

FOOD SOURCES OF SUSPENSION - FEEDING BIVALVES, *Isognomon* sp.
IN THE SETIU WETLAND, TERENGGANU AS ASSESSED BY FATTY ACID
BIOMARKER

HASLAILI BT LOMAN

FACULTY OF MARITIME STUDIES AND MARINE SCIENCE
UNIVERSITI MALAYSIA TERENGGANU

2008

FOOD SOURCES OF SUSPENSION- FEEDING BIVALVES, *Isognomon* sp. IN THE
SETIU WETLAND, TERENGGANU AS ASSESSED BY FATTY ACID
BIOMARKER

By

Haslaili bt Loman

Research Report submitted in partial fulfillment of
the requirement 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:

Haslaili, L. 2008 Food Sources of suspension-feeding bivalves, *Isognomon* sp. in the Setiu Wetland, Terengganu as assessed by fatty acid biomarker. Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu. 62p.

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 it be stored in a retrieval system, transmitted, or otherwise copied for public or private use, without written permission from the author and the supervisors of the project.

1100061835



**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:

FOOD SOURCES OF SUSPENSION- FEEDING BIVALVES, *Isognomon* sp. IN THE SETIU WETLAND, TERENGGANU AS ASSESSED BY FATTY ACID BIOMARKER oleh HASLAILI BT LOMAN No Matrik UK12276 telah diperiksa dan semua pembedahan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Marin sebagai memenuhi sebahagian daripada keperluan memperolehi Ijazah Sarjana Muda Sains (Biologi Marin), Fakulti Pengajian Maritim dan Sains Marin, Universiti Malaysia Terengganu.

Disahkan oleh:

Penyelia Utama

DR. ZAINUDIN BACHOK
Lecturer

Nama:

Department of Marine Science
Faculty of Maritime Studies and Marine Science
Universiti Malaysia Terengganu (UMT)
21030 Kuala Terengganu,

Cop Rasmi:

Tarikh:

4.5.2008

Penyelia Kedua (jika ada)

AHMAD SHAMSUDDIN BIN AHMAD
Lecturer

Nama:

Department of Marine Science
Faculty of Maritime Studies and Marine Science
Universiti Malaysia Terengganu (UMT)
21030 Kuala Terengganu

Cop Rasmi

Tarikh:

5.5.2008

Ketua Jabatan Sains Marin

Nama:

DR. RAZAK ZAKARIYA
Ketua Jabatan Sains Marin
Fakulti Pengajian Maritim dan Sains Marin
Universiti Malaysia Terengganu
(UMT)

Cop Rasmi:

Tarikh:

11/5/08

ACKNOWLEDGEMENT

Alhamdulillah...Thanks to God for giving me the opportunity to complete my final year project thesis successful. Special thanks to my supervisor, Dr. Zainudin Bachok for his support, guidelines and advice in accomplishing my final year project and this thesis. Thanks also to Dr Ahmad Shamsuddin, as my second supervisor.

My deepest appreciation goes to the sciences officers and laboratory assistant of the Oceanography and Biodiversity Laboratory who helped me a lot in accomplishing my laboratory work.

Special thanks also to all of my friends for helping and supporting me in accomplishing the lab work and also in completing my thesis.

TABLE OF CONTENT

Contents	Page
ACKNOWLEDGEMENT	ii
TABLE OF CONTENT	iii
LIST OF TABLES	v
LIST OF FIGURES	vii
LIST OF ABBREVIATIONS	x
LIST OF APPENDICES	xi
ABSTRACT	xii
ABSTRAK	xiii
CHAPTER 1: INTRODUCTION	
1.1 Introduction	1
1.2 Significant of study	2
1.3 Objectives	3
CHAPTER 2 : LITERATURE REVIEW	
2.1 Mangroves	4
2.1.1 Properties of mangroves	4
2.1.2 Responses of mangroves and mangrove ecosystem to light and temperature	5
2.2 Bivalvia	8
2.3 The bivalves that were studied	8
2.3.1 Taxonomy of Isognomon sp.	9
2.4 Food sources of bivalves	9
2.5 Lipids	10
2.6 Fatty acids	10
2.6.1 Saturated (SAFA) and unsaturated fatty acids	11
2.6.2 Monounsaturated fatty acids (MUFA) and Polyunsaturated fatty acids (PUFA)	12
2.6.3 Fatty acids as a biomarker and utilization of biomarker	12

CHAPTER 3: METHODOLOGY	
3.1 Sampling location	14
3.2 Samples collections	16
3.3 Samples preparations	16
3.4 Lipids extractions	17
3.4.1 Ultrasonifications of lipids	17
3.4.2 Saponifications and methylizations of lipids	17
3.4.3 Purifications of lipids	18
3.5 Gas chromatography analysis	18
3.6 Data analysis	19
CHAPTER 4: RESULT	
4.1 Lipids concentration	20
4.2 Lipids component	22
4.3 Fatty acids composition	23
4.3.1 Fatty acids of <i>Isognomon</i> sp.	23
4.4 Fatty acid classes in <i>Isognomon</i> sp.	27
4.5 Gut content analysis	36
CHAPTER 5: DISCUSSION	
5.1 Lipid concentration	40
5.2 Fatty acids of the <i>Isognomon</i> sp.	41
5.3 Food sources of <i>Isognomon</i> sp as indicates by fatty acids biomarkers	42
5.3.1 Bacteria sources	42
5.3.2 Microalgal sources	44
5.3.3 Mangroves detritus markers	46
5.3.4 Copepods sources	48
5.3.5 Green macroalgae sources	50
5.3.6 Comparison of all food sources markers	52
CHAPTER 6: CONCLUSION	53
REFERENCES	55
APPENDICES	58
CURRICULUM VITAE	62

LIST OF TABLE

NO	TITLE	PAGE
4.1	Lipid component in the tissue, feces and suspended particulate material (SPM) collected at Setiu Wetland, Terengganu in all sampling month, August, October and December. Values are mean \pm S.D	23
4.2	Total lipid concentration (g g^{-1} dry wt) and fatty acids compositions (percentage of total fatty acids) in the suspended particulate material (SPM) of the water sample collected at Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D. (n=3)	24
4.3	Table 4.3 Total lipid concentration (g g^{-1} dry wt) and fatty acids compositions (percentage of total fatty acids) in the tissue of <i>Isognomon</i> sp. collected at Setiu Wetland, Terengganu in all sampling month, August, October and December. Values are mean \pm S.D (n=3)	25
4.4	Total lipid concentration (g g^{-1} dry wt) and fatty acid composition (percentage of total fatty acids) in the feces of <i>Isognomon</i> sp. collected at Setiu Wetland, Terengganu in all sampling month, August, October and December. Values are mean \pm S.D (n=3)	26
4.5	The contribution of fatty acid classes (percentage of total fatty acid) which are Saturated fatty acid (SAFA), Monounsaturated fatty acid (MUFA), Branching Fatty acids (BrFA) and Polyunsaturated fatty acids (PUFA) in the Suspended Particulate Material (SPM), in the water sample collected in mangrove area at Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D (n=3)	29

- 4.6 The contribution of fatty acid classes (percentage of total fatty acid) which are Saturated fatty acid (SAFA), Monounsaturated fatty acid (MUFA), Branching Fatty acids (BrFA) and Polyunsaturated fatty acids (PUFA) in the tissue of *Isognomon* sp. collected in mangrove area at Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D (n=3) 30
- 4.7 The contribution of fatty acid classes (percentage of total fatty acid) which are Saturated fatty acid (SAFA), Monounsaturated fatty acid (MUFA), Branching Fatty acids (BrFA) and Polyunsaturated fatty acids (PUFA) in the feces of *Isognomon* sp. collected in mangrove area at Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D (n=3) 31

LIST OF FIGURE

FIGURE	TITLE	PAGE
2.1	Monthly total rainfalls (mm) for the coastal area of Terengganu in 2007 (source: Malaysia Meteorological Department, Ministry of Science, Technology and Innovation)	7
2.2	The structure of the fatty acid	11
3.1	Map of sampling location at Kampung Gong Batu, Setiu, Terengganu	15
4.1	Total lipid concentration (g g^{-1} dry wt) in suspended particulate material (SPM), tissue and feces of <i>Isognomon</i> sp. collected at Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D (n=3)	21
4.2	The determination of the lipid component by measuring the area of the component on the plates coated with Kiesegel 60 silica.	22
4.3	Contribution of Saturated fatty acid (SAFA), Monounsaturated fatty acid (MUFA), Branching Fatty acids (BrFA), Polyunsaturated fatty acids (PUFA) and ($\omega 3 + \omega 6$) PUFA content (percentage of total fatty acids) in suspended particulate material (SPM) collected in Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D (n=3)	32
4.4	Contribution of Saturated fatty acid (SAFA), Monounsaturated fatty acid (MUFA), Branching Fatty acids (BrFA), Polyunsaturated fatty acids (PUFA) and ($\omega 3 + \omega 6$) PUFA content (percentage of total fatty acids) in tissue of	32

Isognomon sp. collected in Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D (n=3)

- 4.5 Contribution of Saturated fatty acid (SAFA), Monounsaturated fatty acid (MUFA), Branching Fatty acids (BrFA), Polyunsaturated fatty acids (PUFA) and (ω 3 + ω 6) PUFA content (percentage of total fatty acids) in the feces of *Isognomon* sp. collected in Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D (n=3) 33
- 4.6 Contribution of Saturated fatty acid (SAFA) content (percentage of total fatty acids) in suspended particulate material (SPM), tissue and feces of *Isognomon* sp. collected in Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D (n=3) 33
- 4.7 Contribution of Monounsaturated fatty acid (MUFA) content (percentage of total fatty acids) in suspended particulate material (SPM), tissue and feces of *Isognomon* sp. collected in Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D (n=3) 34
- 4.8 Contribution of Polyunsaturated fatty acids (PUFA) content (percentage of total fatty acids) in suspended particulate material (SPM), tissue and feces of *Isognomon* sp. collected in Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D (n=3) 34
- 4.9 Contribution of Branching Fatty acids (BrFA) content (percentage of total fatty acids) in suspended particulate material (SPM), tissue and feces of *Isognomon* sp. collected in Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D (n=3) 35

4.10	Some pictures of organisms found in the gut content of <i>Isognomon</i> sp. that collected in Setiu Wetland, Terengganu	36
5.1	Contribution of bacteria markers in suspended particulate material (SPM), tissue and feces samples of <i>Isognomon</i> sp. (percentage of total fatty acid) collected in Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D (n=3)	43
5.2	Contribution of microalgae markers in suspended particulate material (SPM), tissue and feces samples of <i>Isognomon</i> sp. (percentage of total fatty acid) collected in Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D (n=3)	46
5.3	Contribution of mangrove detritus markers in suspended particulate material (SPM), tissue and feces samples of <i>Isognomon</i> sp. (percentage of total fatty acid) collected in Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D (n=3).	48
5.4	Contribution of copepod markers in suspended particulate material (SPM), tissue and feces samples of <i>Isognomon</i> sp. (percentage of total fatty acid) collected in Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D (n=3)	49
5.5	Contribution of green macroalgae markers in suspended particulate material (SPM), tissue and feces samples of <i>Isognomon</i> sp. (percentage of total fatty acid) collected in Setiu Wetland, Terengganu in all sampling month. Values are mean \pm S.D (n=3)	51

LIST OF ABBREVIATION

ω	=	Omega
$^{\circ}\text{C}$	=	Degree celcius
$^{\circ}$	=	degree
%	=	percentage
sp.	=	species
v	=	volume
g g^{-1}	=	gram per gram
wt	=	weight
N	=	North
E	=	East
min^{-1}	=	per minute
SPM	=	suspended particulate material
SAFA	=	saturated fatty acids
MUFA	=	monounsaturated fatty acids
PUFA	=	polyunsaturated fatty acids
BrFA	=	branching fatty acids
rpm	=	round per minute
TLC	=	thin-layer chromatography technique
FAME	=	fatty acid methyl ester
ANOVA	=	analysis of variance

LIST OF APPENDICES

NO	TITLE	PAGE
1	Anova result for fatty acid classes	58
2	Example of the plates coated with Kiesegel 60 silica with the bands of lipid component.	61

Abstract

The bivalvia *Isognomon* sp. and Suspended Particulate Material (SPM) were collected in the Lagoon of Setiu Wetland, Terengganu in August, October and December 2007. The fatty acid composition in the tissue of *Isognomon* sp. were compared with those in its' feces and in SPM in order to assess the oysters' food sources. The mean concentration of total lipid in tissue shows the differences among months. The differences in the amount of total lipid in the tissue of *Isognomon* sp. in each month could be caused by physiological condition and food supply of this oyster species. Six lipid components comprise of phospholipids, sterols, free fatty acids, triglycerols, fatty acids and waxes were obtained in all samples. The fatty acids in groups of polyunsaturated fatty acids (PUFA), saturated fatty acid (SAFA), monounsaturated fatty acid (MUFA) and branching fatty acids (BrFA) were recorded in all component in all sampling month. The fatty acids that contributed most were in the class of PUFA. A total of 42 fatty acids were recorded in the tissue of *Isognomon* sp. Microlagae markers were higher in the tissue, SPM and feces of the *Isognomon* sp. in all sampling month except for December. Analysis on gut content of the *Isognomon* sp. also shows the high contribution of microalgae in the stomach of the animals. In December, the mangrove detritus markers show the significantly higher contribution in feces and SPM component. The higher contribution of mangrove detritus markers might be caused by high mangrove litter production due to the heavy rainfall in December. To conclude, the result shows that microalgae form the main component of these bivalves diet. The contribution of other markers such as mangrove detritus, bacteria, copepod and green macroalgae markers shows that *Isognomon* sp. also consumes other sources such as mangrove detritus, bacteria, copepod and green macroalgae as their food sources in all sampling month.

Abstrak

SUMBER MAKANAN BIVALVIA SUSPENSION FEEDING, *Isognomon* sp. DI SETIU WETLAND TERENGGANU SEPERTI DITAKSIRKAN OLEH PENANDA BIO ASID LEMAK

Bivalvia, *Isognomon* sp. dan bahan- bahan terampai dalam sampel air (SPM) telah diambil di kawasan Lagun Setiu Wetland, Terengganu pada bulan Ogos, Oktober dan Disember. Komposisi asid lemak dalam tisu *Isognomon* sp. dibandingkan dengan komposisi asid lemak dalam bahan buangan haiwan tersebut dan juga dalam bahan- bahan terampai untuk mengenal pasti sumber makanannya. Purata kepekatan total lipid dalam tisu menunjukkan perbezaan pada setiap bulan. Perbezaan tersebut boleh disebabkan oleh keadaan fisiologi dan sumber makanan *Isognomon* sp. Enam komponen lipid yang terdiri daripada phospholipids, sterols, free fatty acids, triglycerols, asid lemak dan waxes telah diperolehi dalam semua sampel. Asid lemak dalam kumpulan polyunsaturated fatty acids (PUFA), saturated fatty acid (SAFA), monounsaturated fatty acid (MUFA) and branching fatty acids (BrFA) telah direkodkan dalam setiap bulan. Asid lemak yang paling banyak adalah dalam kelas PUFA. Sebanyak 42 asid lemak direkodkan dalam tisu *Isognomon* sp. Penanda mikroalga adalah tinggi dalam tisu, SPM dan bahan buangan *Isognomon* sp. dalam semua bulan kecuali Disember. Analisis pada kandungan dalam perut *Isognomon* sp. juga menunjukkan kandungan mikroalga yang banyak. Pada Disember, penanda mangrove detritus menunjukkan kehadiran yang tinggi dalam sampel bahan buangan dan SPM. Kehadiran penanda mangrove detritus yang banyak mungkin disebabkan oleh penghasilan buangan mangrove yang banyak disebabkan oleh hujan lebat pada Disember. Sebagai keputusan, mikroalga merupakan komponen utama bagi diet bivalvia ini. Kehadiran penanda mangrove detritus, bakteria, copepod

dan makroalga hijau menunjukkan *Isognomon* sp. juga menggunakan mangrove detritus, bakteri, copepod dan makroalga hijau sebagai sumber makanannya pada setiap bulan penyampelan.