42 * Ln [TP] + 4.15 (in ug/L)

TSI - C = 30.6 + 9.81 Ln [Chlor-a] (in ug/L)

TSI - S = 60 - 14.41 * Ln [Secchi] (in meters)

Average TSI = [TSI-P + TSI-C + TSI-S]/3

Results and Discussion

During the present study the trophic index values of Sharanabasaveshwara lake presented in Table No. 1 and 2.

Before restoration of lake the (2005-06), the sacche disk values ranged between 1.1m and 58 (northeast monsoon season), 0.8 m (summer season), 0.7 (southwest monsoon season), whereas after the restoration of lake the secchi disk values were ranged between 2.9m (northeast monsoon season), 2.4m (summer season), 2.1m (southwest monsoon season) respectively

Before restoration the chlorophyll values were recorded in different seasons, 79.2 ppm and (northeast monsoon season), 83.8 (summer season), 67.9 (southwest monsoon season). While after the restoration of lake the chlorophyll values were recorded, 6.5(northeast monsoon season), 8.3 (summer season), 4.1(southwest monsoon season) respectively.

Total phosphorus values of 2005-06 (***before restoration***) were ranged between 215 (northeast monsoon season), 198 (summer season), 233 (southwest monsoon season), where as after the restoration (2013-14) the phosphorus values ranged between 11 (northeast monsoon season), 12 (summer season), 33 (southwest monsoon season) respectively.

The average trophic state index values (TSI) were ranged between 71 to 73 (***before restoration***) and 43-46 (***after the restoration***) respectively.

The values of the three variables, index for each parameter and average of their attributes are all presented in Table No 22 These index values plotted in table No 23 to denote the relative ranking of the average Trophic State Index. Based on the trophic state index results, before restoration the Sharanabasaveshwara lake shown TSI values between 70-80, where as after restoration of the lake, TSI values varied between 40-50. before restoration the water transparency (S.D) of Sharanabasaveshwara lake was between 1.1 m (max) to 0.7 m (min), while after restoration (2013-14) the S.D was 2.9 m to 2.1m respectively .The high values of chlorophyll-a was recorded in summer and low values were noticed in southwest monsoon season in both the periods. The phosphorus content was high in northeast monsoon season and low amount was observed in summer. By the calculating the Trophic State Index of 2005-06, the Sharanabasaveshwara lake was attributed to eutrophic where water is less clear, algal bloom is high and light limited productivity and after restoration, the Trophic State Index values indicate Sharanabasaveshwara lake water was clear and productive. It supported for high diversity and density of biotic component of lake.

Table 1: Trophic State Index of Sharanabasaveshwara lake

Year / season	S.D	CHL	TP	TSI (SD)	TSI(CHL)	TSI (TP)	Average TSI
2005-06							
NEM	1.1	79.2	215	58	73	81	71
Summer	0.8	83.8	198	63	74	80	72
SWM	0.7	67.9	233	65	71	82	73
2013-14							
NEM	2.9	6.5	11	44	48	38	43
Summer	2.4	8.3	12	47	51	39	46
SWM	2.1	4.1	33	49	37	54	46

Table No 2: CARLSON'S TROPHIC STATE INDEX (TSI)

TSI <30	Classic Oligotrophy; Clear water, oxygen through the year in the hypolimnion, salmonid fisheries in deep lakes.
TSI 30-40	Deeper lakes still exhibit classical oligotraphy, but some shallower lakes will become anoxic in the hypolimnion during the summer.

TS 40-50	Water moderately clear, but increasing probability of anoxia in hypolimnion during summer.
TS 50-60	Lower boundary of classical eutrophy: Decreased transparency, anoxic hypolimnion during the summer, macrophyte problems evident, warm-water fisheries only.
TSI 60-70	Dominance of blue-green algae, algal scums probable, extensive macrophyte problems.
TSI 70-80	Heavy algal blooms possible throughout the summer, dense macrophyte beds, but extent limited by light penetration. Often would be classified as hypereutrophic.
TSI > 80	Algal scums, summer fish kills, few macrophytes, dominance of rough fish.

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