



De La Salle University - Dasmariñas
GRADUATE PROGRAM

Sanitary Survey of Microbial Population in Relation to
Physico-chemical Factors and Aquatic Lifeform
in De La Salle University-Dasmariñas Lake

2000

A Master's Thesis

Presented to

The Faculty of the Graduate School of Education,

Arts and Sciences

De La Salle University-Dasmariñas

Dasmariñas, Cavite

In Partial Fulfillment

of the Requirements for the Degree

Master of Science in Biology

HADRIAN JOSEPH FLORES NATIVIDAD

May 1999

01 JUL 1999

AKLATANG EMILIO AGUINALDO
ARCHIVES



ABSTRACT

Name of Institution : De La Salle University-Dasmariñas
Address : Bagong Bayan, Cavite
TITLE : Sanitary Survey of Microbial Population
in Relation to Physico-Chemical Factors
and Aquatic Lifeform in De La Salle
University-Dasmariñas Lake

AUTHOR : Hadrian Joseph Flores Natividad

DATE STARTED : November 1998

DATE COMPLETED : May 1999

OBJECTIVES OF THE STUDY :

A. GENERAL:

Survey of the sanitary quality of the De La Salle University –
Dasmariñas Lake using coliforms and microbial population as
“indicators” in relation to the physico-chemical properties and aquatic
lifeform (*Tilapia nilotica*) of the lake.

B. SPECIFIC:

- 1 To determine the population density pattern of total and fecal



coliforms, and heterotrophic density of both bacteria and fungi in DLSU-D Lake.

2. To determine the density of heterotrophic bacteria present in a selected parts of Tilapia.
3. To evaluate which of the sampling stations exhibit the highest extent of microbial density.
4. To determine the physical properties of the DLSU-D Lake in terms of water temperature and water transparency.
5. To determine the chemical properties of the DLSU-D Lake in terms of its pH, dissolved oxygen (DO), salinity and alkalinity.
6. To determine if significant correlation exist between microbial density and the physico-chemical properties.
7. To determine if significant correlation exist between microbial density and aquatic lifeform.

The sanitary quality of the lake water of DLSU-D was evaluated in a 6-month survey. Total and Fecal coliform test were employed to assess possible fecal contamination. The heterotrophic plate count was also used to determine the extent of the microbial contamination.



All stations with major inlet point of waste runoff contained a significantly high total coliform ($>2.40E+03$ MPN/100 ml), fecal coliform ($>2.40E+03$) and HPC ($10^5 - 10^6$ cfu/ml). Bacterial density in sampled fish intestine revealed $10^3 - 10^5$ cfu/20 grams. Of the 32 bacterial species isolated and identified, 87.5 % belonged to *Enterobacteriaceae* group, and notably, with wide distribution of *Escherichia coli* (41%) was observed.

Physico-chemical properties of the lake in terms of its water temperature, transparency, pH, dissolved oxygen, salinity and alkalinity were periodically tested and found in congruence with the Class C water quality criteria. The calculated correlation between microbial density and physico-chemical factors, and fish bacterial density by Pearson r failed to establish a significant correlation at 5 % level of significance. However, heterotrophic plate count of bacteria posed a negative correlation with pH of water.

Shoreline survey of the actual and potential source of pollution was recommended together with strict review of waste disposal management of the DLSU-D Lake.



TABLE OF CONTENTS

	PAGE
TITLE PAGE	1
ABSTRACT	2
APPROVAL SHEET	5
ACKNOWLEDGMENT	7
TABLE OF CONTENTS	9
LIST OF TABLES	13
LIST OF FIGURES	16
LIST OF PLATES	17
CHAPTER	
1. THE PROBLEM AND ITS BACKGROUND	
Introduction	19
Theoretical Framework	22
Conceptual Framework	23
Statement of the Problem	23
Scope and Delimitation of the Study	31



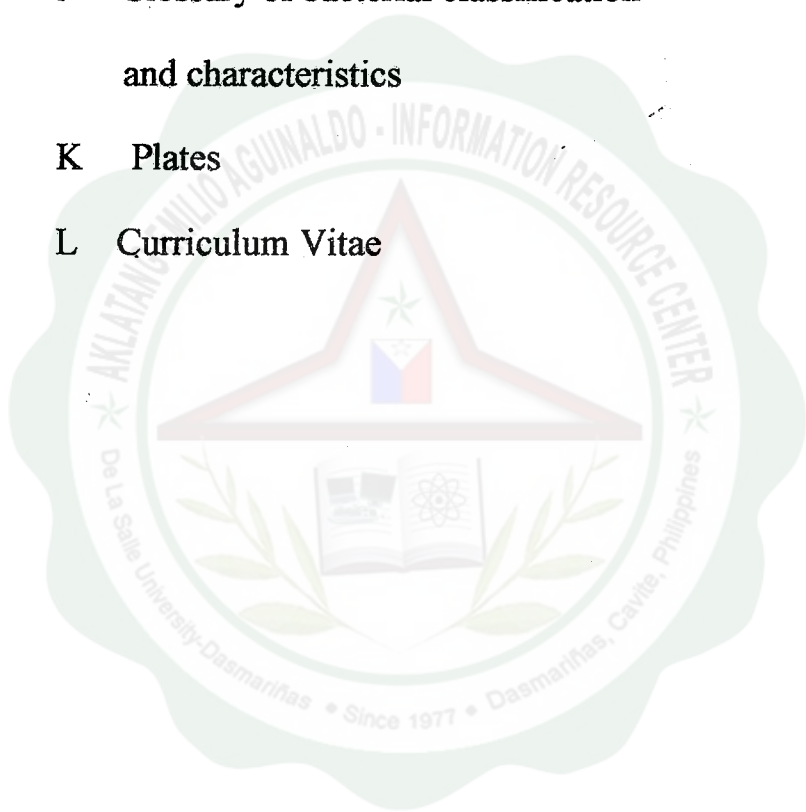
Significance of the Study	32
Definition of Terms	33
2. REVIEW OF RELATED LITERATURE	
Conceptual Literature	35
Research Literature	47
3. METHODOLOGY	
Research Design	52
Research Setting	52
Research Procedure	53
Data Gathering	60
Statistical Tools	63
4. PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA	
Problem No. 1	65
Problem No. 2	73
Problem No. 3	76
Problem No. 4	84
Problem No. 5	87



Problem No. 6	96
5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	
Summary	114
Major Findings	117
Conclusions	121
Recommendations	125
REFERENCES	127
APPENDICES	
A Map of De La Salle University-Dasmariñas lake	135
B Summary of test parameters and methods	137
C Flowchart of total and fecal coliform test	138
D Most Probable Number index	139
E Microbiological procedures	140



F	Lists of microbiological test results	143
G	Tabulation of bacterial identification	148
H	Lists of physico-chemical test results	152
I	Summary of water quality standard	156
J	Glossary of bacterial classification and characteristics	157
K	Plates	162
L	Curriculum Vitae	173





LIST OF TABLE

Table	PAGE
1 Mean monthly density of total coliform based on their MPN indices	143
2 Mean monthly density of fecal coliform based on their MPN indices	144
3 Mean monthly density of heterotrophic bacteria in all stations	144
4 Mean monthly density of fungi in all stations	145
5 Mean monthly count of bacteria present in selected parts of the fish (Tilapia)	145
6 Mean of microbial densities among four stations	146
7 Analysis of variance of total coliform in four sampling sites	146
8 Analysis of variance of fecal coliform in four sampling sites	147
9 Analysis of variance of heterotrophic plate	



	count of bacteria in four sampling sites	147
10	Analysis of variance of heterotrophic plate count of fungi in four sampling sites	147
11	Results of biochemical tests of bacteria	148
12	Identification of bacteria using Analytical Profile Index 20E (API 20E)	149
13	Distribution of bacterial species in four stations	150
14	Frequency of occurrence of bacterial species	151
15	Monthly mean of water temperature in four stations	152
16	Monthly mean of water transparency in four stations	152
17	Monthly mean of pH readings in all stations	153
18	Monthly mean of dissolved oxygen in four stations	153
19	Monthly mean of salinity in all stations	154
20	Monthly mean of alkalinity in all stations	154
21	Correlation coefficient between microbial density and the physico-chemical characteristics of the lake	155
22	Correlation coefficient between heterotrophic plate count of bacteria and heterotrophic plate count of bacteria	



on selected parts of the fish (Tilapia)

155





LIST OF FIGURES

Figure	PAGE
1 The variables and their relationship	24
2 Map of DLSU-D Lake in relation to other school premises	135
3 Locations of four sampling stations in DLSU-D Lake	136
4 Monthly trend of coliform densities in all stations	67
5 Monthly trend of bacterial count in DLSU-D Lake	70
6 Monthly trend of fungal count in DLSU-D Lake	72
7 Distribution of bacterial population in selected parts of Tilapia	75
8 Distribution of different genera of bacteria present in DLSU-D Lake	83
9 Monthly trend of water temperature in four stations	86
10 Monthly trend of water transparency in four stations	89
11 Monthly trend of pH in four stations	90
12 Monthly trend of dissolved oxygen in four stations	92
13 Monthly trend of alkalinity in four stations	95



LIST OF PLATES

Plate	PAGE
1 View of Station 1	162
2 Southwest view of station 2	162
3 Northwest portion of station 3	163
4 View of station 4	163
5 Water samples	164
6 <i>Tilapia nilotica</i>	164
7 Measuring water transparency	165
8 Total coliform test	165
9 Fermentation tubes for total coliform test	166
10 Gas formation in fermentation tubes	166
11 Confirmatory test	167
12 <i>Escherichia coli</i> on EMB	167
13 Heterotrophic plate count set up	168
14 Fungal colonies	168
15 Bacterial colonies	169



16	Counting of bacterial colonies	169
17	Battery of biochemical tests	170
18	Analytical Profile Index 20E Results	170
19	<i>Escherichia coli</i>	171
20	<i>Enterobacter cloacae</i>	171
21	<i>Proteus mirabilis</i>	172
22	<i>Salmonella arizonae</i>	172

