International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

MICROBIAL POPULATION IN THE FISHES AND PHYSICO-CHEMICAL CHARACTERISTICS OF FRESH WATER LAKE OF DAVANGERE DISTRICT, KARNATAKA

MANOHARA BM[1*], THIRUMALA S[2] AND KIRAN BR[3]

1: Department of Physics, Government First Grade College, Davangere-577004, India

2: Department of Environmental Science, Government First Grade College & P.G. Center, Near Anubav Mantapa, Davanagere-577004, Karnataka

3: Research & Teaching Assistant in Environmental Science, DDE, Kuvempu University, Shankaraghatta-577451, Karnataka

*Corresponding Author E Mail: drst2008@gmail.com

ABSTRACT

A study was conducted to identify the bacterial populations and water quality in lake water and in some organs of cultured fishes *Oreochromis mossambicus, Labeo rohita, Cirrhinus mrigala* and *Cyprinus carpio* in a freshwater Bathi lake to evaluate the public health aspects associated with the consumption of fishes. Among the organs the maximum bacterial load was found in skin followed by gills and intestine. The enteric bacteria isolated from the freshly caught fish as well as in water were found to belong to 9 genera involving a total of 11 species. In general, the bacteria isolated from fish samples appeared to be very similar to those obtained from water. Amongst the various bacteria present in the fishes, *E. coli* and *P. aeruginosa* contributed the most in all the four fish species. In the water also, the most dominant bacterial species was same as in fishes. Thus, there appears to be a close correlation between the bacteria in water and

the organs of fishes with *E. coli* was dominant followed by *P. aeruginosa* in all the four types of fishes. The presence of a large number of enteric pathogenic bacterial species in the lake suggests the need for following strict hygienic methods during the processing of fish to prevent humans from getting diseases.

Keywords: Bathi lake, Bacteria, Indian major carps, fish, Water quality

INTRODUCTION

The Lake water in extraordinary cases is unfit for drinking, swimming and other recreational exercises. Monetarily significant fish populace is supplanted by unwanted fish populace [1-3]. Recently, has consideration been given to microbiological contemplates concentrating on bacterial separation planned for building up reasons for fish infections and medication strategies. Further just insignificant consideration has been given to the arrangement of the microflora, its varieties in time and impact on fish [4].

Lake is normally framed water body with variable size encompassed via land. Lakes are more profound than lakes. They are found in uneven regions, crack zones and zones progressing glaciations. Globe is secured with water about 75% and this water is of saline. Under 5% is of the crisp water and is accessible in the icecaps, icy masses and groundwater. Water is available in inexhaustible quantity under the surface however 1% of it is fluid crisp water. Earth's water is evaluated to be 1.4 billion cubic kilometer of water, it is in seas or in solidified in polar ice caps and ice sheets. Sea water comprises of 35gm/lt of broke down minerals or salts. These sorts of water is unfit for drinking [5].

The wetlands of South Asia are confronting tremendous anthropogenic pressure, which can extraordinarily impact the structure of the bird animal network [18]. Wetlands have significant natural and monetary significance. For the most part they are exceptionally gainful however naturally fragile, at risk to degradation and degeneration under the predominant anthropogenic pressure [6].

The present paper is based on the data collected over a period of one year to know the physico-chemical and microbial characteristics of fresh water body of Davangere district and occurrences of microbes have been recorded and their possible role as bio monitors of organic pollution has been discussed.

MATERIALS AND METHODS

Bathi Lake is a little water system situated between 14°28'27" N latitude and

75°52′13″ E longitude. It lies at a height of 598 mt above mean ocean level (MSL) in Davanagere Taluk of Davanagere District in Karnataka, India **(Figure 1)**. This lake is arranged neighboring Harihar Davanagere state roadway street. This water body is utilized for aquacultural practice just as water system to encompassing horticultural terrains of DoddaBathi town. The lake is roughly 7 km good ways from Davanagere city and 7 km from Harihar Taluk. The territory of Bathi lake is 74 acres of land. Samples were gathered in 2 liter plastic cans at month to month interims during February 2014 to January 2015.The strategies for assortment, conservation and examination of physico-chemical parameters were utilized as portrayed by Trivedy and Goel **[7]** and APHA **[8]**. The topographical and physical parameters of the lake is given **Table 1**.

Water tests for microbiological examinations were gathered, placed into clean 500 ml sampling bottles and analyzed inside 1-2 hours of assortment in the research center. All water tests were broke down for the nearness of aggregate and fecal coliform microorganisms, fecal Streptococci and pathogenic *Salmonella* by the most probable number (MPN) technique following the American Public Health Association **[8]** methods. The total viable count (TVC) of every heterotrophic bacterium was done on supplement agar plates hatched at 28 ˚C for 48 hours. Ten samples from each fish species were inspected upon the arrival of collect. Swab tests of around 4-5 cm 2 fish skin region were gathered and vaccinated onto media as those utilized for the water tests to gauge the MPN esteems. Bits of fish muscle, gills and stomach related tracts were gathered independently under aseptic conditions and put into sterile petri dishes. Comparing organs from a similar fish animal varieties were pooled, gauged and homogenized with a clean warring blender with 10 ml of 0.1% phosphate support saline of pH 7.5 per gram of fish tissue. A volume of 0.1 ml of the homogenate was plated in this manner onto supplement agar and Mac Conkey agar and hatched at 37° C for 24-48 hrs. For subjective ID of different microscopic organisms from water and fish tests, new strong media of modified fecal coliform (M-FC) agar were immunized in copy and hatched at $37^°$C for 24 hrs. After unmistakable shaded settlements of different microorganisms created on the plates, further distinguishing proof of the bacterial provinces were finished by Edwards and Ewing **[9]**, Cowan **[10]**, Martin and Washington **[11]**, Brenner **[12]**, Cheesbrough **[13]** and Saraswathi *et al* **[14]**.
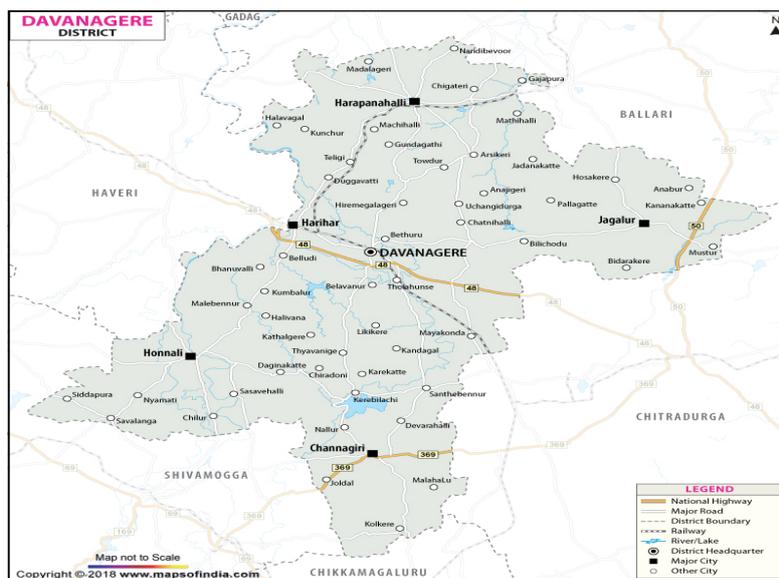
Figure 1: Location of the study area (Source: www.mapsofindia.com)

RESULTS AND DISCUSSION

Bacteria in water

The total bacterial count at $30^{o}C$ is 3.41×10^{6} and total bacteria at $38^{o}C$ was 8.90×10^{5}. Total coliform (MPN) count was 7.40×10^{3} and faecal streptococcai count was 490.

Thus it is quite natural that *E. coli* (23.8%) and *P. aeruginosa* (19.36%) which are the dominant bacteria in water also dominated in all the fishes. The presence of *E. coli* bacteria can be attributed to the adding up of animal wastes, the entry of *P. aeruginosa* into the lake might be due to water containing these bacteria from the nearby areas entering into the lake as surface runoff water. **Figure 2** shows different views of Bathi lake showing aquatic vegetation. **Figure 3** depicts the various physico-chemical variables of in lake water during the study.

Bacteria in Fish organs

Tables 1 represents the length and weight data of the various fishes used for the present study. All the fishes were almost of the same size and weight except for *Oreochromis mossambicus* which was smaller in size. **Tables 2 and 3** record the bacterial counts in water and among the various fish organs.

A comparison of the total bacterial count in the skin among the four fishes reveals that *Cyprinus carpio* recorded the maximum count followed by *Cirrhinus mrigala, Labeo rohita* and *Oreochromis mossambicus*. Amongst the gills, the maximum load was found in *Cirrhinus mrigala* followed by

Oreochromis mossambicus, *L. rohita* and *C. carpio*. The bacterial counts in intestine is maximum in *Oreochromis mossambicus* followed by *C. mrigala, C. carpio* and *L.rohita*.

In the intestinal tract of the fishes *E.coli* bacteria was highest in *Labeo rohita* (40.4%) followed by *Cyprinus carpio* (30.6%) ,*Oreochromis mossambicus* (25.4%) and *Cirrhinus mrigala* (22.5%). Similarly, *Pseudomonas aerugenosa* was maximum in *Labeo rohita* (27.2%) followed by *Cirrhinus mrigala* (26.8%). *Cyprinus carpio* (26.4%), *Oreochromis mossambicus* (22.5%) respectively.

Among the various fish organs analyzed, the total maximum bacterial load was found in the order of: Skin > Gills > intestine.

Water Quality

pH: It estimates alkalinity and acidity of the solution. The pH of the lake varied from 7.7 to 7.9 and it shows basic in nature.

Free CO$_2$: Carbon Dioxide is available in water as a dissolved gas. Surface waters regularly contain under 10 ppm free carbon dioxide, while some ground waters may effortlessly surpass that fixation. Carbon dioxide is promptly dissolvable in water. Over the normal temperature go (0-30° C) the solvency is around multiple times that of oxygen. Calcium and magnesium join with carbon dioxide to shape carbonates and bicarbonates. Vegetation suspended in the water, phytoplankton, just as huge established plants, use carbon dioxide in the photosynthesis of plant materials; starches, sugars, oils, proteins. The carbon in every one of these materials originates from the carbon dioxide in water. In this investigation free CO$_2$ content varied from 4-8 ml/l.

DO: It represents the amount of oxygen dissolved in water. The results indicated it fluctuated from 2.9-5.4 mg/l.

BOD & COD: The amount of oxygen required by the microbes to degrade the organic matter under aerobic condition. In this study, the values are higher than the desired limits due to the organic loading of the lake. BOD ranged from 5.2 to 34 mg/l. COD content deviated from 14 to 20 mg/l.

Chloride: Chloride is an anion and can be found in all kind of natural water. Chloride content ranged from 14 to150.2 mg/l.

Total solids: Total solid consists of dissolved solids and suspended solids in water. In this study, total solids deviated from 81.4-190.6 mg/l respectively.

Phosphate: Phosphate ranged from 0.14-3.8 mg/l. It is additionally as a contamination if its fixation surpasses as far as possible in water. The phosphate causes eutrophication

in water. It is accessible in three structures, that is natural phosphorous (related with natural particles), orthophosphate and polyphosphates. Common decay of rocks and minerals, agrarian overflow, disintegration and sedimentation and direct contribution by creatures/natural life are the non point sources, while point sources are sewage effluents and modern releases. The prescribed estimation of phosphorous in drinking water as per EPA is 5mg/l. However, in passable point of confinement it is fundamental for human wellbeing, in any

case, past admissible utmost it might harm kidney and causes osteoporosis **[15, 16]**.

Nitrate & Nitrite: The nitrate concentration in surface water is normally low (0–18 mg/l) but can reach high levels as a result of agricultural runoff, refuse dump runoff or contamination with human or animal wastes. The concentration often fluctuates with the season and may increase when the river is fed by nitrate-rich aquifers **[17]**. Nitrite substance of the lake varied from 0.2 to 0.4 mg/l respectively.

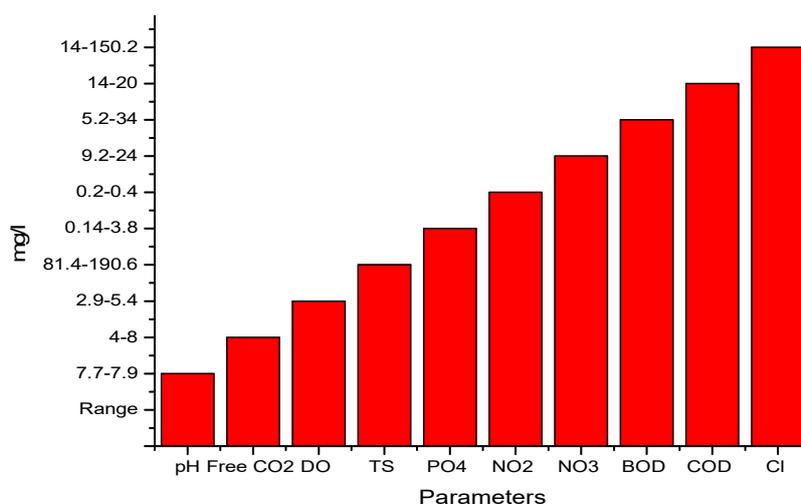**Figure 2: Different views of Bathi lake showing aquatic vegetation**

Figure 3: Average physico-chemical parameters of Bathi lake

Table 1: Length and weight ranges of fishes used in this study

S. No.	Name	Length range (mm)	Average length (mm)	Weight range (gm)	Average weight (gm)
1	*Cyprinus carpio*	380.4-480.8	430.2	610.5-820	690.2
2	*Oreochromis mossambicus*	130.5-250.5	200.5	44.5-290	182.5
3	*Labeo rohita*	530.6-590	550.4	530.5-640.6	590.4
4	*Cirrhinus mrigala*	370.2-450.2	410.2	590.1-730	635.2

Table 2: Distribution (%) of Enteric bacterial species from water & Intestinal tract of fishes

Bacteria	Lake Water	*Cyprinus carpio*	*Oreochromis mossamicus*	*Labeo rohita*	*Cirrhinus mrigala*
E-coli	23.8	30.6	25.4	40.4	22.5
Enterobacter aerogens	6.6	11.20	6.7	2.3	7.8
Enterobacter cloacae	7.5	0	8.3	1.0	8.4
Proteus vulgaris	8.6	8.9	7.5	7.2	10.6
Proteus mirabilis	7.9	5.3	8.2	4.5	2.2
Salmonella typhi	5.1	0.5	1.5	0	9.4
Pseudomonas aerugimosa	19.36	26.4	22.5	27.2	26.8
Klebsiella pnemoniae	8.34	4.8	3.80	8.6	1.2
Aeromonas hydrophila	4.7	5.6	10.2	2.4	3.4
Vibrio alginolyticus	5.05	3.7	3.6	4.0	4.2
Staphylococcus aureus	3.05	3.0	2.3	2.4	3.4

Table 3: Bacterial counts (per gram) in different organs of fish carps (For 10 fishes)

Organs	Fish name	Total bacteria at room temp.	Total bacteria at 37°C	Total coliforms	Faecal bacteria	Staphylo coccai
Skin	*Cyprinus carpio*	2.05×10^3	11.62×10^2	50	45	0
	Oreochromis mossambicus	3.95×10^4	7.1×10^3	60	55	0
	Labeo rohita	4.5×10^3	10.2×10^2	85	78	38
	Cirrhinus mrigala	3.2×10^4	11.4×10^3	140	30	20
Gills	*Cyprinus carpio*	2.78×10^3	4.4×10^4	280	130	0
	Oreochromis mossambicus	2.95×10^4	11.5×10^4	260	200	20
	Labeo rohita	7.4×10^4	6.2×10^4	290	180	5
	Cirrhinus mrigala	2.9×10^5	12.2×10^4	435	150	0
Intestine	*Cyprinus carpio*	8.7×10^5	7.4×10^5	1080	290	0
	Oreochromis mossambicus	8.1×10^4	11.2×10^6	1310	270	0
	Labeo rohita	6.2×10^5	5.5×10^5	790	260	0
	Cirrhinus mrigala	10.5×10^4	8.5×10^5	2070	310	0

CONCLUSION

The anthropogenic activity has definitely expanded in Bathi lake as it is contaminated microorganisms react rapidly to the ecological changes and henceforth their standing harvest and organization are bound to show the nature of water mass in which they are found. They firmly impact on the water quality especially pesticides and manures utilized by agriculturists and domestic wastes in these regions at last arrive at the Bathi lake water expanding contamination. Subsequently the outcome demonstrates that diverse biological elements have affected the microbial wealth. The present examination guarantees that variety

in the plenitude of organisms can be affected by the effect of ecological elements .Thus microorganisms have been utilized as pointer of water quality a few animal varieties flourish well in oligotrophic just as in eutrophic waters. Due to their short lifecycle it might be reasoned that the density of microorganisms is subject to various abiotic factors either in a roundabout way or legitimately in the aquatic biological system

REFERENCES

[1] Colinvaux, P. 1986. Ecology. John Wiley & Sons Inc., New York.

[2] Ramalingaiah 1985. Monitoring of water quality changes between the protected chain lakes and unprotected chocolate lake. Ph.D Thesis, Technical University of Navascotia, Halifax, Canada.

[3] Suresh S, Hiresagarhalli Bommappa Aravinda and Siddalingappa Thirumala.2011. Phytoplankton for biomonitoring of Organic pollution in two tanks of Davangere District, Karnataka, India. South Western Journal of Horticulture, Biology and Environment 2 (2): 107-112.

[4] Zmyslowska, I., Lewandowska, D.,Nowakowki, T. and Kozlowski, J. 2001. Occurrence of Bacteria in Water and in Vendace (*Coregonus albula*) during rearing in Tanks. Pol.J. Environ. Stud., 10: 51-56.

[5] Padmini V.N and H.B Aravinda.2016. Domestic wastewater effecting on physico-chemical Properties of Bathi lake, Davangere city, Karnataka. International Journal of Research in Engineering and Technology. 5 (8): 146-149.

[6] Gupta AK, Singh SK.2003. Changing wetlands due to discharge of effluents from small scale industries around Varuna river corridor. Ecology, Environment & Conservation. 9(2):209-212.

[7] Trivedy, R. K., Goel, P. K. 1986. Chemical and biological methods for water pollution studies. Environmental publication, Karad.

[8] APHA, 1995. Standard methods of examination of water and waste water. 19th edition. APHA, AWWA, WCPF, Washington D.C.

[9] Edwards, P. R. and Ewing, W. A. 1972. Identification of Entero-bacteriaceae. 3rd ed. Burgess Publishing, MN. pp.143.

[10] Cowan S.T.1974. Cowan and Steels Manual for the Identification of Medical Bacteria. 2nd ed.

Cambridge University Press, Cambridge.

[11] Martin, W. J. and Washington, J. A.1980. Enterobacteriaceae. In: The Manual of Clinical microbiology, 3rd edition (E. H. Lennette, A. Belows, W. J.Hausler and J. P. Truant ed.), p. 195-219.

[12] Brenner, D. J. 1984. Entero-bacteriaceae. In: Bergey's Manual of Systematic Bacteriology, Vol. I (Ed., N. R. Kreig), Williams and Wilkins, Baltimore, M.D. pp. 408-516.

[13] Cheesbrough, M. 1989. Medical Laboratory manual for Tropical Countries. Vol. II. Microbiology. Butterworth Heinemann, London. pp. 198.

[14] Saraswathi, R., P. Sumithra and R. Sivakami.2015. Identification of Enterobacteriaceae studies in Carps during rearing a fresh water pond. Int. J. Curr. Microbiol. App. Sci. 4(12): 661-669.

[15] Slatopolsky, E., S. Calgar, J.P. Pennell, D.B. Taggart, J.M. Canterbury, E. Reiss and N.S. Bricker. 1971. On the pathogenesis of the uremic state: An exposition of the 'trade-off hypothesis'. N Engl J Med. 286: 1093–1099.

[16] Asha Lata Singh. 2013. Nitrate and Phosphate contamination in Water and possible remedial measures. Environmental Problems and Plant. Ed. Dwivedi, N.:44-56.

[17] WHO. 2011. Nitrate and nitrite in drinking - water Background document for development of WHO Guidelines for Drinking - water Quality. World Health Organization, 20 Avenue Appia, 1211 Geneva.

[18] Bird Life International.2003. Saving Asia's Threatened Birds: A Guide for Government and Civil Society. BirdLife International, Cambridge, 2246.

[19] https://jayeshkparmar.files.wordpress.com/2015/02/practical-51.pdf.