

THE USE OF AQUATIC INSECTS IN THE WATER QUALITY
CLASSIFICATION OF SUNGAI TERSEK, MUKIM
BEREMBONG, TERENGGANU

MEHAR ALEEM MOHD. ALIS

FAKULTI SAINS DAN TEKNOLOGI
UNIVERSITI MALAYSIA TERENGGANU
2007

THE USE OF AQUATIC INSECTS IN THE WATER QUALITY
CLASSIFICATION OF SUNGAI TERSAT, HULU TERENGGANU,
TERENGGANU.

By

Intan Azleena Mohd Alis

Research Report submitted in partial fulfillment of
the requirements for the degree of
Bachelor of Applied Science (Biodiversity Conservation and Management)

Department of Biological Sciences
Faculty of Science and Technology
UNIVERSITI MALAYSIA TERENGGANU
2007

1100051203

This project should be cited as:

Intan Azleena, M. A. 2007. The use of aquatic insects in the water quality classification in Sungai Tersat, Hulu Terengganu, Terengganu. Undergraduate thesis, Bachelor of Applied Science in Conservation and Biodiversity Management, Faculty of Science and Technology, Universiti Malaysia Terengganu, Terengganu. 57p.

No part of this project report may be produced by any mechanical, photographic, or electronic process, or in the form of phonographic recording, nor may it be stored in a retrieval system, transmitted, or otherwise copied for public or private use, without written permission from the author and the supervisor(s) of the project.




JABATAN SAINS BIOLOGI
FAKULTI SAINS DAN TEKNOLOGI
UNIVERSITI MALAYSIA TERENGGANU


**PENGAKUAN DAN PENGESAHAN LAPORAN
PROJEK PENYELIDIKAN I DAN II
RESEARCH REPORT VERIFICATION**

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk: THE USE OF AQUATIC INSECTS IN THE WATER QUALITY CLASSIFICATION IN SUNGAI TERSAT, HULU TERENGGANU, TERENGGANU oleh Intan Azleena Mohd. Alis, no. matrik: UK 10329 telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Biologi sebagai memenuhi sebahagian daripada keperluan memperoleh ijazah Sarjana Muda Sains Gunaan (Pemuliharaan & Pengurusan Biodiversiti), Fakulti Sains dan Teknologi, Universiti Malaysia Terengganu.

Disahkan oleh: / Verified by:


Penyelia Utama / Main Supervisor
Nama: **WONG CHEE HO**
Pensyarah
Cop Rasmi: Jabatan Sains Biologi
Fakulti Sains dan Teknologi
Universiti Malaysia Terengganu
21030 Kuala Terengganu.

Tarikh: **6/5/07**


Penyelia Kedua (jika ada) / Co-Supervisor (if applicable)
Nama: **AMIRRUDIN AHMAD**
Pensyarah
Cop Rasmi: Jabatan Sains Biologi
Fakulti Sains dan Teknologi
Universiti Malaysia Terengganu
21030 Kuala Terengganu.

Tarikh: **06 MAY 2007**


Ketua Jabatan Sains Biologi / Head, Department of Biological Sciences
Nama:
Cop Rasmi: **DR. AZIZ BIN AHMAD**
Ketua
Jabatan Sains Biologi
Fakulti Sains dan Teknologi
Universiti Malaysia Terengganu
21030 Kuala Terengganu

Tarikh: **2/5/2007**

ACKNOWLEDGEMENT

Firstly, I would like to gratitude a truly, deeply appreciation to my supervisor Madam Wahizatul Azmi for all her guidance in order to accomplish this project. Thank you very much for your constructive advice, valuable lessons, comments, and time in helping me to complete this project successfully. A big thank you is also attributed to my co-supervisor Mr. Amirrudin Ahmad for assisting me in running this project and for your continuous guidance. I am highly thankful to all MBU staffs especially Mr. Syed Ahmad Rizal and Tuan Haji Muhammad Razali Salam as well as Along for aiding me during laboratory works and assisting me in field works. I could not complete this task without them.

I am also thankful to Department of Biology as well as Faculty of Science and Technology, UMT for supporting this project and providing the needs of this project.

My thanks are also contributed to my colleagues especially Zulaikha, Seh Ling, Fidayu, Ashriah, Faizaitul and Aima for answering to my needs regarding my project, for great assistance, helpful ideas and moral supports. Last but not least, special thanks and acknowledgement to my family for supporting and encouraging me during my three years in UMT. To everyone who had indirectly aided me to complete this project, I am very grateful and thank you from the deepest of my heart.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	ii
LIST OF TABLES	v
LIST OF FIGURES	vi
LIST OF ABBREVIATIONS	vii
LIST OF APPENDICES	viii
ABSTRACT	ix
ABSTRAK	x
CHAPTER 1 INTRODUCTION	1
1.1 Objectives	3
CHAPTER 2 LITERATURE REVIEW	4
2.1 Major orders of aquatic insects	4
2.1.1 Ephemeroptera (Mayflies)	4
2.1.2 Odonata (Dragonflies and damselflies)	5
2.1.3 Plecoptera (Stoneflies)	5
2.1.4 Hemiptera (True bugs)	6
2.1.5 Megaloptera	6
2.1.6 Coleoptera (Water beetles)	6
2.1.7 Tricoptera (Caddisflies)	7
2.1.8 Diptera (True flies)	7
2.2 Distribution of aquatic insects	8
2.3 Factors affecting the abundance and distribution of aquatic insects	9
2.3.1 Influence of physico – chemical parameters to the abundance and distribution of aquatic insects	9
2.3.2 Influence of habitat heterogeneity to the abundance and distribution of aquatic insects	12
2.3.3 Impact of human interventions in to the abundance and distribution of aquatic insects	13
2.4 Aquatic insects as bioindicator	14

2.5 The use of biotic indices in water quality classification	16
CHAPTER 3 METHODOLOGY	18
3.1 Sampling site	18
3.2 Water quality measurement	21
3.2.1 Physical measurement	21
3.2.2 Physico-chemical parameters measurement	21
3.3 Aquatic insects sampling	21
3.4 Data analysis	22
3.4.1 Statistical analysis	22
3.4.2 Biological analysis	22
3.4.2.1 Family Biotic Index (FBI)	23
3.4.2.2 Biological Monitoring Work Party (BMWP)	24
3.4.2.3 Average Score per Taxon (ASPT)	24
3.4.3 Similarity index and Clustering Analysis	25
CHAPTER 4 RESULTS	26
4.1 Diversity and abundance of aquatic insects in Sungai Tersat, Hulu Terengganu	26
4.2 Physico-chemical parameters of study sites	30
4.3 The water quality classification based on composition and abundance of aquatic insects in Sungai Tersat, Hulu Terengganu	32
CHAPTER 5 DISCUSSION	36
5.1 Diversity and abundance of aquatic insects in Sungai Tersat, Hulu Terengganu	36
5.2 Influences of physico-chemical parameters on the abundance of aquatic insects community	37
5.3 The water quality classification based on composition and abundance of aquatic insects in Sungai Tersat, Hulu Terengganu	41
CHAPTER 6 CONCLUSION	42
REFERENCES	43
APPENDICES	52

LIST OF TABLES

Table		Page
3.1	The scores of FBI	22
3.2	The scores BMWP	23
3.3	The scores ASPT	24
4.1	Composition of aquatic insects at three study sites, Station 1 (ST1), Station 2, (ST2) and Station 3 (ST3) in Sungai Tersat, Hulu Terengganu	26
4.2	Physico-chemical variables in ST1, ST2 and ST3 in Sungai Tersat, Hulu Terengganu	29
4.3	Comparison of mean values of water quality parameters of ST1, ST2 and ST3 with NIWQS	30
4.4	Biological indices based on composition and abundance of aquatic insects community in Sungai Tersat, Hulu Terengganu	31
4.5	Kruskal-Wallis Test of total families and individuals between ST1, ST2 and ST3 in Sungai Tersat, Hulu Terengganu	31
4.6	R-values of Pearson Correlation Analysis between water quality parameters, total of individuals and families in Sungai Tersat, Hulu Terengganu	32
4.7	The similarity matrix of aquatic insects' families in ST1, ST and ST3 based on (UPGMA) Sorenson's Coefficient	32

LIST OF FIGURES

Figure		Page
3.1	The map of the middle section of Sungai Tersat, Hulu Terengganu, Terengganu.	18
3.2	General make up of a section at (a) Station 1, (b) Station 2 and (c) Station 3 along the river	19
4.1	General Composition of taxonomic group of aquatic insects orders in Sungai Tersat, Hulu Terengganu	27
4.2	Total abundance of orders and families in ST1, ST2 and ST3 in Sungai Tersat, Hulu Terengganu	28
4.3	Total abundance of individuals in ST1, ST2 and ST3 in Sungai Tersat, Hulu Terengganu	28
4.4	Dendrogram using Sorenson's Coefficient method for clustering analysis of total individuals of aquatic insects' families in ST1, ST2 and ST3 in Sungai Tersat, Hulu Terengganu	34

LIST OF ABBREVIATION

UMT	- Universiti Malaysia Terengganu
DO	- Dissolved Oxygen
TDS	- Total dissolved solid
TSS	- Total suspended solid
MVSP	-Multivariate Statistic Package
SPSS	- Statistical Package for Social Science
ST1	- Station 1
ST2	- Station 2
ST3	- Station 3

LIST OF APPENDICES

Appendix		Page
1	Aquatic insects fauna in first sampling (August 2006)	52
2	Aquatic insects fauna in second sampling (September 2006)	53
3	Aquatic insects fauna in third sampling (October 2006)	54
4	Aquatic insects fauna in fourth sampling (November 2006)	55
5	National Interim Water Quality Standards (Department of Environment)	56

ABSTRACT

A study on the use of aquatic insects in the water quality classification of Sungai Tersat, Terengganu was conducted in four consecutive months (August-November 2006). Aquatic insects were sampled in three selected stations (ST1, ST2 and ST3) along the river with differing degree of intervention. All specimens were collected by using Turtox bottom kick net, preserved in 75% ethanol and brought back to laboratory for identification. A total of 2515 individuals of aquatic insects belonging to 36 families from seven orders have been recorded encompassing Ephemeroptera (46%), Odonata (13%), Plecoptera (10%), Diptera (10%), Trichoptera (8%), Hemiptera (8%) and Coleoptera (5%). The most dominant family of all stations was Heptageniidae from order Ephemeroptera with 581 individuals were captured. ST1 represented the highest number of aquatic insects individuals due to the habitat heterogeneity and favorable substrate content. On the other hand, ST3 exhibited the lowest abundance of aquatic insects and family numbers due to the interferences. Family Biotic Index (FBI) showed that the water quality of all stations were in excellent and good condition with the possible slight organic pollution. Meanwhile, Biological Monitoring Working Party (BMWP) indicated that all stations were in very high or good water quality and Average Score Per Taxon (ASPT) showed that all stations demonstrated clean water even though there were a lot of disturbances occurred. There were no significant difference between sites and number of individuals based on Kruskal Wallis Test. The relationships between the physicochemical and the macroinvertebrates data were investigated by Pearson correlation analysis. This analysis showed that the abundance of aquatic insects was probably influenced by pH value, temperature, conductivity and velocity. The highest similarity was discovered in ST1 and ST3 based on Sorenson's Coefficient Analysis.

**PENGGUNAAN SERANGGA AKUATIK DALAM PENGGELASAN
KUALITI AIR DI SUNGAI TERSAT, HULU TERENGGANU,
TERENGGANU**

ABSTRAK

Kajian tentang penggunaan serangga akuatik dalam pengelasan kualiti air di Sungai Tersat, Terengganu telah dijalankan dalam empat bulan berturut-turut (Ogos-November 2006). Sampel serangga akuatik dikutip di tiga stesen yang dipilih (ST1, ST2 dan ST3) sepanjang sungai dengan darjah gangguan yang berbeza. Semua spesimen disampel dengan menggunakan "Turtox bottom kick net", disimpan di dalam etanol 75% dan dibawa balik ke makmal untuk pengecaman. Sejumlah 2515 individu serangga akuatik mewakili 36 famili dan tujuh order telah direkodkan yang terdiri daripada Ephemeroptera (46%), Odonata (13%), Plecoptera (10%), Diptera (10%), Trichoptera (8%), Hemiptera (8%) dan Coleoptera (5%). Famili paling dominan bagi semua stesen adalah Heptageniidae daripada order Ephemeroptera di mana 581 individu telah berjaya ditangkap. ST1 menunjukkan bilangan serangga akuatik yang tertinggi disebabkan oleh kepelbagaian habitat dan kandungan substrat yang baik. Sebaliknya, ST3 menunjukkan kelimpahan serangga akuatik dan bilangan famili yang paling rendah disebabkan oleh gangguan. Family Biotic Index (FBI) menunjukkan bahawa kualiti air di semua stesen adalah dalam keadaan baik dengan kemungkinan berlaku sedikit pencemaran organik. Manakala, Biological Monitoring Working Party (BMWP) menunjukkan bahawa semua stesen berada dalam kualiti air yang baik dan Average Score Per Taxon (ASPT) menunjukkan bahawa semua stesen mempunyai air yang bersih walaupun gangguan berlaku. Tiada perbezaan yang nyata ditunjukkan antara stesen dan bilangan individu berdasarkan Ujian Kruskal Wallis. Hubungan antara faktor fizik-kimia dan data invertebrata makro dikaji dengan menggunakan Analisis Korelasi Pearson. Analisis ini menunjukkan kelimpahan serangga akuatik dipengaruhi oleh nilai pH, suhu, konduktiviti dan halaju. Kadar persamaan yang tinggi didapati di ST1 dan ST3 berdasarkan analisis "Sorenson's Coefficient".