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RESEARCH ARTICLE MICROBIOLOGY

DIVERSITY OF INDICATOR BACTERIA IN FIVE PONDS AROUND KANYAKUMARI DISTRICT, TAMILNADU.

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ABSTRACT

The present study attempts to understand the diversity of indicator bacteria in five ponds around Marthandam and Nagarcoil town Kanyakumari District, July-2010 to December-2010. Occurrence of bacterial indicators in water depicts the pollution status of lentic ecosystem. The current study is a quantitative appraisal of *Total coliforms, Fecal coliforms, Faecal Streptococci, Salmonella* and *Shigella* counts. *Total coliforms* varied from 187 to $42x10^3$ cfu/ml, *fecal coliforms* varied from 13 to $42x10^2$ cfu/ml *Faecal Streptococci* varied from 2 to $61x10^2$ cfu/ml, *Salmonella* from 2 to $2.9x10^2$ cfu/ml and *Shigella* from $7x10^2$ to $91x10^2$ cfu/ml. As per bureau of Indian standards (BIS), *Total coliforms* counts should be 1/100ml in drinking water and 10 cfu/ml in recreational waters all ponds were found to harbour huge bacteria load via surface run of as well as defication of people. Standards of *coliforms* even in waste water for disposal as per BIS (1991) should not exceed 5000/100ml. This situation posses public health and reveals that *coliforms* counts in the ponds exceed even the limits prescribed for waste water disposal which warrants urgent measures for protection of the lentic ecosystems and source water treatment.

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KEYWORDS

Fecal Coliforms, Lentic Ecosystem, Salmonella, Shigella, Indicator Bacteria.

INTRODUCTION

Ponds have been used since time immemorial as the traditional source of water source in India. However water of the ponds, lakes and river are polluted mainly due to discharge waste water from residential areas, sewage outlets, solid waste detergents, automobile oil waste fishing facilities and agricultural pesticides from farm lands. (Srivastava et al., 2003; Usha et al., 2006; Hasan et al., 2007)[1] . In recent years, their importance has somewhat declined due to technological advancements leading to more centralized water supply system. Major degrading factors include excessive eutrophication due to nutrient and organic matter loading; sedimentation due to inadequate erosion control in agriculture, construction, logging and mining activities; removal of native vegetation in the catchment; introduction of alien species etc. (Prasad *et al.,* 2002, Ramachandra, *et a*l., 2005a, 2005b, Wetzel *et al*., 1991)[2] There is a relationship among ecologist and micro planners about the importance of conservation of ponds as sustainable source of water for rural communities (Park and Park,2005)[3] A change in microbial diversity ultimately will lead to ethical, aesthetical and public health concerns to the human society. If this trend continues, it may not only affect human health and social-economic development, but also lead to the collapse of lake ecosystems themselves (Goldman, *et al*., 1983; Constanza *et al*., 1997; Rapport *et al*., 1998)[4].

This condition becomes critical in societies where scientifically ignorant population depend lentic ecosystems for their living. Classic example of this situation is the people of Kanyakumari, who have been beneficiaries of numerous ponds, now suffers from their contaminated and shrunk state of affairs. A systematic assessment of bacterial contamination of ponds would elucidate the nature and source of pollution and thereby help to devise precautions and remedies to water borne ailments.

Under the specific background, current study is carried out for six months period July-2010 to December.2010 in five ponds of Kanyakumari district.

OBJECTIVES OF THE STUDY

1. Monthly enumeration of indicator bacteria and a few potential pathogens in water samples of five ponds surrounding Marthandam and Nagercoil.
2. Appraisal of the bacterial counts in terms of their epidemiological significance.
3. Attempt to suggest remedial management options for the study area.

MATERIALS AND METHODS

(i) Sample collection

Bacterial species selected for the present study are total *coliforms* (TC), fecal *coliforms* (FC), fecal *Streptococci* (FS), *Shigella* sp (SHLO) and *Salmonella* sp (SLO). They are collected from ponds such as Theroor, Putheri, Chukankadai, Neduvalikkulam and Nalloor from July-2010 to December-2010.

(*ii) Analysis*

Sample analysis was carried out following APHA (1995)[5] which recommended usage of commercial media for bacterial enumeration. Readymade media procured from M/S. Hi-

Media, Mumbai were used for pour plate method. Serial dilution of the sample was made up to 10^{-5} and duplicate plating was carried out for each organism.

(iii)Media and enumeration characters

Mc Conkey Agar, M7Hr FC Agar, M-Enterococcus agar and XLD Agar were used respectively for enumeration of TC, FC, FS, *Shigella* and *Salmonella* sp. TC colonies appeared pink to red after an incubation at 37°C for 24hrs, FC developed as blue colonies at 44.5°C after 24hrs, FS as maroon colonies after 24hrs at 37°C and *Shigella* sp. -red colonies and Salmonella sp. -red colonies with black centres after 24hrs at 37°C.

Figure 1

KanyaKumari District map showing five ponds

Table: 1

Distribution of bacteria during the month of July 2010

Name of Organisms	Count of organisms in different stations(cfu/ml)				
Station	**Theroor Pond**	**Putheri Pond**	**Chungankadai Pond**	**Neduvali Pond**	**Nalloor Pond**
Total Coliforms	$21.6x10^3$	$17x10^2$	$42x10^2$	$11x10^3$	$42x10^3$
Fecal Coliforms	$12x10^2$	178	$12x10^2$	170	$20x10^2$
Fecal Streptococci	$44x10^2$	$20x10^2$	$12x10^2$	$18x10^2$	$27x10^2$
Salmonella	73	13	2	3	$21x10^2$
Shigella	$33x10^2$	$37x10^2$	$42x10^2$	$27x10^2$	$67x10^2$

Table: 2
Distribution of bacteria during the month of August 2010

Name of Organisms	Count of organisms in different stations(cfu/ml)				
Station	**Theroor Pond**	**Putheri Pond**	**Chungankadai Pond**	**Neduvali Pond**	**Nalloor Pond**
Total Coliforms	$56x10^3$	187	$24x10^2$	$32x10^2$	$27x10^3$
Fecal Coliforms	$12x10^2$	13	$11x10^2$	$16x10^2$	$32x10^2$
Fecal Streptococci	$26x10^2$	$8x10^2$	$17x10^2$	$22x10^2$	$31x10^2$
Salmonella	17	9	12	13	128
Shigella	$36x10^2$	$41x10^2$	$38x10^2$	$31x10^2$	$41x10^2$

Table: 3
Distribution of bacteria during the month of September 2010

Name of Organisms	Count of organisms in different stations(cfu/ml)				
Station	**Theroor Pond**	**Putheri Pond**	**Chungankadai Pond**	**Neduvali Pond**	**Nalloor Pond**
Total Coliforms	$14.3x10^3$	$80x10^2$	$10.1x10^3$	$13x10^3$	$21x10^2$
Fecal Coliforms	$12x10^2$	$42x10^2$	$39x10^2$	280	$13.4x10^2$
Fecal Streptococci	$12x10^2$	$61x10^2$	$42x10^2$	$16x10^2$	$13.7x10^2$
Salmonella	$2.9x10^2$	72	31	17	$2.45x10^2$
Shigella	$11.3x10^2$	$91x10^2$	$84x10^2$	$15x10^2$	$20.6x10^2$

Table: 4
Distribution of bacteria during the month of October 2010

Name of Organisms	Count of organisms in different stations(cfu/ml)				
Station	**Theroor Pond**	**Putheri Pond**	**Chungankadai Pond**	**Neduvali Pond**	**Nalloor Pond**
Total Coliforms	$27x10^2$	$11x10^2$	$12x10^2$	$11x10^2$	$14x10^3$
Fecal Coliforms	$20x10^2$	182	$7x10^2$	$13x10^2$	$28x10^2$
Fecal Streptococci	$22x10^2$	$28x10^2$	$11x10^2$	$9x10^2$	$23x10^2$
Salmonella	6	3	Nil	Nil	19
Shigella	$47x10^2$	$60x10^2$	$21x10^2$	$18x10^2$	$7x10^2$

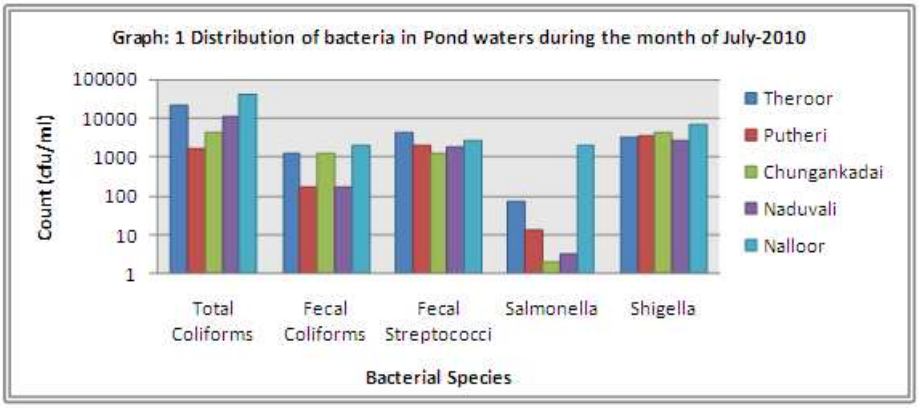
Table: 5
Distribution of bacteria during the month of November 2010

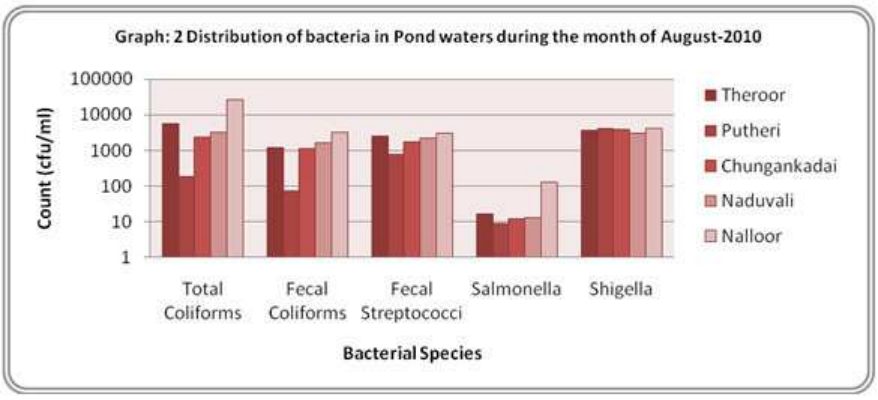
Name of Organisms	Count of organisms in different stations(cfu/ml)				
Station	**Theroor Pond**	**Putheri Pond**	**Chungankadai Pond**	**Neduvali Pond**	**Nalloor Pond**
Total Coliforms	$21x10^2$	$12x10^2$	$15x10^2$	$21x10^2$	$31x10^2$
Fecal Coliforms	$11x10^2$	$6x10^2$	$18x10^2$	$9x10^2$	$14x10^2$
Fecal Streptococci	$20x10^2$	$11x10^2$	$8x10^2$	$6x10^2$	$19x10^2$
Salmonella	23	17	Nil	Nil	19
Shigella	$25x10^2$	$34x10^2$	$30x10^2$	$27x10^2$	$56x10^2$

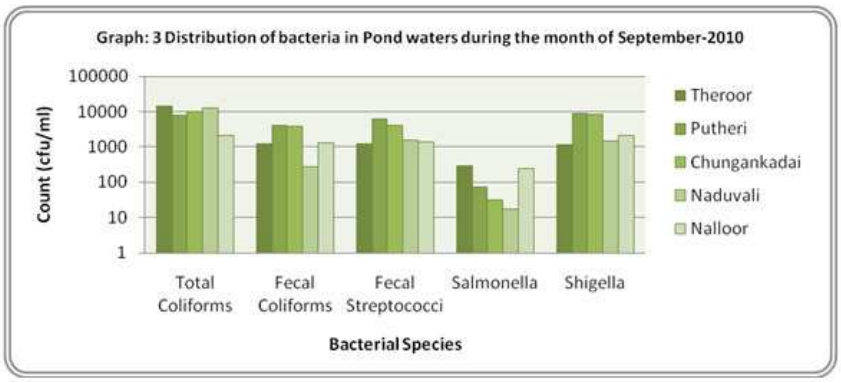
Table: 6
Distribution of bacteria during the month of December 2010

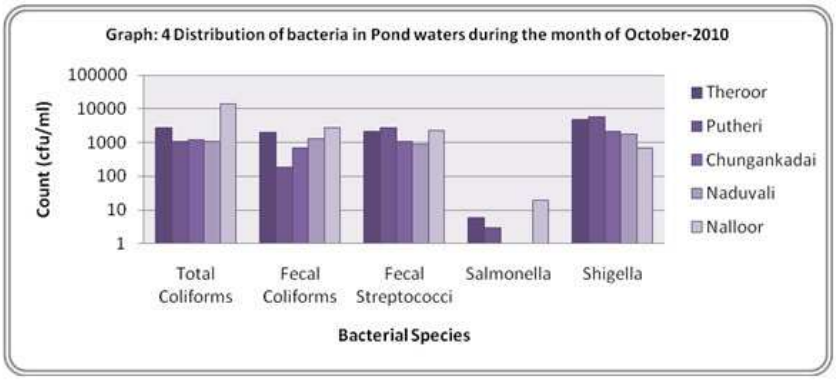
Name of Organisms	Count of organisms in different stations(cfu/ml)				
Station	**Theroor Pond**	**Putheri Pond**	**Chungankadai Pond**	**Neduvali Pond**	**Nalloor Pond**
Total Coliforms	237	$13x10^2$	$7x10^2$	$9x10^2$	$21x10^2$
Fecal Coliforms	113	$6x10^2$	174	205	$7x10^2$
Fecal Streptococci	$10x10^2$	$3x10^2$	128	135	$12x10^2$
Salmonella	22	12	Nil	Nil	34
Shigella	$12x10^2$	$21x10^2$	$22x10^2$	$17x10^2$	$36x10^2$

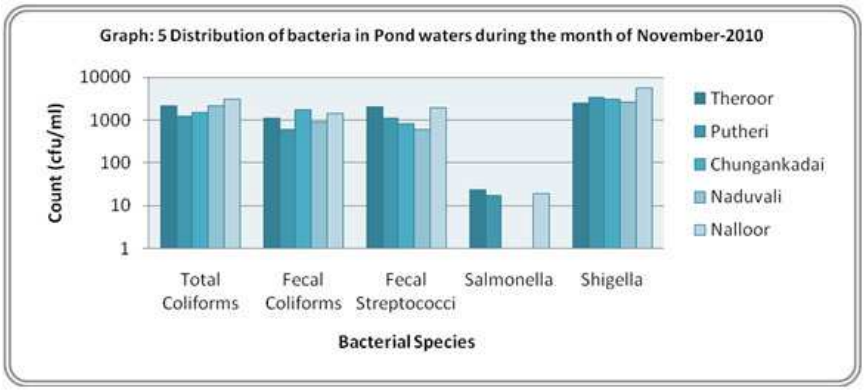
RESULTS

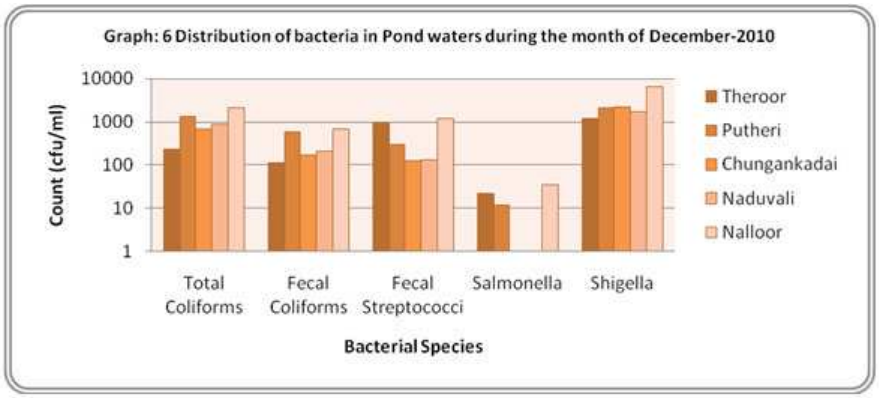



Graph: 2 Distribution of bacteria in Pond waters during the month of August-2010
Count (cfu/ml)
100000
10000
1000
100
10
1
Total Coliforms
Fecal Coliforms
Fecal Streptococci
Salmonella
Shigella
Bacterial Species
Theroor
Putheri
Chungankadai
Naduvali
Nalloor


Graph: 3 Distribution of bacteria in Pond waters during the month of September-2010
Count (cfu/ml)
100000
10000
1000
100
10
1
Total Coliforms
Fecal Coliforms
Fecal Streptococci
Salmonella
Shigella
Bacterial Species
Theroor
Putheri
Chungankadai
Naduvali
Nalloor


Graph: 4 Distribution of bacteria in Pond waters during the month of October-2010
Count (cfu/ml)
100000
10000
1000
100
10
1
Total Coliforms
Fecal Coliforms
Fecal Streptococci
Salmonella
Shigella
Bacterial Species
Theroor
Putheri
Chungankadai
Naduvali
Nalloor


Graph: 5 Distribution of bacteria in Pond waters during the month of November-2010
Count (cfu/ml)
10000
1000
100
10
1
Total Coliforms
Fecal Coliforms
Fecal Streptococci
Salmonella
Shigella
Bacterial Species
Theroor
Putheri
Chungankadai
Naduvali
Nalloor



DISCUSION

Total Coliforms indicates degree of pollution and their higher density portrays the differences between pure and polluted water (Rai and Hill, 1978)[6]. Graph 1 clearly depicts the overall input of *coliforms* in the ponds during the month of July-2010. Maximum *Total Coliform* count ($42x10^3$cfu/ml) is observed at Nalloor pond followed by Theroor Pond ($21.6x10^3$cfu/ml). In August the maximum *Total coliforms* was observed at Theroor pond ($56x10^2$cfu/ml) and lowest was the putheri pond (187cfu/ml). In September the *Total coliforms* count was high at Theroor pond ($14.3x10^3$cfu/ml) and second polluted one is Neduvali that is (word missing?) ($13x10^3$cfu/ml). the maximum *Total coliforms* was in the month of August in Putheri pond (187cfu/ml). The reason of the *Total coliforms* in Nalloor pond is the pond receive considerable amount of sewage, which has caused a severe and peristant microbial pollution Clark and Pogel (1977)[7] considered *coliforms* as a reliable indicator of contamination of water since they indicate the possibility of simultaneous occurrence of human pathogens.

Fecal Coliforms should be used as the indicator organism for evaluating the microbiological suitability of recreation water. During the month of July *Fecal coliforms* was high at Nalloor pond ($20x10^2$cfu/ml) and low at Neduvali pond (170cfu/ml). During the month of August *Fecal Coliforms* was high at Nalloor pond ($32x10^2$cfu/ml) and low at putheri pond (7cfu/ml). During the month of September the *Fecal Coliforms* was high at Putheri ($42x10^2$ cfu/ml) and low at Neduvali (280cuf/ml). In the month of October *Fecal coliforms* was high at Nalloor pond ($28x10^2$cfu/ml) and low at putheri pond (182cfu/ml). In the month of November, Fecal Coliforms was high at chugankadai pond ($18x10^2$cfu/ml) and low at putheri pond ($6x10^2$cfu/ml). In the month of December the maximum count was at Nalloor pond ($7x10^2$cfu/ml) and low at Theroor (113cfu/ml). While comparing the five ponds the Nalloor pond is more polluted due to surface ruff and release of human excreta in open space. However *Fecal coliforms* being one of the harmful members of *fecal coliforms* group and most of the more than 100 different strains are harmless, the huge number identified should be treated a precautionary not disastrous for source restoration point at view. While comparing all the months, the maximum *Fecal coliforms* was obtained in the month of September in putheri pond ($42x10^2$ cfu/ml) and minimum was obtained in the month of August in Putheri pond (73cfu/ml). The reason is that due to the onset of south west monsoon.

Fecal Streptococci counts also were extremely high in the study source maximum in putheri ($61x10^2$cfu/ml) in the month of September and second one is the Theroor pond ($44x10^2$cfu/ml) in the month of July. The third one is the Chugankadai pond ($42x10^2$cfu/ml) in

the month of September. The fourth one is the Nalloor pond ($31x10^2$cfu/ml) in the month of August. While comparing all the ponds *Fecal Streptococci* was low at Neduvali pond. This shows that *Fecal Streptococci* is an indicator of immediate Fecal Contamination Rainfall has the single most important effect on *Fecal coliforms* and *Streptococci* densities (Martin trough and Lynne Robinson -1996)[8].

Salmonella typhi causative of Typhoid is an inhabitant of intestine of warm blooded animals. It indicates their occurrence only through surface water in flow. The maximum *Salmonella* count noticed in Theroor Pond ($2.9x10^2$cfu/ml) in the month of September and minimum count at Chungankadai (2cfu/ml) in the month of July. Graph 4, 5, 6 clearly depicts the count was nil in Chungankadai and Neduvali pond during the month October, November, December. Being a member of *Coliiform* group, *Shigella* cause Shigellic dysentery, Chance of Causation of the epidemic cannot be ruled from current the study sources.

Maximum count obtained in the putheri pond ($91x10^2$cfu/ml) in the month of September and minimum in the month of October in Nalloor Pond ($7x10^2$cfu/ml). The study comprehensively shows that lentic system around Marthandam and Nagarcoil town is anthropogenically polluted. Considering the density of population settled around the ponds and their continuous usage of them, very huge bacterial count noticed is clearly an indication of possible epidemics.

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