

## TABLE OF CONTENTS

	Page
<b>ABSTRACT</b>	I
<b>ABSTRAK</b>	iii
<b>ACKNOWLEDGEMENTS</b>	v
<b>TABLE OF CONTENTS</b>	vi
<b>LIST OF TABLES</b>	xiii
<b>LIST OF FIGURES</b>	xiv
<b>LIST OF ABBREVIATIONS</b>	xxi
<b>SYMBOLS AND UNITS</b>	xxii
<b>1.0 INTRODUCTION</b>	1
1.1 LOCATION OF TASEK BERA	1
1.2 BACKGROUND OF TASEK BERA	1
1.3 TASEK BERA AS A RAMSAR SITE	3
1.4 INTERNATIONAL IMPORTANCE OF TASEK BERA RAMSAR SITE	3
1.5 RESEARCH BY THE INTERNATIONAL BIOLOGICAL PROGRAMME (IBP)	4
1.6 DEVELOPMENT AND HUMAN ACTIVITIES IN THE WATER CATCHMENT AREA	5
1.7 OBJECTIVES OF THE RESEARCH	6
<b>2.0 LITERATURE REVIEW</b>	7
2.1 TASEK BERA ECOSYSTEM AND BIOLOGICAL DIVERSITY	7
2.2 ENVIRONMENTAL CONDITIONS OF TASEK BERA	8
2.2.1 Rainfall	8

2.2.2	Physical properties	9
2.2.2.1	Transparency	9
2.2.2.2	Temperature	10
2.2.2.3	Water level fluctuations	11
2.2.3	Chemical properties	11
2.2.3.1	Dissolved oxygen and carbon dioxide	11
2.2.3.2	pH	12
2.2.3.3	Conductivity	13
2.2.3.4	Phosphate and nitrogen	15
2.2.4	Primary production	17
2.2.4.1	Classification of algal primary producers	17
2.2.4.2	Population density and standing crop	21
2.2.4.3	The chlorophyll content of phytoplankton	22
2.2.4.4	Photosynthetic production	22
2.3	THE DISTRIBUTION PATTERNS OF FRESHWATER PHYTOPLANKTON	23
2.3.1	Spatial distribution	23
2.3.1.1	Vertical distribution	23
2.3.1.2	Horizontal distribution	24
2.3.2	Temporal distribution	25
2.4	FACTORS CONTROLLING THE GROWTH OF PHYTOPLANKTON	25
2.4.1	Physical factors	25
2.4.1.1	Temperature	25
2.4.1.2	Light	26
2.4.1.3	Dissolved oxygen	27
2.4.1.4	Carbon dioxide	27

2.4.1.5 pH	28
2.4.2 Photosynthetic activities	28
2.4.3 Nutrient requirements	31
2.4.3.1 Nutrient uptake and growth rates of phytoplankton	32
2.4.3.2 Phosphorus availability	32
2.4.3.3 Nitrogen availability	33
2.4.3.4 The cycle of phosphorus and nitrogen in freshwater wetlands	35
2.5 PERIODICITY AND SEASONAL CHANGES IN PHYTOPLANKTON COMPOSITION	37
2.5.1 Seasonal succession	38
2.5.2 Adaptive characteristics and class succession patterns	39
2.5.3 Long term compositional response	48
2.6 EFFECTS OF HUMAN ACTIVITIES AND CHANGES OF LAND USE ON THE COMPOSITION OF STREAMS	51
2.6.1 Agriculture and water quality	54
2.6.2 Integrated agricultural practices in palm oil and / or rubber plantations	56
2.7 EUTROPHICATION	61
2.7.1 Natural and anthropogenic eutrophication	61
2.7.2 Eutrophication Indices and their relation to other indices of ecosystem change	63

2.8 USE OF ALGAE FOR MONITORING RIVERS	66
2.8.1 Principles and aims of monitoring	66
2.8.2 Methodological aspects and perspectives of bio-monitoring	69
2.8.3 Problems of sampling river algae for monitoring	75
2.9 MANAGEMENT POTENTIAL OF FRESHWATER WETLANDS	76
<b>3.0 MATERIALS AND METHODS</b>	<b>77</b>
3.1 THE SAMPLING SITES	77
3.2 Field measurements and sampling	77
3.2.1 Physical and chemical parameters	85
3.2.2 Productivity measurements	85
3.2.3 Phytoplankton sampling	86
3.3 LABORATORY MEASUREMENTS	87
3.3.1 Chlorophyll-a measurements	87
3.3.2 Chemical analysis	88
3.3.2.1 Dissolved orthophosphate	88
3.3.2.2 Ammoniacal-nitrogen	89
3.3.2.3 Nitrate	90
3.3.3 Microscopic identification and quantification of phytoplankton	91
3.3.3.1 Microscope calibration	91
3.3.3.2 Phytoplankton counting techniques	92
3.4 DATA ANALYSIS	94
3.4.1 Frequency	94
3.4.2 Diversity studies	95
3.4.3 Statistical analysis	96

<b>4.0 RESULTS</b>	98
4.1 FIELD MEASUREMENTS	98
4.1.1 Physical and chemical parameters	98
4.1.1.1 Water depth	98
4.1.1.2 Transparency	98
4.1.1.3 Conductivity	101
4.1.1.4 pH	101
4.1.1.5 Temperature	101
4.1.1.6 Dissolved oxygen	101
4.1.2 Productivity measurements	105
4.1.3 Rainfall data in the catchment area	114
4.1.4 Fertiliser application data from various plantations in the catchment area	114
4.2 LABORATORY MEASUREMENTS	119
4.2.1 Chlorophyll-a measurements	119
4.2.2 Chemical analysis	126
4.2.2.1 Dissolved orthophosphate	126
4.2.2.2 Ammoniacal-nitrogen	126
4.2.2.3 Nitrate	138
4.2.3 Microscopic identification and quantification of phytoplankton	144
4.2.3.1 Checklist of phytoplankton and abundance	144
4.2.3.2 Frequency (%) of phytoplankton	166
4.2.3.3 Diversity Indices	166
4.2.3.4 Sorensen's Similarity Coefficient	193

4.3 DATA ANALYSIS	196
4.3.1 Statistical analysis	196
4.3.1.1 Two-way ANOVA	196
4.3.3.2 Multiple regression	198
4.3.3.3 Cluster analysis	200
<b>5.0 DISCUSSION</b>	205
5.1 ENVIRONMENTAL QUALITY OF TASEK BERA	205
5.1.1 Water depth and transparency	205
5.1.2 Conductivity	206
5.1.3 pH	207
5.1.4 Temperature	207
5.1.5 Dissolved oxygen	208
5.1.6 Dissolved orthophosphate	208
5.1.7 Ammoniacal-N	210
5.1.8 Nitrate	211
5.1.9 Rainfall in the catchment area	212
5.2 PRIMARY PRODUCTIVITY IN TASEK BERA	212
5.2.1 Chlorophyll-a measurements	212
5.2.2 Photosynthetic productivity	213
5.3 PHYTOPLANKTON DIVERSITY	214
5.3.1 Checklist of phytoplankton and abundance	214
5.3.2 Sorensen's Similarity Coefficient	216
5.3.3 Diversity Indices	217
5.3.4 Dominance	220
5.3.5 Trophic classes	220

5.4 EFFECT OF THE ENVIRONMENTAL PARAMETERS ON PHYTOPLANKTON	226
5.4.1 Statistical analysis	227
5.4.2 Biological indicators	229
5.5 SOURCES OF DEGRADATION AND MANAGEMENT RECOMMENDATIONS	231
5.5.1 Human Induced Factors Influencing Water Quality	233
5.5.1.1 Modification of catchment area	233
5.5.1.2 Pollution (point source)	235
5.5.1.3 Fires	235
5.5.2 Legislation, Administration and Management of Tasek Bera	237
5.5.3 Zonation for Site Management	243
<b>6.0 CONCLUSION</b>	247
<b>REFERENCES</b>	253
<b>APPENDIXES</b>	