

**EFFECT OF MONSOONS ON HYDROLOGICAL PARAMETERS
IN THE SETIU LAGOON, TERENGGANU**

NOR MAISARAH RAMELI

**FACULTY OF MARITIME STUDIES AND MARINE SCIENCE
UNIVERSITI MALAYSIA TERENGGANU**

2008

**EFFECT OF MONSOONS ON HYDROLOGICAL PARAMETERS IN THE
SETIU LAGOON, TERENGGANU**

By

Nor Maisarah Rameli

**Research report submitted in partial fulfillment of
the requirements for the degree of
Bachelor of Science (Marine Biology)**

**Department of Marine Science
Faculty of Maritime Studies and Marine Science
UNIVERSITI MALAYSIA TERENGGANU
2008**

This project should be cited as:

Nor Maisarah, R. 2008. Effect of Monsoons on Hydrological Parameters in the Setiu Lagoon, Terengganu. Undergraduate Thesis. Faculty of Maritime Study and Marine Science, University Malaysia Terengganu. 75p.

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

1100061857

2008



**JABATAN SAINS MARIN
FAKULTI PENGAJIAN MARITIM DAN SAINS MARIN
UNIVERSITI MALAYSIA TERENGGANU**

**PENGAKUAN DAN PENGESAHAN LAPORAN
PROJEK PENYELIDIKAN I DAN II**

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk:

Effect of Monsoons on Hydrological Parameters in the Setiu Lagoon oleh
Nor Maisarah binti Rameli, No.Matrik **UK 12567** telah diperiksa dan semua
pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada
Jabatan Sains Marin sebagai memenuhi sebahagian daripada keperluan memperoleh
Ijazah Sarjana Muda Sains (Biologi Marin), Fakulti Pengajian Maritim dan Sains
Marin, Universiti Malaysia Terengganu.

Disahkan oleh:

Penyelia Utama

Nama: **PROF. MADYA DR. MOHAMED KAMIL ABDUL RASHID**
Timbalan Dekan (Siswazah & Penyelidikan)
Cop Rasmi: **Fakulti Pengajian Maritim dan Sains Marin**
Universiti Malaysia Terengganu
(UMT)

Tarikh: 4.5.2008

Penyelia Kedua

Nama: **YONG JAW CHUEN**
Pensyarah
Jabatan Sains Marin
Cop Rasmi: **Fakulti Pengajian Maritim dan Sains Marin**
Universiti Malaysia Terengganu (UMT)
21030 Kuala Terengganu.

Tarikh: 4/5/2008

Ketua Jabatan Sains Marin

Nama: **DR. RAZAK ZAKARIYA**
Ketua Jabatan Sains Marin
Cop Rasmi: **Fakulti Pengajian Maritim dan Sains Marin**
Universiti Malaysia Terengganu
(UMT)

Tarikh: 12/5/08

ACKNOWLEDGEMENTS

First and foremost I would like to thank Allah s.w.t. for His blessing of good health, physically and mentally to accomplish this project. I would like to take this opportunity to give my sincere thanks to my supervisor, Prof. Madya Dr. Mohamed Kamil Abdul Rashid and my former supervisor, Prof. Dr. Law Ah Theem for the advices, continuous guidance, comments and unlimited support to finish my study for fulfill the requirement of the Bachelor Degree of Science in Marine Biology.

I also want to thank Mr. Yong Jaw Chuen, Mr. Suffian Idris, and Dr. Edlic for their comments and recommendations regarding to this project. My thanks also go to all oceanography laboratory assistants; Mr. Sulaiman, Mr. Raja and Mr. Chuah Lai Fatt and individuals that helped me directly or indirectly whenever I faced difficulties in doing my work.

Special thanks to my parent and family, who understand me in what I am doing for and always support me whenever I in need. Lastly, also thanks to my friends and my fellow course mates for their help and kindness in helping me to finish this final year project.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	iv
TABLE OF CONTENTS	v
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF ABBREVIATIONS	xi
LIST OF APPENDICES	xii
ABSTRACT	xiii
ABSTRAK	xiv
CHAPTER 1: INTRODUCTION	1
1.1 Introduction	1
1.2 Importance of Study	2
1.3 Objectives of Study	4
CHAPTER 2: LITERATURE REVIEW	5
2.1 Lagoon	5
2.2 Monsoons and Precipitation in the Setiu Lagoon	6
2.3 Hydrological Relationship	8
2.4 Hydrological Characteristics of the Setiu Lagoon	9
2.4.1 Temperature	9
2.4.2 Salinity	10
2.4.3 Dissolved oxygen	12

2.4.4	pH	13
2.4.5	Current measurement	15
2.4.6	Water alkalinity	16
CHAPTER 3: METHODOLOGY		18
3.1	Study Site	18
3.2	Sampling Technique	19
3.2.1	Water sampling	20
3.2.2	Determination of hydrological measurement	20
3.2.3	Determination of current measurement	21
3.3	Analytical Technique	21
3.3.1	Preparation of methyl orange 0.05%	21
3.3.2	Preparation of 0.01 N hydrochloric acids (HCl)	22
3.3.3	Titration analysis	23
3.3.3.1	Determination of alkalinity	23
3.4	Statistical Analysis	24
CHAPTER 4: RESULTS		25
4.1	Depth	25
4.2	Temperature	28
4.3	Salinity	33
4.4	Dissolved Oxygen	37
4.5	pH	41
4.6	Current Movement	45
4.6.1	Speed of water current	45

4.6.2	Current direction	47
4.7	Total Alkalinity	50
CHAPTER 5: DISCUSSION		52
5.1	Depth Profile	52
5.2	Temperature	54
5.3	Salinity	56
5.4	Dissolved Oxygen	58
5.5	pH	60
5.6	Current Movement	61
5.6.1	Speed of water current	61
5.6.2	Current direction	62
5.7	Total Alkalinity	64
CHAPTER 6: CONCLUSION		65
REFERENCES		67
APPENDICES		70
CURICULUM VITAE		75

LIST OF TABLES

Table		Page
3.1	Coordinate of stations set up in Setiu Lagoon	18

LIST OF FIGURES

Figure		Page
3.1	Location of sampling station in the Setiu Lagoon	19
4.1	Distribution of depth which recorded during each sampling in the Setiu Lagoon (a) Southwest Monsoon, (b) Inter-monsoon and (c) Northeast Monsoon	26
4.2	Depth measured for each station during the sampling periods	27
4.3	Surface water temperature recorded at every station for all samplings	28
4.4	Temperature distribution for (a) Southwest Monsoon, (b) Inter-monsoon and (c) Northeast Monsoon	30
4.5	Data plotted for temperature against depth at each station for (a) Southwest Monsoon, (b) Inter-monsoon and (c) Northeast Monsoon	31
4.6	Mean temperatures recorded at all stations in Setiu Lagoon	32
4.7	Distribution of salinity recorded in the Setiu Lagoon in (a) Southwest Monsoon, (b) Inter-monsoon and (c) Northeast Monsoon	34
4.8	Salinity profiles for each station against depth recorded in Setiu Lagoon for (a) Southwest Monsoon, (b) Inter-monsoon and (c) Northeast Monsoon	35
4.9	Mean salinity recorded at all station for each sampling periods	36

4.10	Distribution of dissolved oxygen during (a) Southwest Monsoon, (b) Inter-monsoon and (c) Northeast Monsoon in the Setiu Lagoon	38
4.11	Dissolved oxygen concentrations for all samplings at each station for (a) Southwest Monsoon, (b) Inter-monsoon and (c) Northeast Monsoon	39
4.12	The mean of dissolved oxygen for all stations during the three samplings	40
4.13	Distribution of pH in Setiu Lagoon during (a) Southwest Monsoon, (b) Inter-monsoon and (c) Northeast Monsoon	42
4.14	pH recorded at all stations against depth in Setiu Lagoon for (a) Southwest Monsoon, (b) Inter-monsoon and (c) Northeast Monsoon	43
4.15	Mean pH for all samplings according to stations	44
4.16	Speed of water recorded in Setiu Lagoon during (a)(b) Southwest Monsoon, (c)(d) Inter-monsoon and (e)(f) Northeast Monsoon	46
4.17	Mean speed of water during Southwest Monsoon, Inter-monsoon and Northeast Monsoon	47
4.18	Current directions at each station for (a) Southwest Monsoon; (b)(c) Inter-monsoon and (d)(e) Northeast Monsoon	49
4.19	Total alkalinity recorded at all stations for each sampling periods	51
5.1	Monthly total rainfalls (mm) which recorded for the coastal area of Terengganu in 2007	53

LIST OF ABBREVIATIONS

mg	-	miligram
ppt	-	parts per thousand
ppm	-	parts per million
m	-	meter
ml	-	mililiter
m/hr	-	meter per hour
m/s	-	meter per second
cm/s	-	centimeter per second
°	-	degree
°C	-	degree celcius
N	-	normality
TDS	-	total of dissolved solids
CaCO ₃	-	calcium carbonate
HCl	-	hydrochloric acid
H ₂ SO ₄	-	sulfuric acid

LIST OF APPENDICES

Appendix		Page
1	Tidal levels in Setiu Lagoon during the sampling. (a) Southwest Monsoon; (b) Inter-monsoon and (c) Northeast Monsoon	70
2	Chlorophyll a concentrations at all stations for all samplings	71
3	Speed and direction of winds during the samplings	72
4	Two way ANOVA analysis of water temperature	73
5	Two way ANOVA analysis of salinity	74

ABSTRACT

This study was conducted at the Setiu Lagoon during Southwest Monsoon, Inter-monsoon and Northeast Monsoon. The temperature, salinity, pH, dissolved oxygen and water current data were collected *in situ* while for the total alkalinity it was determined by titration method in laboratory. All the data were then analyzed in order to compare the effect of monsoons to each parameter recorded. Most of the hydrological parameters were significantly different to the monsoons ($p < 0.05$). The mean for temperature during Southwest Monsoon, Inter-monsoon and Northeast Monsoon were $31.65 \pm 0.03^\circ\text{C}$, $28.97 \pm 0.16^\circ\text{C}$ and $28.17 \pm 0.11^\circ\text{C}$ respectively. For the salinity, the mean were 26.94 ± 0.08 ppt, 22.79 ± 1.80 ppt and 14.79 ± 0.53 ppt respectively. As for the pH, the mean recorded were 7.75 ± 0.00 , 7.68 ± 0.07 and 6.28 ± 0.08 respectively. The means for dissolved oxygen were 5.37 ± 0.07 mg/l, 3.85 ± 0.25 mg/l and 3.74 ± 0.19 mg/l respectively. As for total alkalinity, the means recorded were 118.05 ± 1.34 mgCaCO₃/l, 35.29 ± 0.80 mgCaCO₃/l and 30.76 ± 0.61 mgCaCO₃/l respectively. However, the current movement was not significantly different to the sampling period ($p > 0.05$), most probably because the current movement was influenced by tide. The means for the current flow were 0.123 ± 0.17 m/s (Southwest Monsoon), 0.199 ± 0.19 m/s (Inter-monsoon) and 0.220 ± 0.24 m/s (Northeast Monsoon). For the stations at the Northwest part of the lagoon, the current direction was towards the Southeast and for the stations at the Southeast; the current direction was in the opposite direction. Since there is monsoon changes in the Setiu Lagoon, it can reduce the effect of wastes accumulation from the aquaculture, culture pond and river runoff. The lagoon can be polluted if there is no dynamic hydrological cycle by the monsoon changes.

KESAN MONSUN TERHADAP PARAMETER HIDROLOGI DI

LAGUN SETIU

ABSTRAK

Kajian ini telah dijalankan di Lagun Setiu pada Monsun Barat Daya, antara monsun dan Monsun Timur Laut. Data suhu, kemasinan, pH, oksigen terlarut dan arus direkodkan secara *in situ* sementara untuk jumlah alkaliniti ditentukan dengan menggunakan kaedah penitratan di makmal. Semua data kemudiannya di analisis bagi membandingkan kesan monsun terhadap setiap parameter yang direkodkan. Kebanyakan parameter hidrologi adalah berbeza terhadap monsun ($p < 0.05$). Min bagi suhu semasa Monsun Barat Daya, antara monsun dan Monsun Timur Laut adalah $31.65 \pm 0.03^{\circ}\text{C}$, $28.97 \pm 0.16^{\circ}\text{C}$ and $28.17 \pm 0.11^{\circ}\text{C}$. Bagi min kemasinan adalah 26.94 ± 0.08 ppt, 22.79 ± 1.80 ppt and 14.79 ± 0.53 ppt. Min bagi pH pula adalah 7.75 ± 0.00 , 7.68 ± 0.07 and 6.28 ± 0.08 . Bagi min oksigen terlarut adalah 5.37 ± 0.07 mg/l, 3.85 ± 0.25 mg/l and 3.74 ± 0.19 mg/l. Min bagi jumlah alkaliniti pula adalah 118.05 ± 1.34 mgCaCO₃/l, 35.29 ± 0.80 mgCaCO₃/l and 30.76 ± 0.61 mgCaCO₃/l. Bagaimanapun, pergerakan arus tidak berubah terhadap masa persampelan ($p > 0.05$), mungkin disebabkan pergerakan arus dipengaruhi oleh pasang surut air. Min bagi pengaliran arus adalah 0.123 ± 0.17 m/s (Monsun Barat Daya), 0.199 ± 0.19 m/s (perantaraan monsun) and 0.220 ± 0.24 m/s (Monsun Timur Laut). Bagi stesen yang berada di bahagian Barat Laut lagun, arah arus menuju the tenggara dan bagi stesen yang berada di tenggara, arah arus adalah berlawanan. Dengan adanya perubahan monsun di Lagun Setiu, ia boleh mengurangkan kesan hasil buangan akuakultur, penternakan kolam dan sungai. Lagun tersebut akan tercemar jika tiada kitaran hidrologi yang dinamik melalui perubahan monsun.