₹ 200 ISSN - 2249-555X

Volume : 1 Issue : 6 March 2012



Journal for All Subjects

www.ijar.in

Listed in International ISSN Directory, Paris.

ISSN - 2249-555X



Indian Journal of Applied Research

Journal for All Subjects

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Volume : 1 | Issue : 6 | March 2012 ISSN - 2249-555X

Research Paper Economics

Carlson's Tropic State Index(CTSI) Used in Mandya Lakes

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ABSTRACT

Carlson's Trophic State Index(CTSI) was applied to the Twenty Lakes of Mandya District.
The index produces values in the range from 0 to 100 and can be used for the classification of lakes. All 20 lakes are characterized as mesotrophic (CTSI values between 46 and 60) which require manual clearing of algal biomass & Hydrophytes. Carlson's Trophic State Index is simple and can serve as an important tool in conservation of fresh waters. The index needs the determination of only three parameters, Chlorophyll a" (CA), Total phosphorous (TP) and Seechi disc depth transparency(SD).

Keywords : Carlson's Trophic State Index, Chlorophyll a", Total phosphorous, Seechi disc transparency, Mesotrophic

Introduction
Mandya District is in the southern part of the Karnataka state The District lies between 76° 19' & 77° 22' East longitude and 12° 13' & 13° 4' North latitude.

Mandya district is blessed by nature with perennial rivers, the water of which are used for raising wet crops. The Rivers in the district which have been put to irrigational use are the Cauvery, Hemavathi, Shimsha & other small river & Streams.

Trophic state is defined as the total weight of living biological material(Biomass) in a water at a specific location & time, Various methods have been adopted for the classification of lakes and to indicate their trophic status the most commonly and widely used method is based on productivity with the frequently used biomass related trophic state index is that of Carlson (1977). this index requires minimum data, three variables Chlorophyll a" (CA), seechi disc depth(SD) and total phosphorous(TA) independently estimate algal biomass and determine the trophic state of any water body.

Twenty lakes of Mandya district were selected for the present study.

Material and Methods:-
Samples for the analysis of Chlorophylla" and total phosphorous were collected during summer months at the point of maximum depth.

Seechi depth(SD) was taken at the study site by an 8" diameter disc. The maximum depth at which the SD can be seen when lowered into the water is noted and measured. readings are usually found on the rope attached to the disc.

Total Chlorophyll a" (CA) was estimated by acetone method and measure using a spectrometer Absorbance was recorded at 630 & 660 nm (APHA 1995).

Total phosphorous was determined by stannous chloric method. And measure using a spectrometer at 690nm(APHA 1995) the Trophic state index[TSI] of Carlson(1977) was calculated using the following formula.

a. TSI for Chlorophyll a"(CA)=9.81 in chlorophyll a" +30.6
b. TSI for seechi depth (meters)(SD)=60-14.41 in seechi depth
c. TSI for Total phosphorus (TP)= 14.42 in total phosphorus +4.15

Where TSI is Trophic state index in as natural logarithm, Cralson's Trophic state Index(CTSI)=(TS1)(Tp)+(TSI)(CA)+TSI(SD)/3

TP & CA in micrograms/Liter SD Transparency in meters.

A value of CTSI between 40 and 50 is usually associated with mesotrophy(moderate roductivity), index values greater than 50 are associated with oligotrophy (low productivity). The range of the trophic state index values and its classification are presented in Table 1.

Results and Discussion:
Carlson's Trophic state index(CTSI) was applied to the 20 Lakes of Mandya District. The index for each parameters and average of their attributes are presented in Table 3. These index values are plotted in table 1. Denote the relative ranking of the average Trophic State Index. All twenty lakes were classified as Mesotrophic.

All lakes have TSi values between 40-50 and this can be attributed to mesotrophic nature where the water is moderately clear and there is increasing probability of hypolimnetic anoxia during summer.

The order of the water changes and the water becomes turbid which may lead to loss of fish population. Under these circumstances manual cleaning of algal mass and excess hydrophytes is necessary.

The main parameter involved in the trophic sate of any water body is phosphorus content. Changes in the quantity of phosphorus in a fresh water ecosystem can alter the trophic status.

Carvalho and Kirika(2003) reported that decline in phosphorous concentration is due to reduction in external nutrient loading which in turn reduces Phytoplankton biomass.

Bergmann(1999) observed a pronounced decrease in seechi depth transparency with an increases in phosphorus and chlorophyll concentrations. This observation is also true in the present study. Monitoring eutrophication is an important part of assessing and managing lake ecosystems.

Phosphorus is commonly the growth limiting nutrient for algae(Horne & Goldman 1944) TP, the combination of free floating compounds of those incorporated in the biota is the most common nutrient measured in lakes, Chlorophyll a" can be an estimate of algae on surfaces. The more cholorophyll a" the more the presence of algal biomass and more eutrophic the lake. A seechi disc is used as a measure of the transparency of water, which is the function of the density of varying algal populations and the suspended solids (Heiskary 1985), Mandya District is rich in agriculture lands; nutrients can enter the lake through agricultural run off increasing the concentration of plant nutrients, primarily phosphorous (Haper 1922), This produces direct and indirect biological changes to lakes leading to the production of algal blooms. Indirectly eutrophication may cause depletion of dissolved oxygen concentration as s result as a bacterial respiration during break down of dead algal biomass. The only possible way of recovering these lakes is by biological control of algal biomass.

Conclusion:-

A mesotrophic lake presents an intermediate between oligotrophic and eutrophic state index [TSI]. All the twenty lakes studied fall under the category, oligotrophic lakes tending to become mesotrophic, The index can be used as a teaching tool. As change in plant biomass affects hypolimnetic oxygen and fish species. It is essential to modify the lake according to the user and not simply making the water clear. Prevention of agro chemical pollution and domestic pollution that can be increases the nutrient levels causing eutrophiciation and connected problems.

Table 1: Carlson's Trophic state Index[TSI]

TSI Values	Trophic Status of the water body
Below 30	Classic oligotrophy, Clear water, Oxygen throughout the year in the hyplimnio, Salman fisheries in deep water
30 to 40	Deeper lakes still exhibit classical oligotrophy, but some shallower lakes become anoxic in the hytpolimnion during summer.
40 to 50	Water moderately clear but increasing probability of anoxia in hytpolimnion during summer
50 to 60	Lower boundary of classical eutrophy, decreased transparency, Anoxia hytpolimnion during summer, macrophytic problems evident only warm water fishes survive.
60 to 70	Dominance of blue green algae, algal scum's probable, extensive macrophytic problems.
70 to 80	Heavy algal blooms possible through out the summer, dense macrophytic beds, limitation of light penetration, often classified as hypereutrophic.
Above 80	Algal scum's dominant, summe fish kills frequent, reduction on macrophytic growth. Dominance of rough & undesirable fish

Table 3: Trophic state of lakes, their attributes and conservation strategies.

No.	Lake	TSI	Trophy	Attributes and Conservation
1	Belur Lake	34	Mesotrophy	Water moderately clear, increasing proability of hypolimnetic anoxia during summer, water colour changes and fish population decreases Manual clearing of algal biomass and hydrophytes
2	Konanahally Lake	38	Mesotrophy	
3	Guttalu	41	Mesotrophy	
4	Gowdagere	41	Mesotrophy	
5	K R Pete	46	Mesotrophy	
6	Thagghalli	46	Mesotrophy	
7	Keelara	46	Mesotrophy	
8	Mangala	48	Mesotrophy	
9	Mallavally	49	Mesotrophy	
10	Kodiyala dodda	49	Mesotrophy	
11	Hirudkere	49	Mesotrophy	
12	Kottahatti	49	Mesotrophy	
13	Sundahalli	49	Mesotrophy	
14	Kasalagere	49	Mesotrophy	
15	Duddakere	49	Mesotrophy	
16	Keragodu	50		Lower boundary of classical eutrophy, Decreased transparency, anoxic hytpolimnion during summer, Macrophytic problem evident only warm water fishes service
17	Hallegere	50		
18	SulaeKere Maddur	50		
19	Anakere	50		
20	Arakere	50		

In table 3. from Belur lake to Dudda kere lake have TSI values between 40-50 and these can be attributed to mesotrophic from keragodu lake to Arakere lake have TSI values 50 and this can be attributed to Lower boundary of classical eutrophy, Decreased transparency, anoxic hytpolimnion during summer, Macrophytic problem evident only warm water fishes service.

Table 2. :

Sl No	Lakes	SD Meters	CA mg/m^3	TP mg/l	CTSI (SD)	CTSI (CA)	CTSI (TP)	CTSI	Trophic Status
1	Konanahally Lake	2.6	5.55	0.16	46	47	22	38	Mesotrophy
2	Guttalu lake	2.1	6.9	0.150	49	50	23	41	"
3	Keragodu Lake	2.01	6.71	0.024	50	49	50	50	"

4	Hallegere	1.93	6.00	0.0242	51	48	51	50	“
5	Malavalli	2.03	6.45	0.022	50	49	49	49	“
6	Ammanakatte	1.98	7.36	0.025	50	50	49	50	“
7	Kodiyala Dodda kere	1.93	5.95	0.0272	51	48	49	49	“
8	Sulae kere Maddur	2.07	7.73	0.0245	50	51	49	50	“
9	Belur Lake	3.2	3.8	0.16	43	37	22	34	“
10	K R Pete Lake	2.20	5.52	0.0397	49	47	42	46	“
11	Hirude Kere	2.08	6.40	0.0254	49	49	49	49	“
12	Kottahati Lake	2.10	6.80	0.025	49	49	49	49	“
13	Sundahalli Lake	1.98	7.55	0.026	50	50	48	49	“
14	Mangala Lake	1.95	5.30	0.030	50	47	46	48	“
15	Thaggahalli Lake	2.00	5.50	0.0405	50	47	42	46	“
16	Kasalagere Lake	1.00	7.9	0.062	60	51	35	49	“
17	Gowdagere Lake	1.80	6.7	0.16	52	49	22	41	“
18	Ankere Lake	1.02	7.9	0.062	60	51	40	50	“
19	Keelara Lake	1.96	6.74	0.048	50	49	40	46	“
20	Dudda kere	1.26	7.53	0.050	57	50	39	49	“

TP:Total Phophorous mg/l, CA-Chlorophyll a” mg/l, SD- Seechi depth in meters, CTSI- Carlson’s Trophic State Index.

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Printed at Unique Offset, Novatsing Rupam Estate, Opp. Abhay Estate, Tavdipura, Shahibaug, Ahmedabad